A STUDY OF THE EFFECTIVENESS OF COOPERATIVE LEARNING STRATEGIES ON STUDENTS' ACHIEVEMENT IN MIDDLE SCHOOL SCIENCE

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Abstract

The main purpose of the present study is to investigate the effectiveness of cooperative learning strategies on students' achievement in middle school science. It is an experimental research. Treatment is based on instructional design concerning cooperative learning strategies. According to the format of that design, (7) sample lesson plans of learning materials were constructed. The target population is Grade Six students. Two high schools that situated in Mayangone and Insein Townships in Yangon Region were selected by random sampling method. A total of (120) students and (4) science teachers participated in it. To study the effectiveness of cooperative learning strategies on students' achievement in middle school science, one of the true experimental designs, pretest- posttest only control group design was used. Treatments were conducted separately to two groups. The experimental groups were taught according to the cooperative learning strategies. The control groups were taught as formal. Learning materials were selected from Chapter (5), Earth and Space, from Grade Six General Science Textbook. The posttest scores or data were analyzed with independent samples *t* test to test the hypotheses of this study. The instrument used in this study was a posttest. The result of this study showed that, there was a significant difference in the achievements of science learning between the students who were taught by using cooperative learning strategies and those who were not. It can be suggested that the cooperative learning strategies should be used in the classroom in teaching middle school science. Therefore, it was concluded that cooperative learning strategies brings positive contributions to the middle school science.

Keywords: cooperative learning strategies, effectiveness, science

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Introduction

Education is the process of helping the child to adjust to the changing world. The best type of education guides the immature child to live his life richly and abundantly, at the same time to contribute social betterment. One of the main tasks of education in a modern society is to keep pace with the advance in knowledge. In such a society, knowledge cannot be received passively. It is something that is to be actively discovered. Thus, the main account in education should be on the awakening of curiosity, the stimulation of creativity, the development of proper interests, attitudes and values and the building of essential skills such as independent study and capacity to think and judge for oneself.

The science teacher sees education as a process of interaction between the child and his environment. They also realize the constant influence of communication media outside the classroom upon the students. Children learn by doing and learn how to learn in groups and also individually. According to Johnson and Johnson (2000), cooperative learning is more than just asking students to sit and work together. It is also an instructional methodology which splits class members into small groups in order for them to learn assigned material and make sure that all members of the group master the assignment (Johnson & Johnson, 1994). Group learning has been defined as the physical placement of students into groups and the usage of specific instructional strategies for the purpose of learning. Cooperative learning differs from traditional whole-class instructions in which students are taught as a single large group by a teacher. By creating a cooperative learning environment, students can share their knowledge about the scientific concepts and discuss their own perspective views on scientific discoveries.

The ultimate aim of education is to grow not just physically but in greater insight into and control over oneself and over one's environment (Khin Zaw, 2001). Thus, all schools and schooling systems accept that part of their role is to prepare students for the world of work, sometimes implicitly more and more, explicitly. To achieve this aim, school systems and their stakeholders see that affective and motivational aspects of science learning are important not only in the classroom but also in the wider societies. Teachers and students enjoy working with science ideas, especially when they have the

opportunity to investigate their own ideas and compare them with the ideas of standard science. But students reject a school science that is disconnected from their own lives, a depersonalized science, where there is no space for themselves and their ideas. To complement this, the students and teachers need to create a cooperative learning environment. Because cooperative learning actually raises student achievement while developing collaborative skills in a mutually supporting environment (Slavin, 1995, Johnson & Johnson, 1994).

Purposes of the Study

The main purposes for this study are:

(1) To study the effectiveness of cooperative learning strategies on students' achievement in middle school science

(2) To describe how to apply cooperative learning strategies in learning science

(3) To evaluate the effectiveness of cooperative learning strategies

Research Hypotheses

(1) There is a significant difference in the achievement between Grade Six General Science students who receive instruction with cooperative learning strategies and those who do not.

(2) There is a significant difference between the science achievement of experimental group and control group in answering knowledge level questions.

(3) There is a significant difference between the science achievement of experimental group and control group in answering comprehension level questions.

(4) There is a significant difference between the science achievement of experimental group and control group in answering application level questions.

Scope of the Study

The following points indicate the scope of the study.

(1) The study is geographically restricted to Yangon Region.

(2) The participants in the study are Grade Six students from the selected schools during the period within the academic year 2016- 2017.

(3) The study is limited to the content areas of "Earth and Space" from Grade Six Science textbook prescribed by the Department of Educational Planning and Training, Myanmar, 2015.

