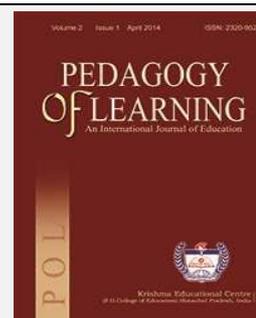


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Effect of Cooperative Learning In Developing Higher Order Thinking Skills in Science at Elementary Level

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Abstract

The main objective of this paper is to study the effectiveness of cooperative learning on higher order thinking skills in science. Two group quasi experimental research design was followed for conducting this experiment. Self developed tools such as test on higher order thinking skills in science was used for pre and post test. Collected data were analyzed by using t test and accordingly interpretation was made. The study found that the group taught by cooperative learning method developed significantly better higher order thinking skills in science than students taught by traditional method. Further cooperative learning method is equally beneficial for boys and girls in developing higher order thinking skills..

Keywords: Cooperative Learning, Higher Order Thinking Skills, Science, Elementary Level

INTRODUCTION

Science refers to a system of acquiring knowledge. In modern usage, "science" most often refers to a way of pursuing knowledge, not only the knowledge itself, it is also often restricted to those branches of study that seek to explain the phenomena of the material universe. The word "science" became increasingly associated with the scientific method itself, as a disciplined way to study the natural world, including physics, chemistry, geology and biology. However, "science" has also continued to be used in a broad sense to denote

reliable and teachable knowledge about a topic, as reflected in modern terms like library science or computer science.

There are mainly two types of method of teaching such as traditional method & constructive method of teaching. Traditional method include lecture method , whereas in the constructivist approach which transforms the student from a passive recipient of information to an active participant in the learning process, always guided by the teacher, students construct their knowledge actively rather than just mechanically ingesting knowledge from the teacher or the text book. Constructive method includes problem solving method, concept mapping, critical thinking, cooperative learning etc.

Conceptualization of the Problem

Cooperative learning is an educational approach which aims to organize classroom activities into academic and social learning experiences. There is much more to cooperative learning than merely arranging students into groups, and it has been described as "structuring positive interdependence." Students must work in groups to complete tasks collectively toward academic goals. Unlike individual learning, which can be competitive in nature, students learning cooperatively can capitalize on one another's resources and skills (asking one another for information, evaluating one another's ideas, monitoring one another's work, etc.). Furthermore, the teacher's role changes from giving information to facilitating students' learning. Everyone succeeds when the group succeeds. Ross and Smyth (1995) describe successful cooperative learning tasks as intellectually demanding, creative, open-ended, and involve higher order thinking tasks. Five essential elements are identified for the successful incorporation of cooperative learning in the classroom. The first and most important element is positive interdependence. The second element is individual and group accountability. The third element is (face to face) promotive interaction. The fourth element is teaching the students the required interpersonal and small group skills. The fifth element is group processing.

Higher order thinking is based on a dynamic model of *lifelong learning* in which new knowledge and skills necessary for successful adaptation to a changing world are continuously acquired throughout life. Higher order thinking skills (HOTs) take thinking to deeper levels than just restating facts. HOTs require that we apply the facts that we learn. These skills are commonly defined based on Bloom's Taxonomy, which examines and categorizes different levels of thinking. The levels of thinking for Bloom's Taxonomy, starting from lowest to highest are: remembering, understanding, applying, analyzing, evaluating and creating.

In order to promote HOTs within the classroom, students must not only have a basic knowledge and comprehension of concepts but be able to apply what they are learning through hands on activities. By stimulating critical thinking; students will be likely to learn how to be self-directed, self-disciplined, self-monitored, and self-corrective in their thinking process. Projects and assignments should include questions that challenge students to clarify their understanding, come up with reasons and evidence for their thinking, define their viewpoints and perspectives, determine implications and consequences, and evaluate concepts.

RATIONALE OF THE STUDY

The 21st Century is the age of Constructivism. The Constructivism movement in instructional design emphasizes the importance of providing meaningful, authentic activities that can help the learner to construct understanding and develop skills relevant to solving problems and not feeding them with more and more information. Knowledge is built by the learner, not supplied by the teacher. Creating such learning environments seems intrinsically problematic in traditional setting. Cooperative Learning assists in creating such environment. Through the use of cooperative learning teachers can provide opportunities for the students to learn think critically and discuss among their peers. Appropriate use of strategy can make learning for students more interesting and enriching. There are a number of potential benefits of using cooperative learning strategy in an educational setting. First, cooperative learning help to support cognitive processes by reducing the memory load of a student and by encouraging awareness of the problem-solving process. Second, it can provide a greater capacity for project-based learning dealing with topics relevant to pupils' interests. Third, it allows the students to engage in science that would be out of reach, thereby stretching students' opportunities.

