



## “COLLABORATIVE LEARNING STRATEGIES IN EMPOWERING HIGHER PRIMARY STUDENTS IN SCIENCE AND MATHEMATICS SUBJECTS”

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### ABSTRACT

*In a global and knowledge based age, a teacher has to enhance students' appetite for more knowledge and variety of skills to cater to global demands. For the Development of the Knowledge and skills in a teacher, required changes have to be made in the instructions, at the teacher training level. These instructions generate new ideas and abilities in a student trainee. The instructions have to be simple and practical and have to inspire Teachers, who are required to bring changes into classroom teaching and learning. During last few decades there has been a radical change in teaching approaches compared to earlier; as a result, today we are very much conscious of using various teaching strategies at all the levels to convince the learners and create interest in learning. The present study reveals that collaborative teaching strategy for the improvement of Science Education at the Higher Primary School students of Raichur City is a welcome idea, and collaborative learning strategy has the potentiality of enhancing low ability students' academic performance in Science and math's at higher primary school level.*



**KEY WORDS :** Empowering, Collaborative strategies, Creative problem solving ability, etc

### INTRODUCTION

Collaborative learning is an instructional method in which student's team together on an assignment. In this method, students can produce the individual parts of a larger assignment individually and then “assemble” the final work together, as a team. Whether for a semester-long project with several outcomes or a single question during class, collaborative learning can vary greatly in scope and objectives. Cooperative learning, sometimes confused with collaborative learning, describes a method where students work together in small groups on a structured activity. Students are individually accountable for their work but also for the work of the group as a whole, and both products are assessed.

Project based Learning, Learning through Activity, computerized Teaching and Learning are recent techniques used in teaching-learning process. Similarly Teachers who are progressive always think of constructivist theories in specific for facilitating, guiding, managing the students in teaching-learning process.

At teacher education level, the teacher educators must develop an environment to help the student trainees to construct the knowledge about various strategies which can be used to improve educational achievements of the pupils at secondary school level in different subjects.

Under constructivist theories, the collaborative Learning strategy is an instructional method, in which the students work in small groups; this strategy can be a very good way of helping students to construct their own knowledge cooperatively.

Collaborative Learning speaks about cooperative effort of students and teachers in a learning process. The teacher becomes a facilitator who structures learning opportunities, serve as a knowledge resource and encourage the students to work together to build a common body of knowledge. This opines that the change in the student attitude is possible through various strategies in teaching. Slow and low achievers may also be attracted to this new strategy.

### SIGNIFICANCE OF THE STUDY:

Coming together is the beginning, Keeping together is progress. Working together is success—Henry Ford. Collaborative learning (CL) is a personal philosophy, not just a classroom technique. In all situations where people come together in groups, it suggests a way of dealing with people with respect to highlight individual group members' abilities and contributions. There is a sharing of authority and acceptance of responsibility among group members for every group action. Group members base the underlying principle of collaborative learning upon cooperation. For the effective implementation of Education for sustainable development, appropriate teaching learning strategies need to be selected and used, Collaborative learning is an educational approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or create a product. The main characteristics of collaborative learning are: a common task or activity; small group learning,

The process of education is aimed at enhancing the academic performance of the students. Only a holistic approach can yield result to improve learning outcomes of the students. Although Academic performance is dependent on many variables like Test of Creative –problem solving, Test Anxiety, Sex, Class, teaching-learning techniques etc. The learning methodology adopted for teaching enhances and affects the achievement of the students in Science and Mathematics. To optimize the educational opportunities, it is necessary to find out the relation between the teaching methodology and academic achievement in Science, mathematics and to what extend collaborative learning strategies and individual learning influences the academic achievement in Science and Mathematics so that the academic achievement of higher primary school students could be increased.

Based on the above significance, it shows that collaborative learning when practiced will help to improve student's academic performances. This study intends to find out the effect of collaborative learning strategy on academic performance of Government higher primary school students of Raichur City.

**Statement of the problem:** "COLLABORATIVE LEARNING STRATEGIES IN EMPOWERING HIGHER PRIMARY STUDENTS IN SCIENCE AND MATHEMATICS SUBJECTS"

### OPERATIONAL DEFINITION OF THE TERM USED:

**1. Collaborative** learning is a situation in which two or more people learn or attempt to learn something together. Thus, **collaborative** learning is commonly illustrated when groups of students work together to search for understanding, meaning, or solutions or to create an artefact or product of their learning.