Definitions of the Key Terms

(1) Cooperative Learning Strategies: The structured, systematic instructional techniques in which small group work together to achieve a common goal. (Slavin, 1995)

(2) Effectiveness: Effectiveness (effect) means having power to produce, or producing, a desired result (Cruickshank & Bainer, 1999).

(3) Science: Science is defined as organized knowledge gained through science as activity, frequency used with a qualifying adjective to indicate a special branch of study (Good, 1959).

Review of Related Literature

Education is very broadly to describe all experiences in which people learn. All instruction is part of education because all instruction consists of experiences leading to learning. But not all education is instruction because many experiences that lead to learning are not specifically developed and implemented to ensure effective, efficient and appealing experiences leading toward particular learning goals. Actually, effective learning occurs as a result of effective teaching strategies. In order to develop effective lesson plans to bring about the attainment of desired objectives, teachers must possess a variety of skills and have a solid understanding of different concepts, ideas, and theories.

Behavioral Learning Theory

Behavioral theory emphasized the influence of the environment on learning. According to behavioral theories, teachers can play a significant role in effecting learning by determining what to teach with objectives based on desired behavior. Another important element in behaviorism is the transfer of learning. The transfer of learning shows the ability to correct theoretical orientation and practical application and to apply what one had achieved in the learning process to real-life situations (Orlich, Harder, Callahan, Trevisan &Brown, 2004).

Cognitive Learning Theory

Cognitive learning theory places much more emphasis on factors within the learner and less emphasis on factors within the environment than behavioral theories. Clearly, cognitive learning theory focuses on explaining the development of cognitive structures, processes and representations that mediate between instruction and learning. In attending to these structures and processes, the role of the learner as an active participant in the learning process takes on great importance. The learner is viewed as constructing meaning residing alone within instruction. Cognitive learning emphasizes social interactions, a purposeful relationship among individuals and their perceived environment. One of the important factors in cognitive teaching is to foster student motivation to become active learners through interactions with the environment Piaget (1952, cited in Reynolds & Muijs, 2011) stated that one of the main influences on children's cognitive development is what he termed maturation, the unfolding of biological changes that are generally programmed into us at birth. A second factor is activity. Increasing maturation leads to an increase in children's ability to act on their environment, and to learn from their actions. This learning in turn leads to an alteration of children's thought processes. A third factor in development is social transmission, which is learning from others. As children act on their environment, they also interact with others and can therefore learn from them to a differing degree, depending on their developmental stage. According to Piaget (1952, cited in Reynolds & Muijs, 2011), learning occurs in four stages of sensori- motor, pre- operational, concrete operational, and formal operational.

Table 1: A Summary of Piaget's Stages

Approximate age range	Stage	Major characteristics
Birth- 2 years	Sensorimotor	Development of object permanence, development of motor skills, little or no capacity for symbolic representation.
2- 7 years	Preoperational	Development of language and symbolic thinking, egocentric thinking.
7- 12 years	Concrete operational	Development of conservation, mastery of concept of reversibility.
12- adulthood	Formal operational	Development of logical and abstract thinking.

Source: Feldman ,1993

Constructivist Learning Theory

The essence of constructivist theory is the idea that learners must individually discover and transform complex information if they are to make it their own (Anderson, 2000, cited in Slavin, 2003). Thus, in a student-centered classroom, the teacher becomes the "guide on the side" instead of the "sage on the stage," helping students to discover their own meaning instead of lecturing and controlling all classroom activities (Windschitl, 1999, cited in Slavin, 2003).

Social Constructivism

The main theory that underpins cooperative learning refers to social constructivism advanced by Lev Semyonovich Vygotsky (1896-1934). In Vygotsky's social constructivism, social interaction is an important way in which children learn knowledge available in their culture without needing to reinvent it by them. Teachers and adults give direction and instructions, comments, and feedback to students. Children also use conversations in working with their peers in handling exercises, projects, and problems. In this way, they exchange ideas and receive information, thereby generating

understanding and developing knowledge. (Wood, Bruner, & Ross, 1976, cited in Eggen & Kauchak, 1999).

Cooperative Learning Strategies

Cooperative learning is a student- centered, instructor- facilitated instructional strategy in which a small group of students is responsible for its own learning and the learning of all group members. Students interact with each other in the same group to acquire and practice the elements of a subject matter in order to solve a problem, complete a task or achieve a goal. Various cooperative learning methods and models have been developed over the years by different scholars and put into actual practice in the classroom. According to Eggen and Kauchak (2012), the most suitable cooperative learning strategies for today's classrooms are Student Teams-Achievement Division (STAD), Jigsaw II and Group Investigation. They are briefly explained as follows.

