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AN INVESTIGATION INTO THE EFFECTIVENESS OF ACTIVE LEARNING INSTRUCTIONAL STRATEGIES ON THE ACADEMIC ACHIEVEMENT OF SCIENCE STUDENTS AT THE MIDDLE SCHOOL LEVEL

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Abstract

The purpose of this study was to investigate the effectiveness of active learning instructional strategies on the academic achievement and basic science process skills of science students at the middle school level. Science process skills are central to the acquisition of scientific knowledge and enable students experience hands-on engagement with science materials when solving problems using practical approaches. These skills can be developed by using active learning instructional strategies in the science classroom because the aim of these strategies is skills development rather than just conveying information: students engage in activities to promote higher order thinking. Therefore, to investigate the effectiveness, nonequivalent control group research design was used. Two townships, one high school from each, were randomly selected from four districts in Yangon Region. Two classrooms from Grade Six were randomly selected and assigned to control and experimental groups in each selected school. A pretest, a posttest and an attitude questionnaire were used. A "*t*" test for independent samples and an analysis of covariance were used to find the difference in the science achievement and basic science process skills between the students who received active learning instructional strategies and those who did not. According to the results, there were significant differences between the two groups in basic science process skills in one of the selected schools. In another school, although there were significant differences between the two groups in communicating, classifying and inferring skills, there was no significant difference in observing, measuring and predicting skills. Moreover, there were significant differences in science achievement between the two groups in both schools. Therefore, it was found that using active learning instructional strategies in teaching science had significant improvement in the academic achievement and basic science process skills of the students, and it developed positive attitudes towards learning science.

Keywords: active learning, active learning instructional strategies, academic achievement

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Introduction

Education, therefore, is a process of the development of talent inborn in the individual and not conveying to an individual a body of information and knowledge (Dhiman, 2007). However the purpose of education is no longer personal cultivation but the acquisition of the skills of science to make value judgments regarding science-based issues occurring daily. Therefore, science plays a vital role in students' everyday lives.

According to Collette and Chiappetta (1989), science should be viewed as a way of thinking in the pursuit of understanding nature, a way of investigating and a body of established knowledge. Therefore, children must learn by doing and then reflecting, how to investigate and discover scientific concepts, theories and processes.

In most secular education settings, students are accustomed to passive learning where the teacher plays a dominant role in passing on information to students who are considered repository of knowledge. In reality, learning is not a spectator sport. Students do not learn much just by sitting assignments and spitting out answers. Contrast to this is using the active learning instructional strategies which encourage the students to interact cognitively, socially, behaviorally with content and processes to construct knowledge within the classroom (Chickering and Gamson, 1985, cited in Bonwell and Eison, 1991).

Purposes

The main purpose of this study is to investigate the effectiveness of active learning instructional strategies in middle school science teaching. The specific objectives are as follows:

(a) To compare the academic achievement between the science students who receive active learning instructional strategies and those who do not.

(b) To highlight the effectiveness of active learning instructional strategies in teaching science.

(c) To give suggestions on active learning instructional strategies in teaching science to teachers.

Research Hypotheses

1. There is a significant difference in the academic achievement between Grade Six science students who receive active learning instructional strategies and those who do not.
2. There is a significant difference in Basic Science Process Skills between Grade Six science students who receive active learning instructional strategies and those who do not.

Scope of the Study

The following points indicate the scope of the study.

1. This study is geographically restricted to Yangon Region.
2. Participants in this study are Grade Six students from selected schools in the academic year (2016-2017). Two classes from each school are selected in this study.
3. This study is limited to the content area of Chapter 5, "The Earth and Space", from Grade Six science textbook prescribed by Basic Education Curriculum, Syllabus and Text book Committee (2014).
4. The duration taken for the treatment is about two weeks for each school.

Definition of Key Terms

Active Learning is a technique that can be thought of as cogitatively engaging students' minds through externally stimulating thinking and physical actions in order to increase retention of presented material (Bonwell and Eison, 1991).

Active learning instructional strategies are defined as instructional activities involving students in doing things and thinking about what they are doing (Bonwell and Eison, 1991).

Academic achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college and university (Oxford Bibliographies, 2015).