### OBJECTIVES OF THE STUDY:

The following are research objectives formulated

1. To develop material on collaborative learning strategies for selected topics/concepts of Science and Mathematics for Higher primary school level.
2. To construct and standardize the achievement tests in Science and Mathematics.
3. To study the difference in the achievement test scores in Science of VII Standard students taught using collaborative learning strategy and those taught using traditional method of teaching.
4. To study the difference in the achievement test scores in Science of VII Standard male and female students taught using collaborative learning strategy and those taught using traditional method of teaching.

5. To study the difference in the achievement test scores in Mathematics of VII Standard students taught using collaborative learning strategy and those taught using traditional method of teaching.
6. To study the difference in the achievement test scores in mathematics of VII Standard male and female students taught using collaborative learning strategy and those taught using traditional method of teaching.
7. To study the difference in the achievement test scores in Science of VII Standard High, Average, and Low Creative problem solving ability students taught using collaborative learning strategy and those taught using traditional method of teaching.
8. To study the difference in the achievement test scores in Science of VII Standard High, Average, and Low Creative problem solving ability among male and female students taught using collaborative learning strategy and those taught using traditional method of teaching
9. To study the difference in the achievement test scores in Science of VII Standard High, Average, and Low Test anxiety students taught using collaborative learning strategy and those taught using traditional method of teaching.
10. To study the difference in the achievement test scores in Science of VII Standard High, Average, and Low Test anxiety among male and female students taught using collaborative learning strategy and those taught using traditional method of teaching
11. To study the difference in the achievement test scores in mathematics of VII Standard High, Average, and Low Creative problem solving ability students taught using collaborative learning strategy and those taught using traditional method of teaching.
12. To study the difference in the achievement test scores in mathematics of VII Standard High, Average, and Low Creative problem solving ability among male and female students taught using collaborative learning strategy and those taught using traditional method of teaching.
13. To study the difference in the achievement test scores in Mathematics of VII Standard High, Average, and Low Test anxiety students taught using collaborative learning strategy and those taught using traditional method of teaching.
14. To study the difference in the achievement test scores in Mathematics of VII Standard High, Average, and Low Test anxiety among male and female students taught using collaborative learning strategy and those taught using traditional method of teaching.

#### **HYPOTHESIS OF THE STUDY:**

The following null hypotheses are formulated to be tested at  $P \leq 0.05$  level of significance

1. There is no significant difference in the achievement test scores in Science of VII Standard students taught using collaborative learning strategy and those taught using traditional method of teaching.
2. There is no significant difference in the achievement test scores in Science of VII Standard male and female students taught using collaborative learning strategy and those taught using traditional method of teaching.
3. There is no significant difference in the achievement test scores in Mathematics of VII Standard students taught using collaborative learning strategy and those taught using traditional method of teaching.
4. There is no significant difference in the achievement test scores in mathematics of VII Standard male and female students taught using collaborative learning strategy and those taught using traditional method of teaching.
5. There is no significant difference in the achievement test scores in Science of VII Standard High, Average, and Low Creative problem solving ability students taught using collaborative learning strategy and those taught using traditional method of teaching.
6. There is no significant difference in the achievement test scores in Science of VII Standard High, Average, and Low Creative problem solving ability among male and female students taught using collaborative learning strategy and those taught using traditional method of teaching

7. There is no significant difference in the achievement test scores in Science of VII Standard High, Average, and Low Test anxiety students taught using collaborative learning strategy and those taught using traditional method of teaching.
8. There is no significant difference in the achievement test scores in Science of VII Standard High, Average, and Low Test anxiety among male and female students taught using collaborative learning strategy and those taught using traditional method of teaching
9. There is no significant difference in the achievement test scores in mathematics of VII and VII Standard High, Average, and Low Creative problem solving ability students taught using collaborative learning strategy and those taught using traditional method of teaching.
10. There is no significant difference in the achievement test scores in mathematics of VII and VII Standard High, Average, and Low Creative problem solving ability among male and female students taught using collaborative learning strategy and those taught using traditional method of teaching.
11. There is no significant difference in the achievement test scores in Mathematics of VII and VII Standard High, Average, and Low Test anxiety students taught using collaborative learning strategy and those taught using traditional method of teaching.
12. There is no significant difference in the achievement test scores in Mathematics of VII and VII Standard High, Average, and Low Test anxiety among male and female students taught using collaborative learning strategy and those taught using traditional method of teaching.

