COOPERATIVE LEARNING USING ICT TOOLS

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project/internship titled **"COOPERATIVE LEARNING USING ICT TOOLS: A RESEARCH BASED PROJECT"**, submitted by Zarin Fairuz Noor Ananya, ID No: 161-15-7223 and Syeda Nabila, ID No:161-15-7223 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 8th October 2020.

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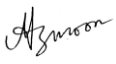

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DECLARATION

We hereby declare that this project has been done by us under the supervision of **Rubaiya Hafiz, Senior Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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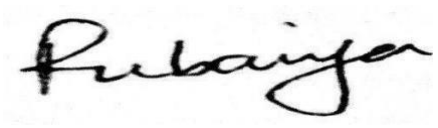

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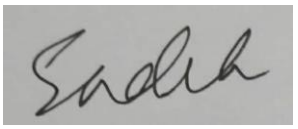

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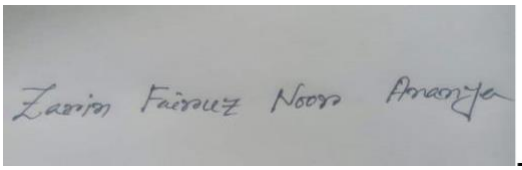

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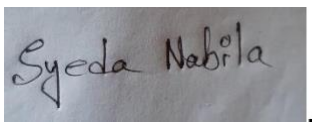

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Finally, we must acknowledge with due respect the constant support and patients of our parents.

Abstract

The purpose of our research paper is to bring students together and educate them in creative learning through the acquisition of real knowledge. By reading this research paper we can find out the reason why students are not educated in actual education. There is a learning gap between students despite teaching in teacher classes. They do not understand what they are reading. They get bad results in exams because of this learning gap. The main reason for this learning gap is that students do not get together. So, we have proposed a model in this research paper so that students can bridge the learning gap by studying together and gain proper knowledge about the subject. We have used cooperative learning and ICT tools in our proposed model. Through cooperative learning, students will be grouped together so that they can bridge their learning gaps by discussing among themselves. And through ICT tools, students will be brought together outside the classroom. Teachers will take two exams. Before cooperative learning and after cooperative learning. And by comparing the numbers of the two exams, the teachers will be able to know about the students. We took the test on C programming language. Approximately 40 students took part in the exam. Then we do research on their results and apply our learning method. Reviewing the results of the research, we see that the results of the students were better in the second test than in the first test. In other words, we have improved the results and knowledge of the students through this learning method. In this way students will be able to bridge the learning gap and gain a clear idea about the subjects.

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CHAPTER 1
Introduction

1.1 Introduction

In our education system there is a learning gap among the students. Teachers give their best effort in the class but some or maximum students cannot capture the knowledge properly from the class. It occurs because of their less attention, shyness, nervousness and lack of cooperation with their teachers. That's why the learning gap occurs and students cannot take proper education. For this reason, they come out with their bad result and lack of knowledge. This learning gap can be reduced by cooperation between students and teachers and by guided collaboration between students. Cooperative learning is very much essential for reducing this problem. It helps the students to overcome their learning gap. So, we are proposing a structured model based on the result of research among the students.

1.2 Motivation

Most of the time students have a lack of knowledge about their studies. Because students cannot share their problem with their teachers in front of other students. They feel shy and they think that other students will laugh at them. On the other hand, some teachers feel disturb if any student throws a question at them. That's why students do not want to ask questions willingly. For this reason, a learning gap creates and this learning gap affects their result. It also affects our educational system. That's why we have thought this problem should be prevented. To overcome this problem, we have found out some methodologies which will make a structured educational system. By observing all these problems, me and my group partner got interested to do this research so that we can solve this problem.

1.3 Rationale of the study

We know that education is the backbone of the nation. If there is a shortage in education it will hamper the whole nation. So proper education is very much important for a nation. Having a lack of knowledge, students get poor CGPA. After getting this poor CGPA they cannot get any suitable job. If any student comes out with a high CGPA having shortness of knowledge they also cannot get a good job. Though they get jobs, they cannot shine in the job sector and thus the

company falls down. This loss affects the whole nation. So, we can see that these kinds of students who are carrying learning gaps, are not only a burden in the job sector or in the economic sector but also to themselves. That means it gives bad influence on the overall country. So, this problem should be solved as soon as possible. Otherwise the whole nation will be hampered to develop.

1.4 Research Questions

For the sake of the research the following questions have been set as research question:

1. Can we propose a model that ensures cooperative learning among students outside the classroom?
2. Does a structured cooperative approach help to overcome students' learning gaps?

1.5 Expected Outcome

The main purpose of this research is to truly educate the students. The education system is completed by taking exams. By taking the test the mistakes of a student are noticed by the teacher. And to correct these mistakes teachers have to follow a few necessary steps. The expected outcome of this research is to actually educate a student by bridging the learning gap.

1.6 Report Layout

Chapter 1 gives an overall idea of the research and Chapter 2 presents works that are related to research. In Chapter 3 we have elaborated our research methodology and chapter 4 contains different types of analysis along with the outcome of hypothesis tests. Chapter 5 describes ethical and social impacts of the research and finally chapter 6 concludes with summary and limitation of our research.

Chapter 2
Background

2.1 Introduction

In this chapter we are going to discuss the overall related works of this topic. We are going to discuss the definition of the term cooperative and collaborative learning. We are also going to differentiate between collaborative and cooperative learning.

We have also explained the approaches of cooperative and collaborative along with the reason for using the term cooperative. We have also mentioned why we have integrated ICT tools with cooperative learning and also mentioned why ICT with cooperative learning is better.

Then we have mentioned some research summary and scope of the problem. And at the end of this chapter we have discussed the challenges of this topic.

2.2 Related Works

Cooperative learning

Cooperative learning is a group learning system where the teacher improves the understanding of each student in the assigned group through their qualifications and knowledge and their collaboration through various types of educational activities [1].

Cooperative learning is teacher centered. Here the teacher controls the activities of the group. In cooperative learning, the teacher assigns a specific task to each group and the students in the group have to submit those tasks to their teacher within the specified time. Each student in each group participates in these activities with their own qualifications and knowledge. The success of each group depends on the spontaneous participation of the students [1].