1. Student Teams-Achievement Division (STAD): STAD is appropriate to use in a wide variety of subjects including mathematics, language arts and social studies. It is most appropriate for teaching well-defined objectives, such as mathematical computations and applications, language usage and mechanics, geography and map skills, and science facts and concepts.

2. ***Jigsaw II:*** Jigsaw was originally designed by Elliot Aronson and his colleagues in1978. Slavin (1995) developed a modification of Jigsaw by adapting Elliot Aronson's technique. It is appropriate to use in subjects like language, literature and social studies in which the learning materials are in the written narrative mode. Jigsaw II has 5 steps. They are (1) Reading, (2) Expert group discussion, (3) Home group reporting, (4) Testing, and (5) Group recognition.

3. Group Investigation: Group investigation is a general classroom organization plan in which students work in small groups using cooperative inquiry, group discussion and cooperative planning and projects. Moreover, it is said to be one of the most student-centered methods as students have much freedom to choose their topics of interest for investigation, plan and carry it out, present and evaluate the results. As group investigation is most suited for

investigating problems which can have different solutions, it helps develop students' higher order thinking skills.

Purposes and Characteristics of Cooperative Learning

Instructional procedures bearing the title or resembling cooperative learning have something in common with all instructional alternatives – they encourage students to learn. In contrast to others, cooperative learning encourages learners to work together for both the common and individual good. Its main purpose is all for one and one for all. Besides, cooperative learning systems are generally characterized by (1) the way the groups or teams are made up, (2) the kinds of tasks they do, (3) the groups' rules of behavior, and (4) their motivation and reward systems. According to Slavin (1985), cooperative learning seems to be an extraordinary success. It has an excellent research base, many viable, successful forms, and hundreds of enthusiastic adherents.

Establishing a Cooperative Task Structure in the Classroom

Establishing a task structure for a cooperative learning activity involves five specific steps. They are (1)specify the goal of the activity, (2) structure the task, (3) teach and evaluate the collaborative process, (4) monitor group performance, and (5) debrief.

1. Specifying the Goal: The goal of a cooperative learning activity specifies the prodct and behaviors that are expected at the end of the activity. To ensure the desired outcome, the teacher's job is to identify the outcome, check for understanding, and set a cooperative tone.

2. Structuring the Task: The structure of the task is what separates just any group activity from a cooperative learning activity. Four characteristics of an effective task structure involve the followings. They are positive interdependence, individual accountability, equal participation and simultaneous interaction.

Diversity contributes to the collaborative process by creating a natural flow of information from those who have it to those who need it. It also promotes the transmission of alternative perspectives and viewpoints that

often sends the flow of information in unexpected and desirable directions (Buehl, 2008 & Putnam, 2006, cited in Borich, 2014).

Students' role in Cooperative Learning: Some of the more popular cooperative learning role functions that teachers can assign within or across groups are summarizer, checker, researcher, runner, recorder, supporter and observer (Johnson & Johnson, 1998, cited in Borich, 2014). In addition to these specific role functions, all group members have other responsibilities to perform.

Teacher's Role in Cooperative Learning: The teacher plays a crucial role in orchestrating and overseeing that group activities occur as planned. There are also some key duties that the teacher must be responsible for. They are (1) Specify academic objectives (2) Specify collaborative skills (3) Decide on group size (4) Assign students to groups (5) Arrange the room (6) Plan materials (7) Assign roles (8)Explain the task (9) Test and question individual students (10) Promote inter group cooperation (11) Monitor students' behavior (12) Praise good use of group skills (13) Provide assistance on understanding a task (14) Provide assistance on how the group can work together more effectively and(15) Ask students to reflect on how well they are working together as a group (Johnson &Johnson, 1994). In addition to deciding on group composition, size and the individual responsibilities of group members, establish a system of reinforcement and reward to keep the students on task and working toward the goal. The reinforcement strategies that have been used effectively with the cooperative learning activities are (1) Grades (individual and group), (2) Bonus points, (3) Social responsibilities, (4) Tokens or privileges and (5) Group contingencies.

3. Teaching and Evaluating the Collaborative Process: Johnson and Johnson (2008) suggest some important cooperative learning skills and some of the ways the teachers can teach them:

(1) Teach how to communicate one's own ideas and feelings.

(2) Make messages complete and specific.

(3) Make verbal and nonverbal messages congruent.

(4) Convey an atmosphere of respect and support.

(5) Demonstrate how to assess whether the message was properly received.

(6) Teach how to paraphrase another's point of view.

(7) Demonstrate how to negotiate meanings and understandings.

(8) Teach participation and leadership.