Review of Related Literature

The Science Process Skills

Science is simultaneously a body of knowledge and a way of gaining and using that knowledge. Science is thus a combination of both "processes" and "products" related to and dependent upon each other. A process is a series of activities or operations performed to attain certain goals or products. Science processes are the inter-linked activities performed by any qualified person during the exploration of the universe. The American Association for the Advancement of Science – AAAS (1968), in their programme, Science – A Process Approach (SAPA) has classified the science process skills into two types - basic and integrated (more complex) skills (Sheeba, 2013).

Basic science process skills apply specifically to foundational cognitive functioning especially in the elementary grades. In addition, these skills also form the backbone of the more advanced problem-solving skills and capacities. **Integrated science process skills** are immediate skills that are used in problem-solving. Basic Science Process Skills comprise the following six sub-skills; observing Skill, classifying skill, measuring skill, communicating skill, predicting skill and inferring skill.

Harlen (1999), cited in Sheeba (2013) also emphasizes the need to include science process skills in the assessment of learning in science and that without the inclusion of science process skills in science assessment, there will be a mismatch between what students need from science, and what is taught and assessed.

Active Learning

According to Farrell (2013), cited in Listyani (2014), "conceptually, active learning implies deep learning on the part of the students as they construct knowledge and create meaning from their surrounding". In educational setting, the application of active learning ranges from focusing activities on cooperative structures to active involvement of thinking process in the learning and application of knowledge. In the active learning classroom, the teacher's role is to talk less and facilitate more by setting up situations and experiences that allow students to be immersed in the material with their peers. In the meantime, students are socially constructing greater understanding of the curriculum.

Therefore, active learning strategies shift from teachers to students and their active engagement with the material. Through active learning strategies and used by teachers, students shed the traditional role as passive receptors and learn and practice how to apprehend knowledge and skills and use them meaningfully. Moreover, active learning strategies involve providing opportunities for students to meaningfully talk and listen, write, read and reflect on the content, ideas, issues and concerns of an academic subject (Meyers and Jones, 1993, cited in Momani et al., 2016).

Constructivist's View of Learning

Constructivist learning is an inductive learning which involves an active process in which learners construct meaning by linking new ideas with their existing knowledge". Constructivists dictate that the concepts follow the action rather than precede it. The activity leads to the concepts; the concepts do not lead to the activity. Essentially, in constructivist learning, the standard classroom procedure is turned upside down – no lectures, no demonstrations, and no presentations. From the beginning, students engage in activities through which they develop skills and acquire concepts. According to Good and Brophy (1994), cited in Bhattacharjee (2015), constructivist learning includes:

1. Learners construct their own meaning
2. New learning builds on prior learning
3. Learning is enhanced by social interaction
4. Meaningful learning develops through "authentic" tasks

Two Major Trends of Constructivist Perspective on Active Learning

According to Bonwell and Eison (1991), active learning is a technique that can be thought of as cogitatively engaging students' mind through externally stimulated thinking physical actions in order to increase retention of presented material. Therefore, before trying to understand active learning, the instructor must have a sound knowledge about how the individual construct knowledge and how learning is enhanced by social interaction.

Cognitive constructivism (Cobb, 1994; Moshman, 1982, cited in Applefied et al., 2000) focuses on internal, individual constructions of knowledge. This perspective, which is derived from Piagetian theory emphasizes individual knowledge construction stimulated by internal cognitive conflict as learners strive to resolve mental disequilibrium. Essentially, children as well as older learners must negotiate the meaning of experiences and phenomena that are discrepant from their existing schema. Students may be said to author their own knowledge, advance their cognitive structures by revising and creating new understandings out of existing ones. This is accomplished through individual or socially mediated discovery-oriented learning activities.

Social constructivism (Brown et al., 1989; Rogoff, 1990, cited in Applefied et al., 2000) views the origin of knowledge construction as being the social interaction of people, interactions that involve sharing, comparing and debating among learners and mentors. Through a highly interactive process, the social milieu of learning is accorded center stage and learners both refine their own meanings and help others find meaning. In this way knowledge is mutually built. This view is a direct reflection of Vygotsky's sociocultural theory of learning, which accentuates the supportive guidance of mentors as they enable the apprentice learner to achieve successively more complex skill, understanding, and ultimately independent competence.

Factors of Active Learning Instruction

Meyer and Jones (1993), cited in Karamustafaoglu (2009) have maintained that active learning consists of three factors which are interrelated. These are: basic elements, learning strategies and teaching resources.