The teacher provides information on a specific topic in each group and instructs them to study that topic in detail. Students in the group work by sharing their own knowledge with each other. In this case, all the students who are less proficient in that subject, the students also become proficient in that subject through the exchange of information. In this way each student in a group acquires detailed knowledge on any subject through their own discussions[1].

Students submit their assignments at the time assigned by the teacher for evaluation at the end of their education. Finally, the teacher reviews the assignments and gives marks on them [1].

Cooperative education bridges the gap between students learning. Because if a student does not understand in the classroom, they understand the subject through mutual discussion. In this way, no student will be weak in that subject [1].

Collaborative Learning

Collaborative learning is a learning method where students invent something new and collectively use their ideas and knowledge to collectively invent something big and new. This is called collaborative learning[2].

Collaborative learning is basically a part of cooperative learning. Students here are not teacher-centered. Students form teams on their own initiative. The team members share their knowledge, experiences and ideas. And everyone's knowledge and experience are combined and something new is invented. In this case, the students of the group study the subject and form the team themselves. In this case, they may or may not take the help of teachers. It depends on the team members [2].

Difference between cooperative learning and collaborative learning

Difference between cooperative learning and collaborative learning are given as follows in [3]:

Cooperative learning:

1) In cooperative learning, teachers share activities on specific topics among students by forming separate teams.

2) Teachers provide the necessary information to the students for their study and each team completes their lesson through cooperation and mutual alignment. The role of each student is important in achieving team success.

3) Student activities are observed and controlled by the teacher.

4) Students in each group submit it to the teacher at the end of their activity so that the teacher can evaluate their activities.

Collaborative learning

1) In Collaborative learning the teacher does not share any activities among the students. Students create teams as their own choice and work in groups to teach or create certain things.

2) Students help each other and provide information by sharing their knowledge with each other.

3) Students' activities are not controlled by the teacher, but they can get help from the teacher if needed. And there is no evaluation by the teacher.

4) Sharing knowledge with each other builds good relationships among students. And here success is achieved individually. Because even though learning is collaborative, its main purpose is to acquire knowledge by filling the learning gap individually.[4]

Methods of Cooperative Approach

There are several methods of cooperative learning. The methods are given below:

1) The teacher forms a team with a few students.

2) In each group the teacher provides information on a specific topic and asks the students to come up with a complete idea and analysis on that topic.

3) The students get a full idea of the subject through discussion among themselves.

4) Teachers take exams to evaluate their knowledge and give them marks based on their performance in their exams.

5) Thus, the whole group process is under the supervision of a teacher.

Methods of Collaborative Approach

There are several methods of cooperative learning. The methods are given below:

1) Students form teams on their own initiative.

2) Something new is created by each student imparting their own knowledge and ideas and integrating everyone’s ideas.

3) Students are not controlled by any teacher. Students perform all tasks on their own initiative and will.

4) Students are responsible for any team outcomes.

5) Teamwork performance is evaluated depending on their success.

Integration of ICT tools in Cooperative learning

In the cooperative learning system, the teacher divides the activities among the students on specific topics by creating separate teams. So that students can discuss together on that subject and gain knowledge and share knowledge with each other. In this way the success of a team is achieved and everyone in the team becomes proficient in acquiring knowledge in that subject. Although almost everyone has an idea about cooperative learning systems, it is not widely used in developing countries. In these countries the traditional education system is followed in the educational institutions. However, now that the education system has improved, online based activities are being observed and educational institutions teach their students using online tools.[5]

In traditional education, cooperative learning is limited to the classroom. Cooperative learning on any subject requires necessary materials and information which is not possible through traditional education. Because, to know about a subject, people have to collect information from online by using online tools. In addition, this system does not allow cooperative learning between teachers and students outside the classroom. Because it is not possible to solve all the issues within the time limit of the classroom.[6]

The current world is information technology centric. Textbooks as well as online education are much more helpful to know in detail and gain knowledge on all subjects. A teacher can take information from the textbook as well as online to provide students with detailed information on the subject during his / her teaching and he/she can do that while sitting in the classroom using online tools. At present, such teaching methods have been introduced in various educational institutions. Following this method, teachers are able to provide their own content / text to students in PDF format. So that students are facilitated to understand. Also taking online classes, taking exams or taking presentations using online classrooms or giving announcements on any subject. But even after all this, the learning gap of the students is still going on. The reason is that online cooperative learning is not happening. Cooperative learning should exist outside of the classroom among teachers and students. So that the students will not have any more learning gap. For that, a bridge of cooperative learning has to be built between the classroom and the online space. In this case, Google Classroom is a great platform. In addition, online cooperative learning can be done with the help of tools like Google Meet or Zoom App or with other tools

like these. This bridge of cooperative learning can be fulfilled by following some stages. The stages are given below: [7]

In this learning system, teachers of each different subject in the classroom will see the performance of students by taking quizzes.

After watching their performance, the teachers will form small groups consisting of weak and strong students.

Then the teachers will take another exam online on all those subjects where students will judge each other by asking questions. In this way they will share knowledge by answering each other's questions and this will help them understand where their learning gaps are. Later the teachers will take another exam or presentation on their respective topics. There will also be a question and answer session among the teacher and students. So that the teachers can understand how much progress the students have made.

2.3 Research Summary

From the above study it is obvious that teachers all over the world are using cooperative methods to ensure that their students are engaged in study outside of their class also. It helps them from good bonding between them and empower themselves about their topics.

As teachers are free to practice their own cooperative method, there are many approaches noticeable in different researches. Integration of ICT tools in cooperative learning has also become a trend in recent time. Summary of our literature review is presented in table 2.1.

Table 2.3. 1: Summary of the literature review

Method	Subject	Tools	Sample size	Reference
Collaborative	Different kinds of Subjects	ICT	Undefined	[1]
Collaborative	Math & Science	ICT	Undefined	[2]
Collaborative	Different kinds of Subjects	ICT	Undefined	[3]
Collaborative	Math	ICT	502	[4]
Cooperative	Different Kinds of Subjects	ICT	Undefined	[5]
Collaborative	Undefined	ICT	Undefined	[6]
Cooperative	Physics	ICT	140	[7]

From the table we can see that in most of the cases collaborative methods were adopted by the educators and almost all of them focused on Science related subjects. However, sample size is not mentioned in many cases.