#### REVIEW OF RELATED LITERATURE

1. **Dorothy DeWitt\*, Saedah Siraj and Norlidah Alias(2012)** Collaborative learning has been shown to be effective for the construction of knowledge. In science instruction, collaboration and knowledge-construction needs to be done in the language of science. A collaborative m learning (CmL) science module employed uses three computer-mediated communication (CMC) tools: wiki, discussion forum and text messaging. This study seeks to determine the forms of communication and learning in the use of these CMC tools in the CmL module. Twenty (20) Form 2 students of different science abilities participated in the study. Data were collected from student interviews; online communications on the wiki, discussion forums, and text messages; students and researchers' journal records; and a survey of students' perception of communication with the CMC tools and learning. The findings showed the learners' frequency of communication was highest in the wiki and text messaging. The combination of three CMC tools was effective as it catered to learners' preferred learning styles. Group work and the collaborative activities enabled learning. The CmL module was effective for learning as verified by the improvement in post-test results. The findings of this study provide insights into group interactions in a CmL environment and show that peer interactions scaffold learners in building their knowledge in science.

2. **Girija N Srinivasalu(2013)** In a global and knowledge based age, a teacher has to increase students' appetite for more knowledge and variety of skills to cater to global demands. For the Development of the Knowledge and skills in a teacher, required changes have to be made in the instructions, at the teacher training level. These instructions generate new ideas and abilities in a student trainee. The instructions have to be simple and practical and have to inspire Teachers, who are required to bring changes into classroom teaching and learning. For this, the teacher educators must develop an environment to help the student trainees to construct the knowledge about various strategies which can be used to improve educational achievements of the pupils at secondary school level in different subjects. Social Sciences as an important subject at the school level, needs new techniques for teaching and learning process. The educated world has begun to appreciate the enormous potentialities of the subject since, it enhances link between Social Sciences and social realities. So it is an energizing and rapidly evolving field which demands new strategies and skills for teaching and learning.

3. **Sahin (2010)** looked into the use of the Jigsaw II technique, an adapted version of the original Jigsaw Classroom technique, on students' academic achievement and attitudes towards a written expression

course. Findings from this study revealed that the Jigsaw II technique contributed to the improvements of the students in their written expression course. In addition, the students perceived the method positively because a majority reported that the method has increased their self-confidence, interest for learning and allowed them to be more active in the classroom.

4. **Honeychurch (2012)** conducted a study of the jigsaw method in which the students from the expert groups had to teach other students by posting their discussions online and then meeting up with the tutor to give presentations of their discussions to the class. Overall, the students achieved marks that were significantly higher than before as well as a reduction in the number of failures. The students’ feedback was very encouraging as they requested the researcher to continue using the jigsaw method.

**METHODOLOGY**

**Research Design**

The research design for this study is experimental pre- test pos- test control group design. A pretest was administered to determine the equivalence in ability level of these two groups (experimental and control groups). Treatments were administered to the experimental groups by exposing the study subjects to collaborative learning strategy, while the control group was taught using convectional lecture method. At the end of the six-week treatment periods, the post-test was administered to both experimental and control groups. Science Achievement Test and Mathematics Achievement test were used in both the pre-test and post-test. The scores from the performances of both experimental and control groups were collected and analyzed in order to determine the differences in the students’ performance using the SPSS statistical package. The design of the study is presented as shown in

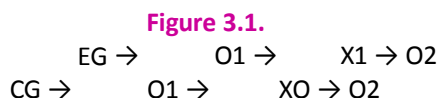


Figure 3.1: Research Design Illustration Where;

- EG = Experimental Group
- CG= Control Group
- O1 = Pretest
- O2 = Posttest
- XO = No Treatment
- X1 = Treatment

**POPULATION OF THE STUDY**

The population for this study comprised all the VI and VII standard students in Government Higher Primary School, Raichur City. There are **20** Government Higher Primary Schools with a population of six thousand five hundred and fifteen students (6,515) made up of 2,542 girls and 3,973 boys. The record of enrolment of all the students in this target population and the summary of the population of this study is presented in Table 3.1