4. Monitoring Group Performance: To establish a cooperative learning structure, teachers must observe and intervene as needed to assist students in acquiring their group's goal. Typically, the teacher will move from group to group at least once at the beginning of a cooperative activity, repeating the task and the goal to be certain each group understand it. Key to teachers' monitoring is their ability to recognize when a group is at a difficult juncture. Teachers' encouragement and support can instill the confidence some students will need to complete a task they may be unsure of and that may not be of their own choosing.

5. Debriefing: Providing feedback to the groups on how well they are collaborating is important to their progress in acquiring collaborative skills (Brookhart, 2008 & Weissglass, 1996, cited in Borich, 2014). The teacher can accomplish debriefing and evaluation at the end of the collaborative activity in the following ways:

(1) Openly talk about how the groups functioned. Ask students for their opinions.

(2) Solicit suggestions for improving the process and avoiding problems so higher levels of collaboration can be reached.

(3) Get viewpoints of predesignated observers. Teachers might assign one or two individuals to record instances of particularly effective and ineffective group collaboration and to report to the full class at the time of the debriefing.

Limitations of Cooperative Learning

Not all lessons are conducive to cooperative learning. Ideally, topics are used that require the searching out of answers and exploring of alternative solutions. The teacher also has to make organizational decisions that may only

be possible in certain circumstances. There can also be difficulties in assigning students to groups. The intent is to form truly heterogeneous groups, but personality conflicts still occur (Chan, 2004, cited in Marsh, 2008). Students may need considerable help in developing problem- solving skills (Barry, 1998, cited in Marsh, 2008).

Outcomes of Cooperative Learning

By bringing students together in adult- like settings to provide appropriately models of social behavior, cooperative Learning is an instructional strategy that instills in learners important behaviors that prepare them to reason and perform in an adult world (Behl, 2008, Gillies, 2010, Johnson & Johnson, 2008 & Jolliffe, 2007, cited in Borich, 2014). According to Borich (2014), the following behaviors resulted from cooperative learning strategies as the outcomes of cooperation.

Attitudes: Adult learners form their attitudes and values from social interaction. Students exchange their information and knowledge with that of others, who have acquired different information and knowledge in different ways. This exchange shapes their views and perspectives.

Prosocial Behavior: During close and meaningful encounters among family members, models of prosocial behavior are communicated. Students learn right from wrong implicitly through their actions and the actions of others that come to the attention of adult family members. Cooperative learning brings students together in adult- like settings that, when carefully planned and executed, can provide appropriate modes of social behavior (Stevens & Slavin, 1995, cited in Borich, 2014).

Alternative Perspectives and Viewpoints: Students formed their attitudes and values by confronting viewpoints contrary to their own. Confronted with these alternatives, they are forced into the objectivity necessary for thinking critically, reasoning, and problem solving. Cooperative learning provides the context or meeting ground where many different viewpoints can be orchestrated, from which the students form more articulate attitudes and values of their own.

Integrated Identity: One of the most noticeable outcomes of social interaction is its effect on how students develop their personalities and learn who they are. Students' personality becomes more coherent and integrated and is perceived by others as a more forceful and confident projection of their thoughts and feelings. Cooperative learning can be the start of stripping away the irrelevant, overly dramatic and superficial appendages that mask the students' deepest thoughts and feelings.

Higher Thought Processes: If all of the preceding benefits of cooperative learning were not enough, cooperative learning has also been linked to increases in the academic achievement of learners at all ability levels (Steven & Slavin, 1995). It actively engages students in the learning process and seeks to improve their critical- thinking, reasoning, and problem- solving skills (Greeno, 2006, Jacobs, Power & Loh 2002, cited in Borich, 2014). Together with these outcomes, cooperative learning can provide the ingredients for higher thought processes and set them to work on realistic and adult- like tasks. These higher thought processes are believed to be stimulated more by interaction with others. These behaviors require interaction with others, as well as reflection on self, to unleash the motivation required for thinking and performing in complex ways. With these outcomes, therefore cooperative learning can be seen that it is not just an activity that engages students in working together but an instructional strategy for acquiring thinking skills and values that represent lifelong learning goals.

Within cooperative learning situations, students benefit from helping each other learn, in competitive learning situations, students suffer from obstruction and frustrating each other's learning, and in individualistic learning situations, neither encouragement nor opposition takes place. Therefore, there is more considerably more helping, encouraging, tutoring and assisting among students in cooperative than in competitive or individualistic learning situations (Johnson & Johnson, 1987).