2.4 Scope of the problem

The use of computers and information technology in this global development is increasing day by day. People have become dependent on computers and technology for everything they do in their daily lives. Bangladesh is not backward in the same way. The use of computers and technology is noticeable in almost every case in Bangladesh. Computers and information technology have made a huge difference in people's lives. They have made people's daily lives easier. Computers and information technology are being used in every aspect of people's daily work, starting from the medical field.

ICT tools are also being used extensively in the field of education. As a result, students are able to participate in classes at home and get various information and updates of their classes while sitting at home. As a result, the education system has become much easier.

We have integrated ICT tools in cooperative learning so that students can get full education with the help of cooperative learning and ICT tools. Using ICT tools, students can study co-operate outside the classroom, i.e. from home. In this case, teachers will also be able to monitor the activities of students using ICT tools. Students and teachers will be able to study in groups together outside the classroom. In other words, cooperative learning can be done by grouping the students outside the educational institution. In this case, it can be reviewed whether the student is studying at home after class.

Moreover, through the use of ICT tools, students will become proficient in this regard. Their knowledge about computers and ICT will increase. Besides, teachers will also become proficient in ICT and computers.

So, we have added ICT to cooperative learning so that the students become proficient in the subjects of study through the practice of knowledge in detail in the study and welfare of computer and information technology.

All the studies we have covered describe methods on how to engage students in learning topics. But none of them focus on students' learning gaps. Therefore, there is a scope to conduct research to propose and develop a cooperative teaching methodology to help students in order to overcome their learning gaps by using ICT tools.

2.5 Challenges

- Not all the students have same internet facilities

- Lack of motivation in cooperative studies

CHAPTER3
Methodology

3.1 Introduction

In this chapter we are going to discuss the overall research methodology and data collection procedure along with a few descriptive statistics of the collected data.

In the Data Collection part, we have discussed the data collection procedure in detail. In order to evaluate whether Cooperative learning helped students to overcome their learning gaps we have taken two quizzes namely pre-test and post-test. Then after manually evaluating the quizzes their scores were considered for a hypothesis test.

Along with data collection procedure a general description of the scores of the students were also discussed to gain an overall understanding of the performance of the students. Later, in the chapter research framework was presented and described in detail.

3.2 Data collection

We collected data by taking exams on 45 students who took computer programming courses. But we collected this data from those students who participated in both exams. The number of such students who participated in both the examinations was 37. We divided the question pattern into six parts. The Six parts are respectively variable, loop, condition, syntax error, sequence and logic. Each part was numbered separately.

The numbers of each part are mentioned below:

- Variable-2marks
- Loop-2marks
- Condition-2marks
- Syntax error-2marks
- Sequence-2marks
- Logic – 5marks

Based on the distribution of these numbers, we took two exams on the students. One was a pre-test on a specific subject of programming, the other was a post-exam on the same subject. The main reason for taking two exams is to know whether the learning gap among the students has

been fulfilled or not. Weak and strong students were separated by taking pre-test. Then a poster presentation was taken online between these two exams. Where students were given the opportunity to question each other. A rule was made that a group could be questioned by three students only and anyone from their own group could not question each other. There was also a rule that a student would have the opportunity to question any group only once and only weak students should answer the questions. It was compulsory to give a presentation because the number was assigned separately on the presentation by the teacher. This created a platform where every student could question each other and, in this way, collaborative learning was created among the students. At the same time cooperative learning was created between teachers and students. And after taking this poster presentation, post exam was taken from the students then those scripts were evaluated as an approach followed in evaluating pre-test. Finally, pre and post test scores were considered for further tests.

3.3 Statistical Analysis

Table 3.3.1 represents a comparative score of two quizzes taken before and after the cooperative activities of the students.

Table 3.3. 1: Comparison of descriptive statistics of pre and post-test marks

	Pre-test	Post-Test
Mean	8.68	11.22
Median	8.00	11.00
Mode	7.00	13.00
Range	12.00	7.00
Minimum	3.00	7.00
Maximum	15.00	14.00
Standard Deviation	3.04	2.02

25% students	7.00	10.00
50% students	8.00	11.00
75% students	11.00	13.00
counted students	37.00	37.00

From the above table the difference in number between pre and post-test is being observed. We have found these differences based on the mean, median, mode, range, minimum number and maximum number. These are explained below:

Mean: Mean means the average of the numbers. Adding all the numbers and then dividing by how many numbers there are we get the mean of the numbers. From the above table the mean of pre-test is 8.68 and the mean of post-test is 11.22.

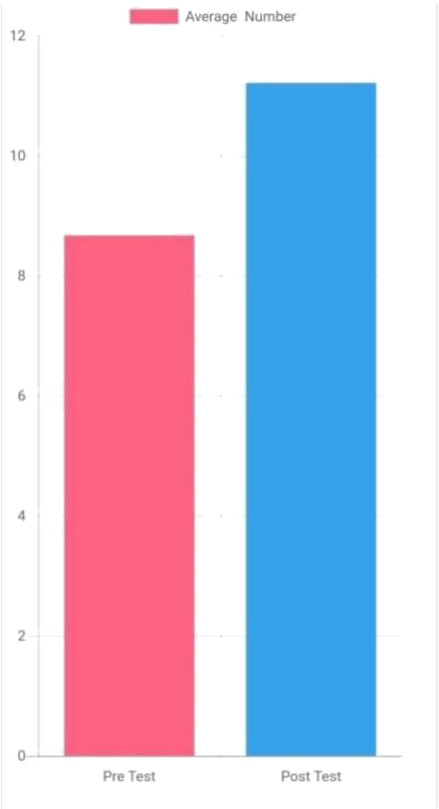

Figure 3.3. 1:Average number of pre-test and post-test

Median: The process of selecting a number in the middle by ordering all the data points is called median. From the above table the median of pre-test is 8 and the median of post-test is 11.