Learning is a social activity. In fact, this social dimension is a critical aspect in the learning process for people of any age. People learn in communities. Together, they accomplish more than as individuals and they have more fun in this process. Students are no different. Research shows that opportunities for cognitive have rehearsal, clarification, and re-teaching have a positive effect on academic achievement. When students collaborate, they have an opportunity to discuss new concepts with someone close to their own level of understanding. They get try out new ideas and ask questions in a small group before speaking to the whole class or finishing a written product. When students discuss & defend their ideas or solutions with teammates, they learn to think problems through, to support their own opinions, and critically consider the opinions of others before coming to the conclusion.

The researchers such as Rosini, B.A (1997), Judith,G. (2002) , Hall, M.(2008), Johnsen, S.(2009), Hillen, K. (2006), Zakaria, E. (2010), Dheeraj, D. & Kumari, R.(2010) Ajaja,O.P.(2010) ,Slattery, B.(2010) ,Praveen, Q. (2011),Chen, J. and Wang ,Y.(2013), Herrmann, K.J. (2013),Dheeraj, D. and Kumari, R.(2013), Bernardo ,C.P .(20013), Adams.A.R.(2013), Mohalik, R (2014)conducted studies on effect of cooperative learning in student's achievement and found positive result regarding cooperative method strategies.

Some researchers like Ho, F.F. and Boo, H.K. (2007),Vijayaratnam, P.(2009), Johnson, D. W., Johnson, R. T. and Stanne, M. B. (2000) Jayaprava, G. (2013), Morgan, B.M. (2013), Kalaiaa, S. A. and Kasim, R.M.(2014) conducted study on problem solving ability, meta analysis, creative and critical thinking, higher order learning, meta cognitive, problem solving ability and meta-analytic method respectively with cooperative learning strategy and found it's positive result with cooperative learning strategy but no one has conducted the study on effect of cooperative learning on higher order thinking skills in Odisha. Most of the study also held in abroad very few study conducted in our country also.

So, in this context research study on effect of cooperative learning on higher order cognitive process on science in Odisha is relevant.

Objectives

1. To study the effectiveness of cooperative learning on cognitive processes in science.
2. To compare the effectiveness of cooperative learning on cognitive processes of boys and girls in experimental group.

Hypotheses

1. There will be no significant difference in the post-test score of control group & experimental group on cognitive process.
2. There is no significant difference between boys and girls in cognitive processes in science of experimental group.

METHODOLOGY

The investigator used a pre-test post-test Quasi-experimental design for conducting the study. The study was conducted in the Government High School, VSS Nagar, Bhubaneswar, Odisha. Two sections of class-VIII of the school are taken as two groups. All the students of both the sections are taken as sample for the study. Measuring tools like test on HOTs is used for collecting data. Five lesson plans on each strategy i.e., cooperative learning and traditional method of teaching are used as instructional strategies. For analyzing the data both descriptive and inferential statistics were used and accordingly interpretations were drawn.

DATA ANALYSIS AND INTERPRETATION

The investigator compared the post-test scores of experimental and control group by taking total score and component wise score by using descriptive and t test, which is given in the table-1

Table-1: Difference in Means of Posttest Score of Experimental and Control Group

Groups	N	Mean	Standard Deviation	Mean Difference	df	t	Sig.
Posttest EG	27	12.70	2.920	2.630	52	3.869	0.001
Posttest CG	27	10.07	2.303				
Posttest analysis-EG	27	5.33	1.710	0.852	52	2.065	0.049
Posttest analysis-CG	27	4.48	1.221				
Posttest evaluation-EG	27	4.07	1.615	1.037	52	3.358	0.002
Posttest evaluation-CG	27	3.04	0.940				
Posttest creation-EG	27	3.33	1.441	0.704	52	2.301	0.030
Posttest creation-CG	27	2.63	0.967				

EG- experimental group and CG-control group

The table-1 points that the mean total score of posttest experimental group is 12.70 whereas the mean score of posttest of control group is 10.07. The S.D of posttest scores of

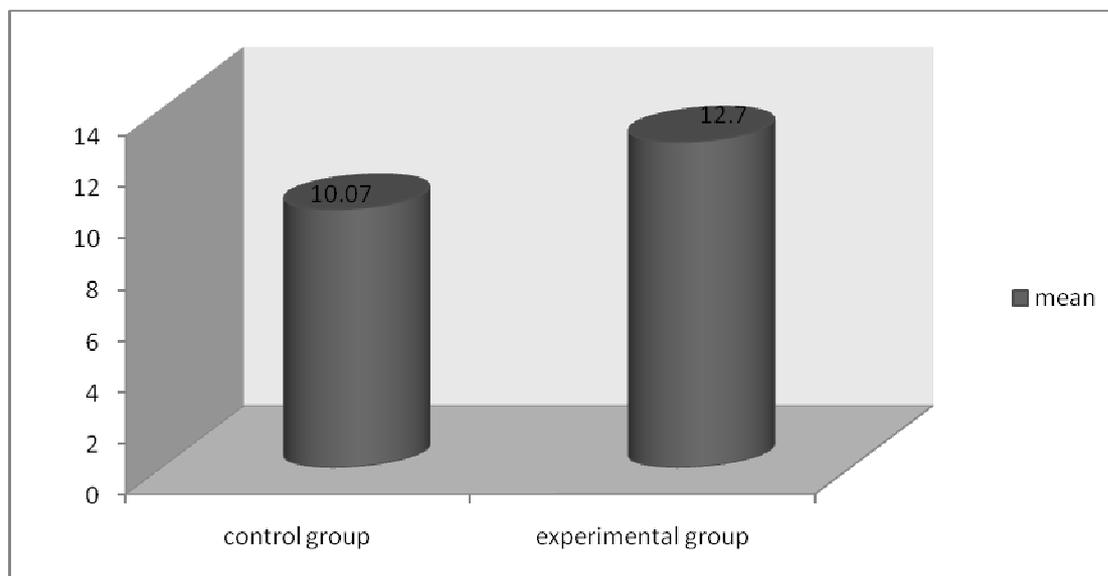
experimental group is 2.920 and S.D of posttest total scores of control group is 2.303. The mean difference between experimental and control group is 2.630. The table reveals that t value (3.869) is significant at 0.01 levels. So the null hypothesis “there will not be significant difference in posttest scores of control group and experimental group” is rejected at 0.01 levels. It can be concluded that the experimental group taught through cooperative learning is better than the group taught through traditional method in cognitive processes in science.