Description of Cooperative Learning Strategies Based Instruction

This study developed a conceptual framework from the literature review of various theoretical models which include Glaser's Basic Teaching Model (1965), Interaction Analysis Model (Flanders), Cooperative learning

methods (Johnson & Johnson, 2002), Cooperative learning (Slavin, 1995) and Cooperative learning strategies (Eggen & Kauchak, 2012). According to this framework, cooperative learning is a general term that describes a set of instructional strategies, all of which have specific structures and are designed to teach content and develop interpersonal skills. In this study, the three types of cooperative learning strategies are used. The steps in these strategies are:-

1. ***Steps in Planning and Implementing STAD Activities***

(a) Planning

(1) Identify content or skill to be mastered.
(2) Plan large- group presentation and seatwork materials similar to planning for any topic.
(3) Plan for assigning students to groups.
(4) Plan for improvement points.
(5) Plan for group rewards.

(b) Implementation

(1) Introduce and explain procedures.
(2) Provide initial instruction on target skill or content.
(3) Divide students into groups and distribute worksheet materials.
(4) Assign students to pairs and use team study to ensure mastery of content.
(5) Monitor groups for active involvement of all members.

(c) Assessment

(1) Administer quiz or teat as the teachers normally do.
(2) Score and assign improvement points.
(3) Recognize team achievement and provide feedback about different group's performance.

2. ***Steps in Planning and Implementing Jigsaw II***

(a) Planning

(1) Identify an area of study requiring students to understand interconnected or organized bodies of information that can be broken down into subtopics.

(2) Divide the content area into three or four roughly equal subtopics that will allow different students to specialize in their study.
(3) Locate resources that students can use to study the topic.
(4) Develop expert worksheets or charts that structure student's study effort and ensure that students will learn essential information.
(5) Divide students into heterogeneous groups.

(b) Implementation

(1) Introduce and explain procedures and divide students into groups.
(2) Hand out worksheets or charts and explain how they are to be used to guide individual study and group teaching.
(3) Monitor study in different groups.
(4) Convene expert groups (use groups of six or smaller) to discuss and compare information.
(5) Monitor students as they teach their topic to other members of the group.

(c) Assessment

(1) Administer quiz or tests as the teachers normally would. Make sure quiz covers all topics and encourages students to interrelate information across topic.
(2) Score, using improvement points.
(3) Recognize team achievements and provide feedback about group performance.

3. Steps in Planning and Implementing Group Investigations

(a) Planning

(1) Indentify a common topic that will serve as a focal point for the class as a whole.
(2) Catalog or gather resources that students can use as they investigate the topic.

(b) Implementation

(1) Introduce the general topic to the class and have students identify specific subtopics that individual groups will investigate.
(2) Divide students into study groups on the basis of student interest and heterogeneity.
(3) Assist students in cooperative learning regarding goals, procedures, and products.
(4) Monitor student progress, assisting students to work effectively in groups.

(c) Assessment

(1) Use group presentations to share information gained.
(2) Provide individual and group feedback about projects, presentation, and group effectiveness.

Method

Procedure

In order to ensure the effects of cooperative learning strategies, seven lesson plans through cooperative learning strategies and seven lesson plans through lecture methods were prepared. The sample lesson plans were validated with (8) experts in this field. After completing the required instruments, a pilot study was started with the total of (60) students. This current study included (120) Grade Six Students. This research used the true experimental design of pretest- posttest control group design. Because true experimental designs control for nearly all sources of internal and external invalidity (Airasian & Gay, 2003). In this study, some experts in the field were asked to validate the pretest items, the posttest items and marking schemes for both tests and rate each on its representativeness, relevance and clarity. After that, these two test items are modified again according to their suggestions. To establish the reliability of the instruments, a pilot study was conducted with (60) Grade Six students at No. (1) B.E.H.S, Insein in Insein Township. To show the internal consistency of the test, the reliability coefficient, Cronbach's alpha, was computed. The values of internal consistency for the instruments are 0.715, 0.723 and 0.807 respectively.

A pretest was administered before the treatment was provided. In experimental group, the treatment was received with cooperative learning strategies based sample lessons. In contrast, the control groups were taught by the formal method. Each class was taught five periods per week. A period lasts forty- five minutes. This research study lasts (2) weeks from end of November to mid of December. After the treatment period, the posttest was administered to both groups. Besides, the attitude questionnaires were received by the experimental groups. The results of each test were analyzed by using the Statistical Package for the Social Science (SPSS 22.0).

Subjects

The required sample schools were selected by using random sampling method. One of the Basic Education High Schools was selected from Mayangone township in western district of Yangon Region. Another Basic Education High School was selected from Insein township in northern district of Yangon Region. After that, simple random sampling method was used to select those sample students. The target population was Grade Six students.