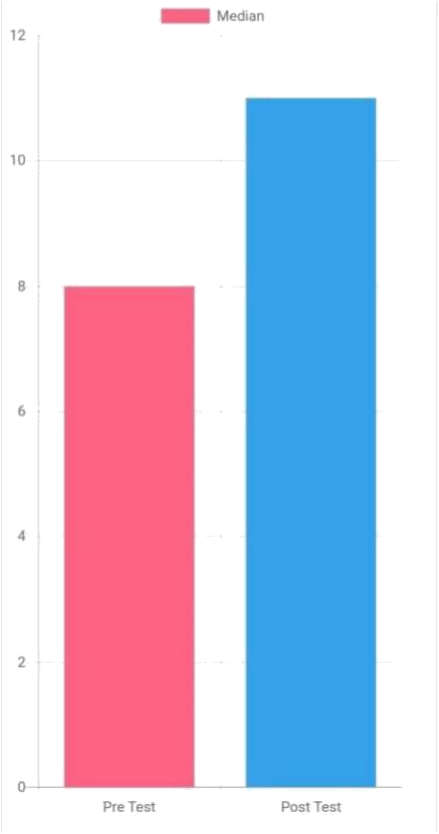

Figure 3.3. 2: Median of pre-test and post-test number

Mode: The number that appears repeatedly in a data set is called mode. From the above table the mode of pre-test is 7 and the mode of post-test is 13.

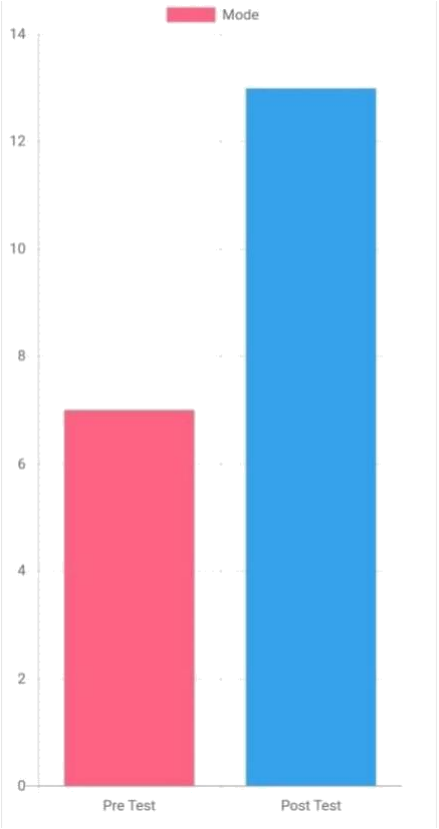

Figure 3.3. 3: Mode of pre-test and post-test number

Range: The difference between the smallest number and the largest number is called range. From the above table the range of pre-test is 12 and the range of post-test is 7.

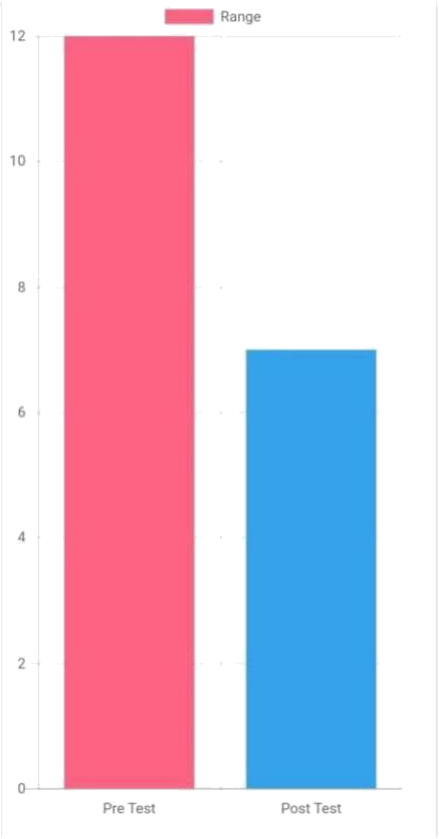

Figure 3.3. 4: Range of pre-test and post-test number

Minimum number: The point at which the value of fusion is lowest is called the maximum number. From the above table the minimum number of pre-test is 3 and the minimum number of post-test is 7.

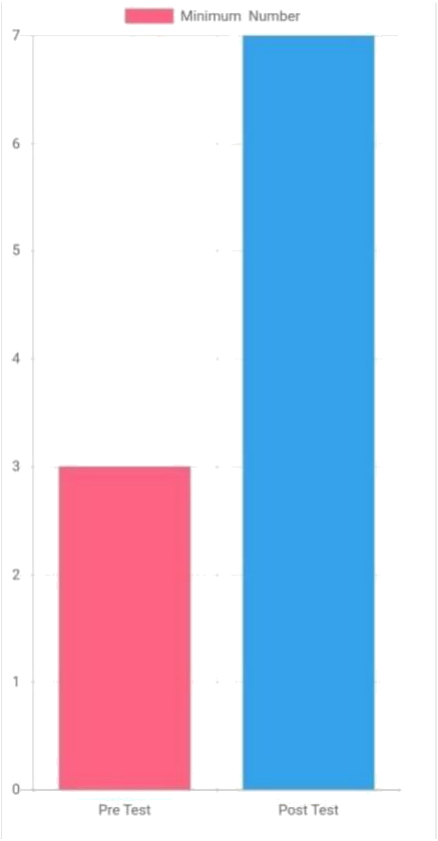

Figure 3.3. 5: Minimum number of pre-test and post-test

Maximum number: The point at which the value of the function is highest is called the maximum number. From the above table the maximum number of pre-test is 15 and the maximum number of post-test is 14.

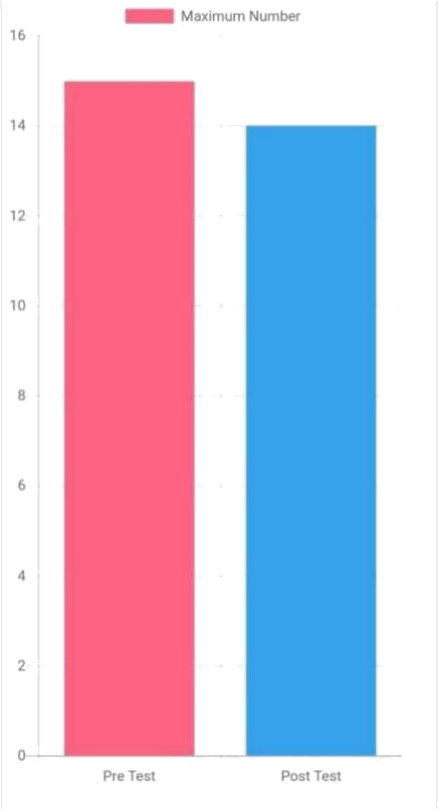

Figure 3.3. 6: Maximum number of pre-test and post-test

Standard deviation: Here the standard deviation of pretest is 3.04 and the standard deviation of posttest is 2.02.