Basic Elements

The basic elements of active learning are talking, listening, reading, writing and reflecting. These five elements involve cognitive activities that allow students to clarify the question, consolidate and appropriate the new knowledge.

Learning Strategies

The second factor of active learning is the learning strategies that incorporate the above five elements. These are small groups, cooperative work, case studies, simulation, discussion, problem solving and journal writing, etc. Active learning tasks are much appreciated for making the learning experiences of the material to learn in a see, hear, do or touch fashion.

Teaching Resources

Bolick et al. (2003), cited in Gist (2003) define teaching resources as teaching aids used to enhance teaching and learning. Teaching resources are integral component of teaching and learning situation, it is not just to supplement learning but to complement its process.

Typical Active Learning Instructional Strategies
Problem Solving Strategies

Sharma (2009) describes that problem solving strategy fits well to the very nature of the science and it gives the students sufficient opportunity, practice and experience to discover and learn the facts of science with their own independent efforts. There are three models in problem solving strategy; exploration is used to gather information; inquiry to generate knowledge that is new to the problem solver; and decision making is employed to help the individual choose among alternative courses of action (Schuncke and Hoffman, 1980, cited in Schuncke, 1988).

Inquiry is one of the primary methods of problem solving to develop the ideas of discipline; concepts and generalizations are the results of the utilization of this scientific method. It utilizes three specific activities that are concerned with the hypothesis (Schuncke, 1988).

1. Determining the problem
2. Hypothesizing
3. Preparing to gather data
4. Gathering data
5. Examining, Analyzing, and Evaluating the Data
6. Accepting or Rejecting Hypothesis
7. Generalizing

Cooperative Learning

Teaching practices that provide opportunities to students to learn together in small groups are known as Cooperative Learning. Cooperative learning allows more students to be actively engaged in learning (World Education, Inc., 2009). Active participation in small groups helps students learn important social skills while simultaneously developing academic skill and democratic attitudes (Arends, 2007). Many of the key features of the Group Investigation (GI) approach were designed by Herbert Thelen. Sharan (1984) and his colleagues, cited in Arends (2007) describe the following six steps of the GI approach:

1. Topic selection
2. Cooperative planning
3. Implementation
4. Analysis and synthesis
5. Presentation of final product
6. Evaluation

Discussion

Discussion may be whole class or small group in nature, groups may vary in size and composition. According to Callahan and Clark (1988), as students gain more experience with group procedure and acquire sophisticated skills, they can begin to handle more substantive aspects of course content through working together in genuine inquiry that provide many opportunities for students to participate actively in the learning process. There are many small group techniques that may be used in almost any course with very little effort or risk. Some of them are Buzz sessions, Brainstorming, The Fishbowl Technique and Jury Trial Technique and so on (Callahan and Clark, 1988). Guidelines for conducting buzz groups include the following:

1. Form buzz groups arbitrarily.
2. Appoint a leader and recorder for each group.
3. Brief the group on what they are to do. Be sure they understand.
4. Let them discuss for five to ten minutes.
5. Follow up with a whole class exercise

Advantages of Active Learning Instructional Strategies

Hall (n.d.) pronounces that several research studies demonstrate the positive impact that active learning can have upon students' learning outcomes:

- Increased content knowledge, critical thinking and problem-solving abilities, and positive attitudes towards learning in comparison to traditional lecture-based delivery
- Increased enthusiasm for learning in both students and instructors
- Development of graduate capabilities such as critical and creative thinking, problem-solving, adaptability, communication and interpersonal skills
- Improving students' perceptions and attitudes towards information literacy

Impediments to Using Active Learning Instructional Strategies in Science Teaching

Martin (2010) describes that there are specific obstacles associated with the use of active learning instructional strategies including limited class time; a possible increase in preparation time; the potential difficulty of using active learning in large classes; a lack of needed materials, equipment, or resources, and potentially reticence on the part of the students to participate. Perhaps the single greatest barrier of all, however, is the fact that teachers' efforts to employ active learning involve risk – the risks that students will not participate.

Research Method

Population and Sample Size

Participants in this study were 151 Grade Six students. Two of four districts from Yangon Region were randomly selected. One township from each selected district was also chosen in random. Then, two of Grade Six classes in the academic year of 2016-2017 were selected by random sampling method in the selected schools.