Table 2: Population and Sample Size

Name of School	No. of Population	No. of Sample
BEHS (Mayangone)	611	60
BEHS (Insein)	465	60
Total (2 BEHS)	1076	120

Instrumentation

To conduct this experimental research, the instruments were constructed in accordance with the selected research design. The pretest consists of True- false items, completion items, multiple- choice items, matching items, and short answer items. At the end of the treatment, both groups were administered by a posttest. True- false items, completion items, multiple- choice items, short answer items and essay items were mainly involved. These items were constructed on the basis of the first three levels of Bloom's Taxonomy i.e. knowledge, comprehension, and application. Both pretest and posttest items were constructed to fifty marks. Test items were constructed based on Grade Six General Science textbook. The allocated time

for pretest and posttest were forty- five minutes. Finally, questionnaire for observing students' attitudes towards cooperative learning strategies was used. In this questionnaire, (8) items were included.

Data Analysis

In order to determine the significance differences between the students' performance in each treatment, descriptive statistics and independent sample *t*-test were used with the Statistical Package for the Social Science (SPSS 22.0). The achievement of students in each group on both tests was analyzed by independent samples *t*-test.

Findings

This section is concerned with the findings of the selected students' achievement in the test for prior knowledge, the findings of these students' achievement on the posttest questions and the summary of the findings for this study. In order to find out the prerequisite knowledge of selected sample students in experimental and control group, pretest was administered for both groups in two schools. The data obtained from the pretest were analyzed by using independent samples *t*-test to compare the difference between experimental groups and control groups. Following tables show the results of *t*-test, the mean scores, standard deviations and mean differences of both groups.

Table 3: *t*-values for Pretest Mean Scores in Science

School	Group	N	$\bar{X}$	SD	MD	*t*	*df*	Sig. (2 ailed)
BEHS (Mayangone)	Experimental	30	23.6	3.125	-0.967	-1.200	58	.235(ns)
	Control	30	22.63	3.113				
BEHS (Insein)	Experimental	30	20.13	3.577	-0.767	-0.837	58	.406(ns)
	Control	30	19.37	3.521				

Note: n.s = not significant

Table 3 shows the pretest mean scores of experimental groups and control groups. It also shows the *t*-values for the scores on science achievement in pretest. Based on the data, it can be interpreted that both the

control and experimental groups were essentially the same on the dependent variable at the start of the study. Data obtained from the posttest were analyzed by independent sample *t*- test to compare the differences between the control group and experimental group.

Table 4: *t*-values for Posttest Scores on Knowledge Level Questions

School	Group	N	$\bar{X}$	SD	MD	*t*	*df*	Sig. (2 tailed)
BEHS (Mayangone)	Experimental	30	3.10	0.923	0.267	1.372	58	0.175
	Control	30	2.83	0.531				
BEHS (Insein)	Experimental	30	3.17	1.206	0.967	3.652	58	0.001
	Control	30	2.20	0.805				

Note: ***$p < .001$

Table 4 shows the *t*-values for knowledge level scores. Results of knowledge level scores showed that the mean scores of the experimental groups were significantly higher than that of the control groups. It showed that there was a significant difference between the experimental groups and the control groups for scores on knowledge level questions.

Table 5: *t*-values for Posttest Scores on Comprehension Level Scores

School	Group	N	$\bar{X}$	SD	MD	*t*	*df*	Sig. (2 tailed)
BEHS (Mayangone)	Experimental	30	10.03	1.732	3.367	7.028	58	.000***
	Control	30	6.67	1.971				
BEHS (Insein)	Experimental	30	9.00	2.665	2.333	3.855	58	.000***
	Control	30	6.67	1.971				

Note: ***$p < .001$

Table 5 shows the *t*-values for comprehension level scores. As regards with the comprehension level scores, the mean scores of the experimental groups were significantly higher than that of the control groups. It showed that there was a significant difference between the experimental groups and the control groups for scores on comprehension level questions.

Table 6: *t*-values for Posttest Scores on Application Level Questions

School	Group	N	$\bar{X}$	SD	MD	*t*	*df*	Sig. (2 tailed)
BEHS (Mayangone)	Experimental	30	6.03	1.956	3.367	1.733	58	.001**
	Control	30	4.30	1.557				
BEHS (Insein)	Experimental	30	5.90	0.023	2.333	1.600	58	.000***
	Control	30	4.30	1.557				

Note: $^{**}p < .01$, $^{***}p < .001$

Table 6 shows the *t*-values for application level scores. As shown in table, the mean scores of the experimental groups were significantly higher than that of the control groups. It showed that there was a significant difference between the experimental groups and the control groups for scores on application level questions.