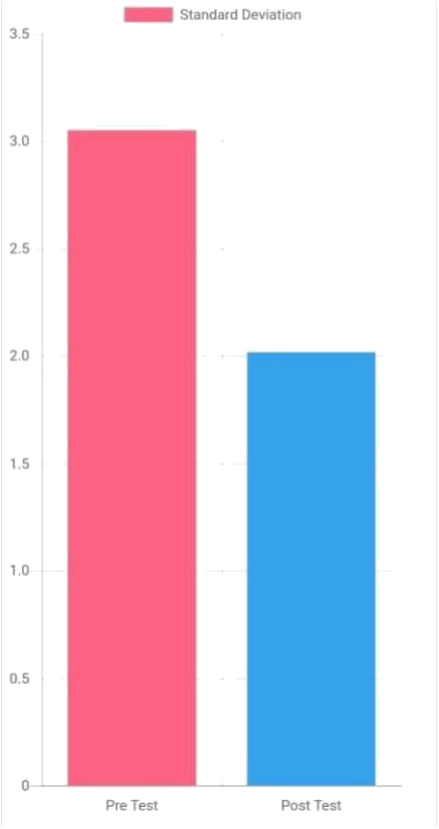

Figure 3.3. 7: Standard deviation of pre-test and post-test number

25% students got 7 in pretest and got 10 in posttest.

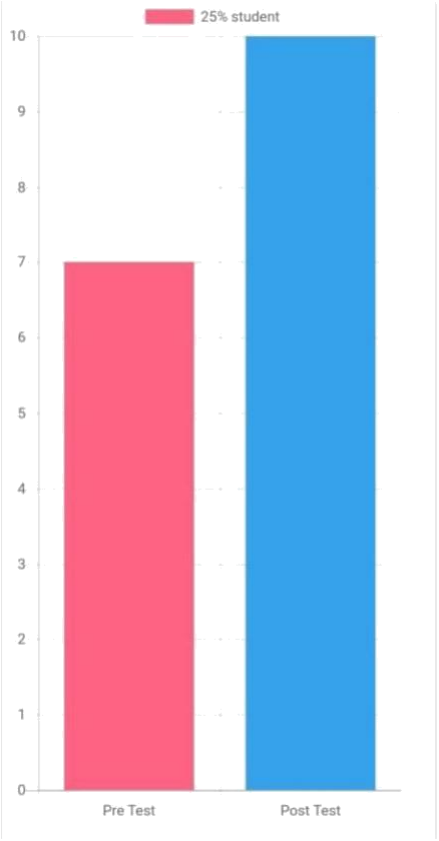

Figure 3.3. 8: 25% student's number in pre-test and post-test

50% students got 8 in pretest and 11 in posttest.

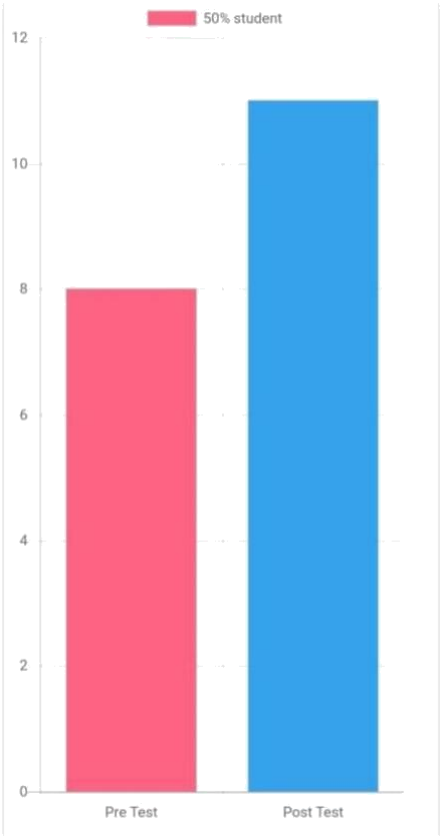

Figure 3.3. 9: 50% student's number in pre-test and post-test

75% students got 11 in pretest and got 13 in posttest.

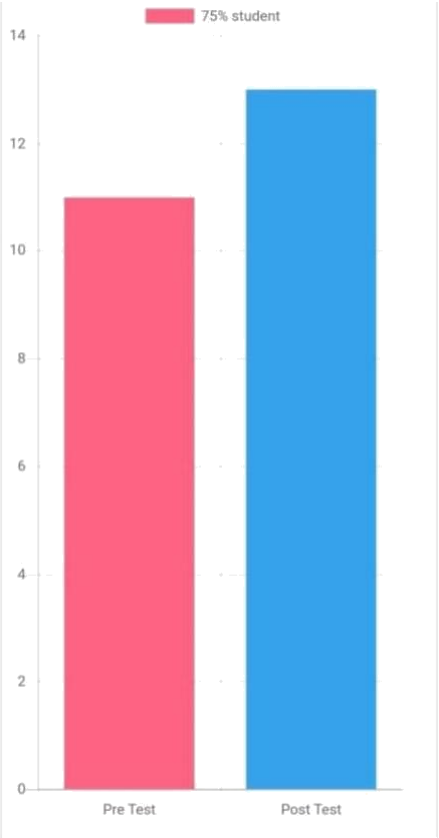

Figure 3.3. 10: 75% student's number in pre-test and post-test

3.4 Research Methodology

The main focus of the research was to ensure reducing learning gaps of the students by using cooperative teaching methods. Overall research framework is presented in figure 3.4.1 followed by the description of every detail.