Sr.no	Govt higher primary School Vidyanagar, Raicur	Govt Higher Primary School Jayanagar ,Raichur
1	Boys- 60	Boys- 60
2	Girls- 20	Girls—20
Total	80	80
<b>Grand total</b>		160

### TOPICS SELECTED FOR THE STUDY

For the selection of topics for this study, VII standard Karnataka state Science and Mathematics Text Book topics were chosen for teaching. The selected topics are presented as follows

#### For Science

- (a) Work, Energy, and Power
- (b) Types of Simple machines, The Wheel and axle, Screw thread and Gears.

#### Instrumentation/ tools used

The instruments and the instructional tools used for data collection in this study are as follows;

1. **Achievement test in Science.** - Investigator prepared and standardizes himself, the detail procedure of construction and validation is given in detail in the third chapter of the thesis.
2. **Achievement test in Mathematics:** Investigator prepared and standardizes himself, the detail procedure of construction and validation is given in detail in the third chapter of the thesis.
3. **Creative problem solving test:** The present investigator employed Passi-Usha Test of Creative Problem Solving (PUTCPS). This test battery is meant to identify creative talent among the students.
4. **Test Anxiety:** Kumar Anxiety scale used for the present study to know the level of anxiety among students.
5. **Lesson plan for both experimental and control groups:** Lesson plans based collaborative approaches will be enclosed in the appendix of thesis.
6. **Collaborative Learning Package (based on jigsaw) (CLP).** The detail procedure collaborative learning packages based on jigsaw method in given in detail in the third chapter of thesis.

#### TREATMENT ADMINISTRATION

In this study, the researcher taught the two groups for Two weeks and one hour per lesson. The first lesson was used to acquaint the subjects with the collaborative learning strategy. The researcher taught experimental group with collaborative learning strategy, and control group with lecture method. Collaborative learning strategy is an approach, which allows students to interact with study materials in groups. Groups and individual members construct meanings of what is learnt. During the process of the lesson, students collaborated by combining what they learn which helps to bring wider meaning of what they have learnt. During the process of this study the researcher, served as a guide and facilitator to the students.

#### DATA COLLECTION PROCEDURE

This research study aimed at determining the effect of collaborative learning strategy on academic achievement in the Science and mathematics for the selected topic among higher Government primary schools of Raichur city. For the purpose of data collection, the following procedures were used in collecting relevant data.

1. Treatment of the Experimental Group
  - a) Train the subjects before exposure to collaborative learning strategy.
  - b) Exposure of the experimental group to teaching using collaborative learning strategies (treatment).
  - c) Pretest Administration
    - a. Training of the subjects for collaborative learning strategy and then teach.
    - b. Exposure of the experimental group to posttest
2. Treatment of the Control Group
  - a. Exposure of control group to lecture method (control)
  - b. Exposure of the study subjects to posttest.

**Scoring Procedure:****1. Achievement test in Science and Math's.**

The collected data for both pre-test and post-test achievement test in Science and mathematics were scored, on the basis of right answer 1 marks is awarded and for wrong answer 0 marks is awarded. Thus, the minimum marks is 0 and maximum marks 40 in each of the test.

**CREATIVE PROBLEM SOLVING TEST:**

The responses were non-verbal or in drawings form. These responses were scored for originality and elaboration on the lines of TTCT and PTC scoring system. The scores on the dimensions of originality and elaboration were added so as to represent a measure of creative problem solving ability. Originality was assessed based on commonness of responses for which a three-point scale from zero to two was developed. Wrong responses were scored zero, the right and responses that are more common were scored one, and exceptionally good and original responses were scored two. Level of commonness is decided by the frequently of occurrence of a particular response in a particular group. Greater the, frequency of occurrence in the relevant groups, more is the commonness and lower is the score on originality, and vice-versa.

**Test anxiety:**

It is easily score able scale. The 'yes' answer to an item means admitting anxiety and 'no' answer to an item means not admitting anxiety. The total number of 'yes' answers denote the raw score of anxiety. The GASC includes 11 items which are labeled as 'lie items' on the basis of which a child receiving a negative score of six or more is rejected because this reveals the lying tendency of the child.