The table-1 also shows that the mean score of total analyzing scores of posttest of experimental group is 5.33 whereas the mean score of total analyzing posttest scores of control group is 4.48. The S.D of the total analyzing posttest scores of experimental group is 1.710 whereas the S.D of total analyzing posttest scores of control group is 1.221. The mean difference between the total analyzing posttest scores of both the groups is 0.852 with ‘t’ value 2.065 which is significant at 0.05 levels.

The table-1 reveals that the mean score of total evaluating scores of posttest of experimental group is 4.07 whereas the mean score of total evaluating posttest scores of control group is 3.04. The S.D of the total evaluating posttest scores of experimental group is 1.615 whereas the S.D of total evaluating posttest scores of control group is 0.940. The mean difference between the total evaluating posttest scores of both the groups is 1.605 with ‘t’ value 3.385 which is significant at 0.01 levels.

The table-1 also indicates that the mean score of total creating scores of posttest of experimental group is 3.33 whereas the mean score of total creating posttest scores of control group is 2.63. The S.D of the total evaluating posttest scores of experimental group is 1.441 whereas the S.D of total creating posttest scores of control group is 0.967. The mean difference between the total creating posttest scores of both the groups is 0.704 with ‘t’ value 2.301 which is also significant at 0.05 level.

The mean score of posttest control group and experimental group graphically represented below.



The investigator compared the boys and girls score in cognitive processes in post test by using t test, which is given in the table-2

Table-2: Statistics of difference between boys and girls in post test score of experimental group

Group	N	Mean	Std. Deviation	Mean Difference	df	t	Sig
Boys	17	12.24	3.011	0.700	25	1.091	0.286
Girls	10	13.50	2.718				

In posttest mean score for boys is 12.24, with S.D 3.011 and mean score for girls is 13.50, with S.D 2.718 in experimental group. Mean difference of both the group is 0.700 and t value is 1.091, which is not significant at 0.05 levels. So the null hypothesis that “there is no significant difference of boys and girls in experimental group” is accepted. It can be concluded that the cooperative learning is equally effective for both boys and girls in improving cognitive processes.

MAJOR FINDINGS

1. There is a significant difference in the posttest score of control group and experimental group on HOTs at 0.01 levels. The cooperative teaching method has significant effect on the students HOTs in science than the students thought through traditional methods.
2. There is no significant difference in HOTs of boys and girls taught by cooperative method in science at 0.05 levels. The cooperative learning method is equally beneficial for both boys and girls in improving HOTs in science.

EDUCATIONAL IMPLICATIONS

1. The present study has significant implications for developing higher order thinking skills in science through cooperative learning strategies. The result of the study justifies the relevance and usefulness of cooperative method for teaching and learning science for elementary class. The students taught through cooperative learning methods can develop their cognitive process and achieve more score than students taught through traditional method.
2. One major finding of this study is that students taught using the cooperative learning approach scored higher marks in science achievement test than those taught using the traditional classroom teaching method. This may have been achieved due to the high level of students' participation in learning activities.
3. All students irrespective of their sexes benefited in about the same margin from the use of cooperative learning strategy. This perhaps may be the reason why no significant difference was found in achievement between the male and female students on the use of cooperative learning strategy.
4. Cooperative learning promoted leadership skills and teamwork. Students were learning from their peers by providing comprehensible input and output. More

advanced students used academic language to explain concepts to group members. More importantly, many of the skills developed through the real world tasks are those which employers usually seek such as team-work, making informed decisions, taking initiative, and solving real world problems.

5. In cooperative learning approach students unconsciously practicing higher order thinking skills such as analysis, synthesis, problem solving and prediction, which help them to solve their real life problems.

CONCLUSION

From this study the investigator came to the conclusion that the cooperative learning teaching strategy has statistically significant effect in developing higher order thinking skills in science. Hence science must be taught through cooperative learning teaching strategy at elementary level.

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