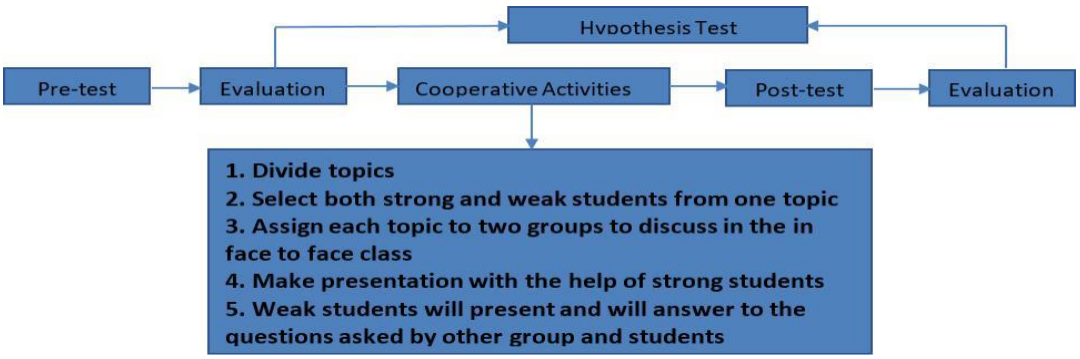

Figure 3.4. 1: Research framework

Effectiveness of cooperative learning is tested through a hypothesis test. So, we can say that there are six parts of this research:

- Pre-Test
- Evaluation
- Cooperative Learning
- Post-Test
- Evaluation
- Hypothesis test

First of all, the teacher will select a specific topic. Each of those topics has to be divided into separate parts. We have discussed C programming in this research. The teacher instructed the students to acquire detailed knowledge on 6 topics. They are: Variable, Syntax, Loop, Condition, Sequence and Logic. After that the students have been informed about the scheduled date of taking a class test. The teacher took the class test of the students sitting in the class on the scheduled day.

The second step of the hypothesis test is evaluation. After taking the exam of the students in the pre-test, they have been marked on these 6 topics. The teacher has marked the 6 topics separately so that the teacher can understand whether the students have acquired good knowledge about the 6 topics. And the teacher has given appropriate marks to the students according to their comprehension ability. The teacher then reviewed the number and divided the students in the class into two parts. One is a weak student and the other is a good student. The teacher has identified the good student and the weak student according to the difference in the number of students.

Then step 3 is cooperative activities. In this step the teacher forms a group with a certain number of weak students and a certain number of good students. In other words, each group has a certain number of weak students and a certain number of good students. The teacher instructed each team to re-discuss the topics that they had tested in the pre-test. Students in each team discuss about 6 topics in detail among themselves. As a result of exchanging information and group discussions among themselves, the weaker students become proficient in that subject. Besides, they gained a clear concept about that topic. The teacher instructs to present each team with a poster presentation and submits it to the Google classroom. And instructs the other groups to review each group's uploaded poster presentation and ask questions about it. And each group has to answer that assigned question. And all this is supervised by the course teacher. And this whole

process is done under the teacher. The teacher marks it. Since here students do group study under the supervision of the teacher, so the method of their study is cooperative learning. Each group is given one week for this cooperative learning.

One week later, the teacher takes another test on the previous topic: Variable, Syntax, Loop, Condition, Sequence and Logic according to the predetermined date. Since this test was taken after Co-operative learning, that's why it is called Post Test.

The last step is the evaluation of the post test. In this step, the teacher gives the number to the students according to their qualifications on the post test. And verified how much the students' skills on that subject have improved through numbers.

An analysis has been made of how much the student has improved by comparing the pre-test and post-test numbers. This means a course teacher gets a clear idea of how much a student's skills have improved by reviewing the difference in pre-test and post-test numbers. In addition, a student has gained a clear idea about the subject through pre-test and post-test and cooperative learning.

This is how a student can gain proper knowledge through cooperative learning using the hypothesis test and the teacher can understand the improvement of the students.

This process will take five steps. Steps are given below:

1st Step: Teacher will divide selected topics.

2nd Step: Teacher will select both strong and weak students from one topic by taking an exam.

3rd Step: Teacher will assign each topic to two groups to discuss in the face to face in the class.

4th Step: Weak students will make the presentation with the help of strong students.

5th Step: Weak students will present and will answer to the questions asked by other groups and students.

By following these steps, the learning gap can be reduced. This process is challenging and also time consuming. But we think by following these processes students can gain accurate and clear concepts about the subjects which are given from their educational institution.

3.5 Implementation Requirements

In order to check whether cooperative learning helped students to overcome their learning gaps or not, we conducted a hypothesis test after getting the score of the post test. For this purpose, we have used Google Colab. The following python libraries were used in hypothesis tests.

1. NumPy
2. Pandas
3. Math
4. SciPy

CHAPTER 4
Experimental Results and Discussion

4.1 Introduction

This chapter aims to discuss the experimental outcome of our research. In this context our main focus is to discuss the hypothesis test and other related comparative findings.

4.2 Experimental Results

Before discussing the main hypothesis test result, we would like to present some documents of cooperative activities of the students.

Cooperative Activities:

It was mentioned from the methodology that after pre-test the subject teacher helped students to form groups for cooperative activities. While forming the group low score obtaining students and high score obtaining students were mixed intentionally so that low scorers can get help from high scorers.