Table 7: Students' Attitudes towards Cooperative Learning Strategies

No.	Statements	Percentage of the Students	
		Agree	Disagree
1.	Enhancing working relationships among students friendly.	88%	22%
2.	Improving teamwork skills.	100%	0%
3.	Getting better memorizing in lessons by working cooperatively.	95%	5%
4.	Willingly participated in cooperative learning activities than the traditional classroom activities.	78%	22%
5.	Getting the habit of accountability in their group work.	83%	71%
6.	Improving the attitudes towards science.	93%	7%
7.	Getting more interest in lessons with cooperative learning strategies.	75%	25%
8.	Preferring cooperative learning strategies to formal method.	85%	15%

From the students' responses in the observation and questionnaire, most of them showed a very positive response and expressed that they like the cooperative learning strategies and enjoyed learning and hoped that the teacher would continue implementing the strategy. The following figure shows the students' attitudes towards cooperative learning strategies according to the data from the questionnaire.

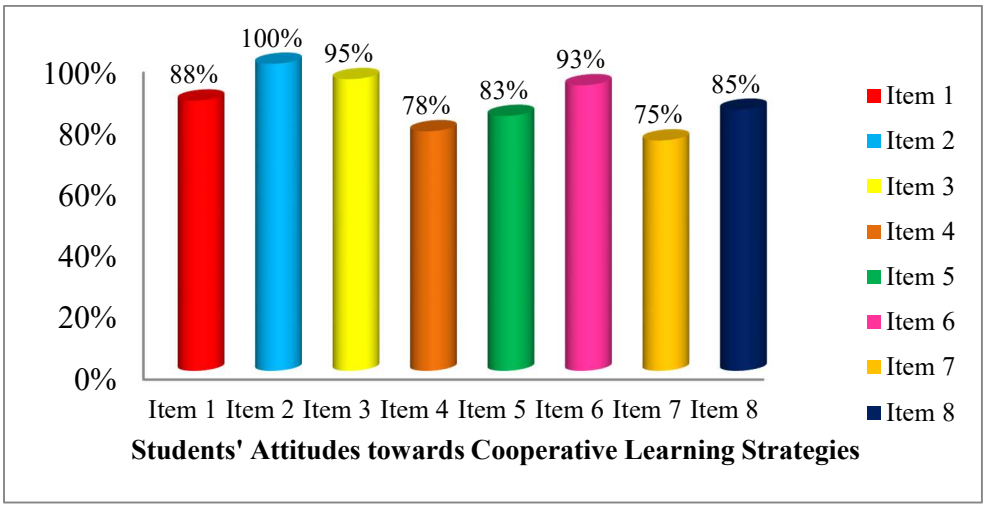

Figure 1: Graphic Illustration of Students' Attitudes towards Cooperative Learning Strategies

Summary of the Findings

From the experimental findings, the following results were found.

- There was a significant difference between the science achievement of experimental groups and control groups.
- There was a significant difference between the science achievement of experimental groups and control groups in answering knowledge level questions. It can be interpreted that cooperative learning strategies have positively contributed to the knowledge level of the science teaching at the middle school level.
- There was a significant difference between the science achievement of experimental groups and control groups in answering comprehension level questions. It can be interpreted that cooperative learning

strategies have positively contributed to the comprehension level of the science teaching at the middle school level.

- There was a significant difference between the science achievement of experimental groups and control groups in answering application level questions. It can be interpreted that cooperative learning strategies have positively contributed to the application level of the science teaching at the middle school level.

According to the results from the questionnaires, the following results were found.

- 88%of the students got working relationships among students friendly.
- 100% of the students got teamwork skills.
- 95% of the students memorized the lessons from working cooperatively.
- 78% of the students willingly participated in cooperative learning activities than the traditional classroom activities.
- 83% of the students got the habit of accountability in their group work.
- 93% of the students improved their attitudes towards science.
- 75% of the students got more interest in lessons with cooperative learning strategies.
- 85% of the students preferred cooperative learning strategies to formal method.

Discussion

Since the primary purpose of this study was to find out the effectiveness of cooperative learning strategies on students' achievement in middle school science, the research results verified it. Results from the study showed that the students who received new treatment had higher achievement in science learning than the control students who received formal or traditional treatment. There were no groups without making errors in answering the test items. Controlled students had more errors in those items than experimental students.