Experimental Design

The design adopted in this study was one of the Quasi-Experimental Designs: The Nonequivalent Control Group Design (see Table 1).

Table 1. Experimental Design

Group	Group Assignment	No. of Students		Pretest	Treatment	Posttest
		No.(1)	No.(5)			
Control	Random	35	37	PSK	Teacher Directed Learning	SA
Experimental	Random	40	39	PSK	Active learning Instructional Strategies	SA

***Note*:** PSK = Previous Science Knowledge　　No. (1) = No. (1) BEHS, Yankin
SA = Science Achievement　　N0. (5) = No. (5) BEHS, Kamayut

Instruments

The instruments used for this study were a pretest, a posttest (Achievement Test), questionnaire and learning materials.

Procedure

Items of the test for students' previous knowledge (pretest) in science were constructed based on the content areas of Chapters (1) to (4) from Grade Six Science Text Book in accordance with Bloom's Basic cognitive Domain

(Jacobsen, 2006). However, items of science achievement test (posttest) were constructed in line with Basic Science Process Skills (Sheeba, 2013) based on the content area of Chapter (5) from Grade Six Science Text Book.

In order to get validation, the instruments such as pretest, posttest, questionnaire and lesson plans were distributed to seven experienced science teachers. According to their suggestions, test items were modified again. To establish the reliability of the instruments, a pilot study was conducted with (31) Grade Six students at No. (1) BEHS, Kamayut in December 2016. After that, the instruments were modified again according to the results of the pilot study.

According to Nonequivalent Control Group Design, the entire classrooms were assigned to treatment in Nonequivalent Control Group Design. It involved random assignment of intact groups to treatment, not random assignment of individuals. Firstly, the pretest was administered on 9th January, 2017 in both schools. In each school, the control group was given treatment by using teacher-directed learning and the experimental group was provided treatment by using active learning instructional strategies. The experiment was conducted in January 2017. At the end of the treatment period, all classes had to sit for the posttest but questionnaire for students' attitude towards learning science was administered to the experimental groups.

Research Findings

Data Analysis

To investigate the effectiveness of using active learning instructional strategies in teaching science at the middle school level, the data were analyzed by using descriptive statistics; *t* test for the independent samples and analysis of covariance (ANCOVA).

Analysis on the Scores of Pretest Questions and Findings

To be able to determine whether there is a significant difference between the experimental group who are taught by active learning instructional strategies and the control group who are taught by teacher directed learning, the data obtained from the pretest were recorded systematically and analyzed by using the *t* test for independent samples. The results are shown in table 2.

Table 2: *t* Values for Scores on Pretest Questions

School	Group	N	M	MD	*t*	*df*	Sig.
No. (1) BEHS, Yankin	Experimental	40	14.33	1.67	2.779	73	.007**
	Control	35	12.66				
No. (5) BEHS, Kamayut	Experimental	39	9.67	-2.92	-5.410	74	.000***
	Control	37	12.59				

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

According to the results, the mean of experimental group was higher than that of control group in BEHS (1), Yankin. However, the mean of the control group was higher than that of the experimental group in BEHS (5), Kamayut. It showed that there were significant differences between the two groups on the pretest questions ($p < .01$, $p < .001$) in both selected schools. Therefore, their scores of posttest questions will be analyzed by using analysis of covariance (ANCOVA).

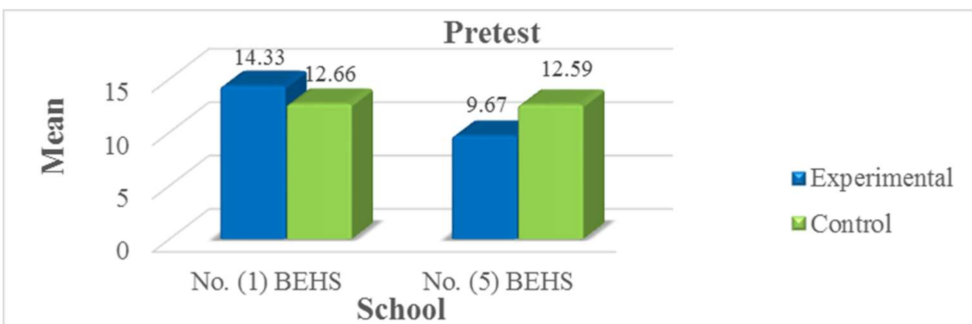

Figure 1: The Comparison of Means for Pretest Questions

The comparison of means for pretest questions showed that the previous science knowledge of the experimental group is slightly higher than that of the control group in BEHS (1), Yankin. On the other hand, the participants of the control group are more knowledgeable about science than that of the experimental group in BEHS (5), Kamayut.