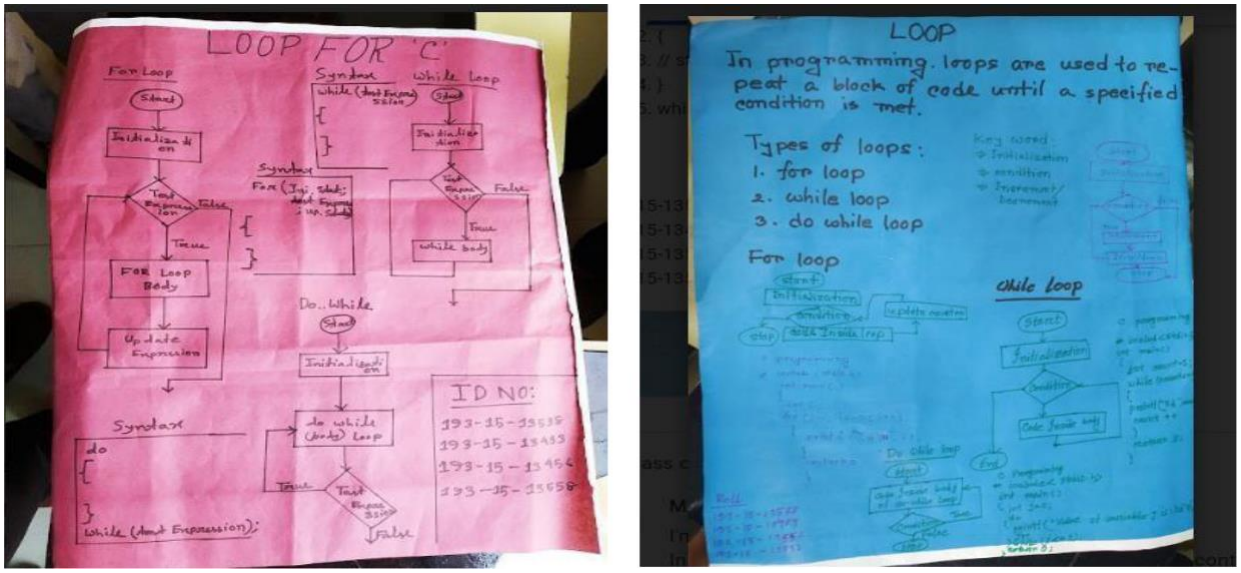

Figure 4.2. 1: Same poster presentation by two groups

Figure 4:1 shows two different posters presented by two groups. Though the topics are the same, it is visible that their posters are not the same which is expected. Later these two groups were

asked to present their posters in the classroom and it was made sure that while one group was presenting, the other group asked them questions about this topic.

In the next step, all of the groups were instructed to upload their posters in Google classroom. Later, every student was told to ask a question to any of the group, other than his own group, if he or she had any question regarding that presentation topic. Group members of that particular group who were asked questions, were instructed to give answers to those questions. Figure 4.2 shows one question answering evidence.

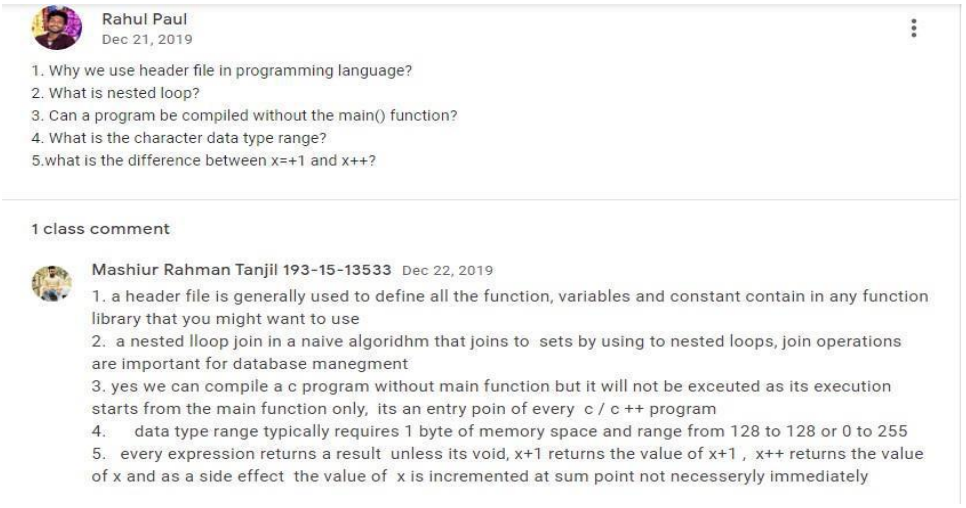

Figure 4.2. 2: Question and answer in Google classroom

Figure 4.2 shows that one student had asked a question to a particular group about the topics he felt difficulty in. In the span of one day, a group member of that particular group where the question was asked replied to his question. Definitely it would be better if there were any reply from the person who has asked the question. But at least these documents prove that a cooperative learning activity was conducted by the course teacher after the pre-test to ensure that the students go deep into the topics to overcome their problems.

Hypothesis test:

In order to examine whether all these cooperative activities actually helped students to overcome their learning or not, a hypothesis test was conducted. As we had only one group and the scores of pre and post cooperative activities were considered for the test, we decided to conduct t test for dependent sample.

For the sake of the test, we have set a hypothesis. They are as follows:

Null hypothesis: The means of two tests score are same

Alternative Hypothesis: The means of two tests score are not same

To get the answer we have written codes in python. At the beginning data were read using Pandas. Figure 4.3 shows code for data reading and printing.

```
#Reading dataset
ds = pd.read_csv("/content/dataset.csv",encoding= 'unicode_escape')
#define pre and post test values as data1 and data2
data1 = ds['pre']
data2 = ds['post']
ds[['pre','post']]
# ds[['pre','post']].describe()
```

	pre	post
0	6	9
1	13	14
2	9	8
3	11	13
4	10	14

Figure 4.2. 3: Code snippet and partial outcome of the dataset

In the above figure it is also visible that pre-test score and post test score are saved as data1 and data2. The following figure presents descriptive statistics of the dataset.

```
ds[['pre','post']].describe()
```

	pre	post
count	37.000000	37.000000
mean	8.675676	11.216216
std	3.046437	2.029438
min	3.000000	7.000000
25%	7.000000	10.000000
50%	8.000000	11.000000
75%	11.000000	13.000000
max	15.000000	14.000000

Figure 4.2. 4: Comparison of descriptive statistics of pre and post test

Figure 4.4 describes that there are 37 rows in the table. Mean and standard deviation of pre-test score 8.67 and 3.04 whereas mean and standard deviation of post-test score are 11.21 and 2.02. Minimum marks obtained in pre and post-test are 3 and 7 and the maximum marks obtained in pre and post-test 15 and 14. Among these 37 data of pre-test 7 of them lie in 25 percentiles, 8 lie in 50 percentiles and 11 lies in 75 percentiles. However, in post-test 10, 11 and 13 data lie in 25, 50 and 75 percentiles respectively.