The experimental groups perform better than the control groups. The experimental groups were actively involved in various learning situations such as the whole class, small group learning, and watching a video. The students

build their understanding of new concepts rather than merely absorbing information. They also learn from each other, they share their ideas and knowledge. Then they discuss their ideas or opinions until to get the common consensus. From the results of the posttest scores on knowledge level questions, the mean score of the experimental group was not significantly higher than that of the control group in both schools. Therefore, traditional teaching methods are not very much different from cooperative learning strategies at knowledge level. With respect to the mean scores on comprehension level questions and application level questions, the mean score of the experimental groups were significantly higher than that of the control groups in each school. Hence, cooperative learning strategies affects not only the students' actual understanding of science concepts but also their performance on the problems based on these concepts. It also supported to the research hypothesis. So, this finding pointed out that cooperative learning strategies have positively contributed to the achievement of the students in science learning.

In this research study, students in the control groups were taught learning materials under the whole class instruction. During the cooperative learning strategies based instruction, the teachers observed the students' activities and the responses to the new treatment. By conducting this research, teachers can understand what the cooperative learning strategies mean: Cooperative learning strategies are successful teaching strategies in which small groups, each with students of various levels of ability, use a multiple of learning activities to improve their understanding of a subject; each member of a team is answerable not only for knowledge what is taught but also for helping other team members to learn, thus developing an environment of success (Slavin, 1995). After implementing the cooperative learning strategies, students in experimental groups were asked to express their attitudes concerned with the new treatment. According to the results from the attitude questionnaires, most of the students wanted to use cooperative learning strategies in their teaching- learning situation. Therefore, integrating the traditional group work with cooperative learning strategies in teaching middle school science is a fruitful choice for students’ achievement.

This study is not perfect in an effort, because there were some limitations in this study such as time duration, and content area. In this study, only one content area was studied. Therefore, the results were not representative for the whole content area of Grade Six General Science. With respect to the research findings, the researcher wants to suggest the following facts. While using cooperative learning strategies, the teachers should plan activities that are challenging and yet doable if the group members work together. Tasks should be required the concentrated efforts of all team members doing their jobs and working with the allotted time. The teachers who use cooperative learning strategies should have a firm knowledge base about the purposes and uses of cooperative learning strategies, as well as considerations for their use such as content validity, engagement, flexibility, inquiry based, ease of use, reciprocal benefits and impact before he/ she select a particular cooperative learning strategy. During the cooperative learning activity, it is the responsibility of the teacher to monitor the students. Regularly, according to the cooperative learning strategies, the teachers had to give immediate feedback and reinforcement for learning. Besides, in science teaching, the teachers have to re-teach certain concepts if necessary. The teachers need to keep a close watch on the personal interactions going on within groups. Happy well-functioning groups matched with appropriate tasks and given adequate time constraints run smoothly. The teachers have to make sure that the cooperative learning activity is organized and has a smooth closure is to allow time after clean up and whole group information sharing to ask the groups to evaluate how they interacted with one another. Moreover, the teachers have to informally assess student learning and collaboration. This study is specially contributed to science teaching at the middle school level. Although this research was concerned with science teaching, it can be applied into other subject matter contexts and the various school levels including primary school level and middle school level. This study was based on only one content area in science because of time limitation. Further research should be carried out by using wide content area of science. In this study, sample schools were randomly selected from Yangon Region. The research should be carried out in every BEHS. So, the result will be more reliable.

Conclusion

To meet the needs of 21st century, schools should move away from teacher-directed whole-group instruction to learner-centred workplaces for a collective culture of students at work. Giving students a chance to share a wide variety of kinds of intelligence adds to their confidence and beliefs in themselves as intelligent and competent learners, that no matter what the tasks they will be able to learn to do it (Bellanca & Brandt, 2010). Out of many teaching strategies, cooperative learning is the key to 21st century learning.

Over (500) research studies back the conclusion that cooperative learning produces gain across all content areas, all grade levels, and among all types of students including special needs, high achieving, gifted, urban, rural, and all ethnic and racial groups. In terms of consistency of positive outcomes cooperative learning remains the strongest researched educational innovation ever with regard to producing achievement gains (Kogan, 1999). Cooperative learning is cognitive in nature. The teachers must realize that for students to be successful in the twenty first century they need to be lifelong learners. Helping them to develop the skills necessary to become lifelong learners requires a different approach to teaching and learning. At that point, the teachers must make every step of the way by providing the environment, the content, the experiment and the place for students to put it all together to share with other students, parents, and the world. In conclusion, cooperative learning strategies take advantage of heterogeneity in classes by encouraging learners to learn from one another and from more and less knowledgeable peers (Adams, 2013). Bonds thus develop among learners which can lead to increased understanding and acceptance of all members of society, a benefit of cooperative learning that expand beyond the walls of the school itself.

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