**STATISTICAL TECHNIQUES USED:**

The scores obtained from different tools used for the present study were analyzed statistically. The statistical techniques used for the data analysis were the co-efficient of correlation to see the relationship among independent and dependent variables. In addition to it ANOVA was implied for finding out the mean and interactional effects of independent variable over the dependent variable and 't' test and analysis of variable (ANOVA) were employed for knowing significant difference between different variable

**Data Analysis**

The data collected for this study was used to test the hypotheses stated in chapter one. Each of the hypotheses is restated below along with the description of the statistical technique used. The level of significance for rejection or retention of the stated hypothesis was set at  $P \leq 0.05$

**Analysis and Interpretation of data:**

**Table No 1: Mean, SD And 't' ratio Values of Achievement test in Science among traditional and Experimental Group of Higher primary School students.**

Sr.No	Group	N	M	Sd	T values
1	Traditional Group	80	32.15	4.99	12.77
2	Experimental Group	80	42.75	5.56	

From table 1, it indicates that the difference in mean of achievement in Science using CL is 42.75 as compared to traditional learning which is 32.15. The standard deviation for CL is 4.99 and for traditional learning is 5.56. The standard error of mean for CL is 4.99 and The t-value 12.77 is significant at 0.05 level. Hence, the hypothesis that there is no significant difference between the achievement scores in Science of VI and VII standard students using Collaborative learning and Traditional learning is rejected. That is there is a significant difference between the means of achievement in Science by using Collaborative and Traditional

techniques. The achievement is higher for collaborative learning methods as compared to traditional teaching strategies.

**Table 2. Mean, SD And ‘t’ ratio Values of Achievement test in Science among control pre-test and Experimental post-test Group of Higher primary School students.**

Sr.No	Group	N	M	Sd	T values
1	Control Group Pre-test	80	30.45	4.77	1.06
2	Control Group Post test	80	32.15	4.99	N.S

N.S = Not significant

**Table 3: Mean, SD And ‘t’ ratio Values of Achievement test in Science among Experimental pre-test and post-test Group of Higher primary School students.**

Sr.No	Group	N	M	Sd	T values
1	Experimental Group Pre-test	80	33.40	4.89	11.54 * S
2	Experimental Group Post test	80	42.75	5.56	

\*s =Significant

**Table 4 : Mean, SD And ‘t’ ratio Values of Achievement test in Science among Control Group pre-test male and female Group of Higher primary School students.**

Sr.No	Group	N	M	Sd	T values
1	Control group pre-test male	60	30.43	4.33	1.83
2	Control group pre-test female	20	28.47	4.12	N.S

N.S = Not significant

**Table 5.: Mean, SD And ‘t’ ratio Values of Achievement test in Science among Control Group pro-test male and female Group of Higher primary School students.**

Sr.No	Group	N	M	Sd	T values
1	Control group post test male	60	33.20	4.99	1.53
2	Control group post test female	20	31.50	4.10	N.S

N.S = Not significant

**Table 6 : Mean, SD And ‘t’ ratio Values of Achievement test in Science among Experimental Group pre--test male and female Group of Higher primary School students.**

Sr.No	Group	N	M	Sd	T values
1	Experimental group pre-test male	60	32.50	4.58	1.60
2	Experimental group pre-test female	20	34.50	4.98	N.S

N.S = Not significant

**Table 7. Mean, Sd values of High, Average and Low Creative problem solving Ability students in Effectiveness of Collaborative learning experimental Group.**

Sr.No	Group	N	M	Sd
	High creative problem solving abilities student’s post-test	20	46.12	4.33
	Average creative problem solving abilities student’s post-test	24	42.74	4.15
	Low creative problem solving abilities student’s post-test	36	38.43	4.06



**Table 8: Summary of analysis of variance of mean scores of High, Average and low Creative problem solving test and Achievement Science (effectiveness of Collaborative learning) in VII standard Students**

Df → 2, 497 = 0.05 → 3.04 0.01 → 4.71

Sl. No.	Source of variance	Df	Sum of squares	Mean sum of squares	F
1.	Between group	2	801.393	400.697	23.211
2.	Within group	77	1,329.273	17.263	
	<b>TOTAL</b>	79	2,130.666		

Above table shows the calculated 'F' value 23.211 for Achievement in Science Score among high, average and low Creative problem solving ability among Higher primary School students is greater than the tabulated " F "value **4.71 and 3.02 for 2, 77** degree of freedom at 1 percent and 5 percent level of significance respectively. The formulated null hypothesis is rejected at both levels of significance. Hence the null hypothesis No) is rejected and alternative hypothesis is accepted.