Later a function was created to calculate necessary values from the dataset for hypothesis tests.

```
# function for calculating the t statistic, degree of freedom, critical value and p value for two dependent samples
def dependent_ttest(data1, data2, alpha):
  # calculate means
  mean1, mean2 = mean(data1), mean(data2)
  # number of paired samples
  n = len(data1)
  # sum squared difference between observations
  d1 = sum([(data1[i]-data2[i])**2 for i in range(n)])
  # sum difference between observations
  d2 = sum([data1[i]-data2[i] for i in range(n)])
  # standard deviation of the difference between means
  sd = sqrt((d1 - (d2**2 / n)) / (n - 1))
  # standard error of the difference between the means
  sed = sd / sqrt(n)
  # calculate the t statistic
  t_stat = (mean1 - mean2) / sed
  # degrees of freedom
  df = n - 1
  # calculate the critical value
  cv = t.ppf(1.0 - alpha, df)
  # calculate the p-value
  p = (1.0 - t.cdf(abs(t_stat), df)) * 2.0
  # return everything
  return t_stat, df, cv, p
```

Figure 4.2. 5: function for generating t statistic and other necessary values for hypothesis test

In order to calculate the statistic, we decided to measure the significance level 95% confidence. Therefore, we have chosen our alpha value as 0.05. Generated t statistic, degree of freedom, critical value and p values are shown in figure 4.6.

```
# calculate the t statistic, degree of freedom, critical value and p value
alpha = 0.05
t_stat, df, cv, p = dependent_ttest(data1, data2, alpha)
print('t=%.3f, df=%d, cv=%.3f, p=%.3f' % (t_stat, df, cv, p))
```

```
t=-5.946, df=36, cv=1.688, p=0.000
```

Figure 4.2. 6: t statistic, degree of freedom, critical value and p values

T statistic generated from the dataset is -5.946 with a degree of freedom 36. Besides, critical value and p value generated from the dataset is 1.688 and 0.000.

Finally, it is easy to calculate that the absolute value of t statistic is greater than critical value and p value is less than alpha. Therefore, both critical and p values generated from the t test deny the null hypothesis and accept alternative hypotheses. This is also generated by the code which is shown in figure 4.7.

```
# interpret via critical value
if abs(t_stat) <= cv:
  print('Accept null hypothesis that the means are equal.')
else:
  print('Reject the null hypothesis that the means are equal.')
# interpret via p-value
if p > alpha:
  print('Accept null hypothesis that the means are equal.')
else:
  print('Reject the null hypothesis that the means are equal.')

Reject the null hypothesis that the means are equal.
Reject the null hypothesis that the means are equal.
```

Figure 4.2. 7: Final outcome of the hypothesis test

4.3 Summary

It is known that two sample independent t tests actually draw a conclusion whether there is any significant difference between mean values or the difference visible in the means are just by chance. However, after conducting our hypothesis test, we can conclude with 95% confidence that the improvement in post-test score is not by chance. It happened due to the cooperative learning activities conducted using ICT tools.

CHAPTER 5
Impact On Society, Ethical Aspects

5.1 Impact On Society

How much a society will improve, that depends on the education acquired by the people of that society. So, the people of a society must be educated in real education. Therefore, the main purpose of our research is to ensure that the students do not have any shortcomings about the prescribed courses of the educational institution and that they can acquire proper knowledge.

With our proposed teaching method, students will be able to finish their class lecture very well. Week students will be able to fill their gaps through group discussions with good students. As a result, they will be able to gain detailed knowledge about the subject. And students will be interested in inventing new topics through discussion among themselves as a result of gaining

knowledge in detail. They will be interested in discovering new things by researching with their deep knowledge. In other words, the students of our country will be research oriented. Creativity will increase among the students. They will use their detailed knowledge everywhere in the society. As a result, its impact will increase from job sector to primary, high school and also varsity levels.

All in all, through our education system, students in every field of society will use their knowledge to create a better society through creativity.

5.2 Ethical Aspects

The most important aspect of ethical aspects is behavior. A teacher should treat every student well so that they can learn everything from the teacher without any hesitation. So that if they don't understand something, they don't hesitate to tell the teacher about it. At the same time students should be respectful and sincere towards the teacher. So that when the teacher teaches in the classroom, a peaceful environment is maintained. In this way, the teacher's teaching is facilitated. Teachers must be honest for every student. Everyone must be taught in the same way. Students should be faithful in every aspect of education and refrain from cheating during exams. The main purpose of education is to teach and teachers are the right planners behind this purpose. Teachers should make proper plans on how to improve the quality of education of students. In that case teachers should plan on how to improve the quality of education ofstudents

through cooperative learning. Cooperative learning will create a good relationship between teachers and students on the other hand, students will also be able to fill in their gaps.

CHAPTER 6

Summary, Conclusion, Recommendation and Implication for Future Research

6.1 Summary Of The Study

In this research we wanted to propose a teaching method that will engage the students for learning and also will fill their learning gaps. All the previous related papers talked about how to engage students for group study. But they did not mention how to fill the learning gaps of the students. With that in mind, we have proposed a teaching method that will help students to fill the learning gaps.

In this method we have used both Cooperative learning and ICT tools. Cooperative learning will help the students to engage for group study.

In our country's education system, students cannot be connected to the teacher outside the classroom. A lot of times a student sitting in the class does not understand the teacher's class lectures. It can be for various reasons. Lack of proper attention to students, late arrival in class, inability to understand, talking to friends, monotony of teachers, not making reading fun, not taking breaks in every class, mental depression of students etc. are some of the reasons why students cannot concentrate in class. Students cannot share the learning gap with their course teacher due to lack of proper communication of the student with the teacher. As a result, this learning gap is going away. And students cannot get good results due to lack of sufficient and clear knowledge. Besides, lack of knowledge cannot create creativity in them. As a result, they do not develop the ability to discover new things. It becomes difficult to do something creative in all spheres of society.

The learning gap will be bridged through cooperative learning. Hypothesis test will take one test before cooperative learning and another test after cooperative learning. And students will be given one week between these two tests. Students will re-do group study on the syllabus of pre-test within this one week and close their learning gap. And this course study will be supervised by a course teacher. This method of group study is cooperative learning.

After the cooperative learning, a post test will be taken. By comparing the numbers of pre-test and post-test, the teacher will be able to get an idea about the amount of knowledge increase of the students. This will close the learning gap of the students and increase their creative thinking.

6.2 Conclusions:

The purpose of this study is to fill the learning gap among students. Most of the students cannot receive proper education due to lack of a proper learning environment. Our methodologies will help them fill in all those educational gaps. Due to which they will get real education.

6.3 Implication for Further Study:

In future this study can be further conducted using a control group. Besides, individual performance can be considered for helping students to learn the subject in depth. Moreover, new approaches can be added to make the activities more enjoyable.

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