**Table 9. Mean, Sd values of High, Average and Low test anxiety students in Effectiveness of Collaborative learning experimental Group.**

Sr.No	Group	N	M	Sd
	High test anxiety student's post-test	30	38.12	4.99
	Average test anxiety student's post-test	26	42.43	4.89
	Low test anxiety student's post-test	24	46.74	5.56

**Table 10: Summary of analysis of variance of mean scores of High, Average and low test anxiety and Achievement Science (effectiveness of Collaborative learning) in VII standard Students**

Df → 2, 497 = 0.05 → 3.04 0.01 → 4.71

Sl. No.	Source of variance	Df	Sum of squares	Mean sum of squares	F
1.	Between group	2	994.750	497.375	18.857
2.	Within group	77	2,030.918	26.376	
	<b>TOTAL</b>	79	3,025.668		

Above table shows the calculated 'F' value 18.857 for Achievement in Science Score among high, average and low test anxiety among Higher primary School students is greater than the tabulated " F "value **4.71 and 3.02 for 2, 77** degree of freedom at 1 percent and 5 percent level of significance respectively. The formulated null hypothesis is rejected at both levels of significance. Hence the null hypothesis No) is rejected and alternative hypothesis is accepted.

**Conclusion:** There is significant difference exists in Achievement Scores (Affect of CL Strategies) in Science among the high, average and low test anxiety among Higher Primary School Students.

**Analysis and interpretation based Effectiveness of Collaborative learning in mathematics achievement**

Same manner of presentation and analysis were followed as in preceding pages

### Major findings of the data

#### Results based on Effectiveness of Collaborative learning strategies on Achievement in Science among higher primary School students

- That is there is a significant difference between the means of achievement in Science by using Collaborative and Traditional techniques. The achievement is higher for collaborative learning methods as compared to traditional teaching strategies.
- That is there is a significant difference in the means of achievement in Science by using Collaborative and Traditional techniques. The achievement is higher for collaborative learning methods as compared to traditional teaching strategies.
- There is no significant difference in the mean scores of Achievement test in Science among control pre-test and Experimental post-test Group of Higher primary School students.
- There is a significant difference in the mean scores of Achievement test in Science among Experimental pre-test and post-test Group of Higher primary School students
- There is no significant difference in the mean scores of Achievement test in Science among Control Group pre-test male and female Group of Higher primary School students.
- There is no significant difference in the mean scores of Achievement test in Science among Control Group pro-test male and female Group of Higher primary School students.
- There is no significant difference in the mean scores of Achievement test in Science among Experimental Group pre--test male and female Group of Higher primary School students
- There is no significant difference in students' Achievement Science due to gender; therefore, we reject the second hypothesis of the study. This proves that boys and girls have similar potentials in learning the Science via the collaborative learning strategy. This could be a strong proof for conducting other studies that will deal with the effect of gender to find out whether girls are more collaborative than boys or not.
- There is significant difference exists in Achievement Scores (Affect of CL Strategies) in Science among the high, average and low Creative problem solving abilities Higher Primary School Students.

### CONCLUSION:

Collaborative learning strategy enhanced the performance of students in Science and mathematics. Collaborative learning strategy has the potential of enhancing low ability basic science students' performances. Jigsaw learning strategy is an effective teaching method in mathematics since the findings of this study confirms that it leads to high achievement of the subject and also reduces gender disparities in mathematics achievement.

The use of Jigsaw learning strategy in teaching results in better students' performance in Science and mathematics. The use of Jigsaw learning strategy is therefore a suitable method for teaching. Curriculum developers should encourage teachers to use this method in teaching Science and mathematics to improve the current trend of dismal performance in Science mathematics especially in District schools. The teacher training colleges and universities should emphasis Jigsaw learning strategy as an effective method of teaching mathematics

In conclusions, using collaborative teaching strategy for the improvement of Science Education at the Higher Primary School students of Raichur City is a welcome idea, and collaborative learning strategy has the potentiality of enhancing low ability students' academic performance in Science and math's at higher primary school level.

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