Analysis on the Scores of Posttest Questions and Findings

The data obtained from the posttest of both schools were recorded systematically. And then these data were analyzed by using the Analysis of Covariance (ANCOVA) to compare the differences between the experimental groups who received active learning instructional strategies and the control groups who received teacher directed learning.

Table 3: The ANCOVA Source Table for Posttest in BEHS (1), Yankin
Dependent Variable: posttest

Source	Type III Sum of Squares	*df*	Mean Square	F	Sig.
Corrected Model	2107.097[a]	2	1053.548	66.459	.000
Intercept	149.348	1	149.348	9.421	.003
pretest	201.563	1	201.563	12.715	.001
Group	1377.828	1	1377.828	86.915	.000
Error	1141.383	72	15.853		
Total	23816.000	75			
Corrected Total	3248.480	74			

Note. $^{***}p < .001$

Table 4: The ANCOVA Source Table for Posttest in BEHS (5), Kamayut
Dependent Variable: Posttest

Source	Type III Sum of Squares	*df*	Mean Square	F	Sig.
Corrected Model	122.022[a]	2	61.011	3.079	.052
Intercept	346.722	1	346.722	17.499	.000
pretest	90.882	1	90.882	4.587	.036
Group	96.018	1	96.018	4.846	.031
Error	1446.399	73	19.814		
Total	20264.000	76			
Corrected Total	1568.421	75			

Note. $^{*}p < .05$

Table 5: Means and Standard Deviation for Science Achievement on Posttest

School	Group	N	M	SD	MD
No. (1) BEHS, Yankin	Experimental	40	21.28	3.850	10.11
	Control	35	11.17	4.743	
No. (5) BEHS, Kamayut	Experimental	39	16.31	4.959	1.28
	Control	37	15.03	4.093	

Results of scores for science achievement showed that the means of the experimental groups were significantly higher than that of the control groups in the selected schools (see Table 5). The differences in their means were found statistically significant ($F (1, 72) = 86.915$, $p < .001$) in BEHS (1), Yankin and ($F (1, 73) = 4.846$, $p < .05$) in BEHS (5), Kamayut (see Table 3 and 4). It showed that there were significant differences between the experimental and control groups on the science achievement in the selected schools.

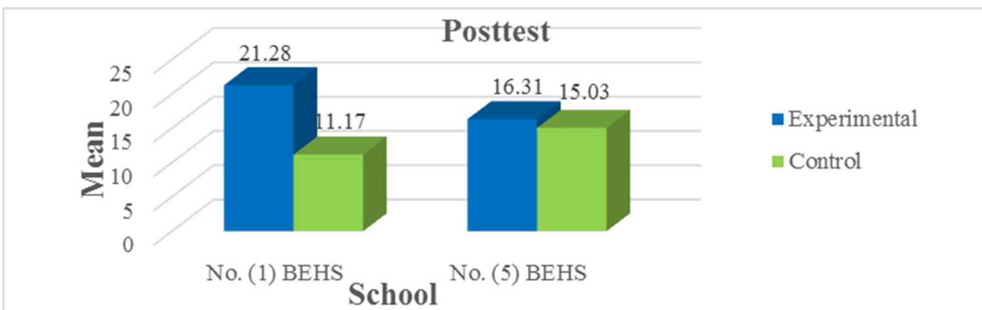

Figure 2: The Comparison of Means for Posttest Questions

The comparison of means for posttest questions revealed that the experimental groups who received active learning instructional strategies did better both in their learning and in science achievement test than the control groups who did not.

Analysis on the Basic Science Process Skills of Students and Findings

The performance on each basic science process skill of the experimental groups who are taught by active learning instructional strategies and the control groups who are not was calculated by using the Analysis of Covariance (ANCOVA) as there were significant differences between the control and experimental groups in the selected schools before they were treated.

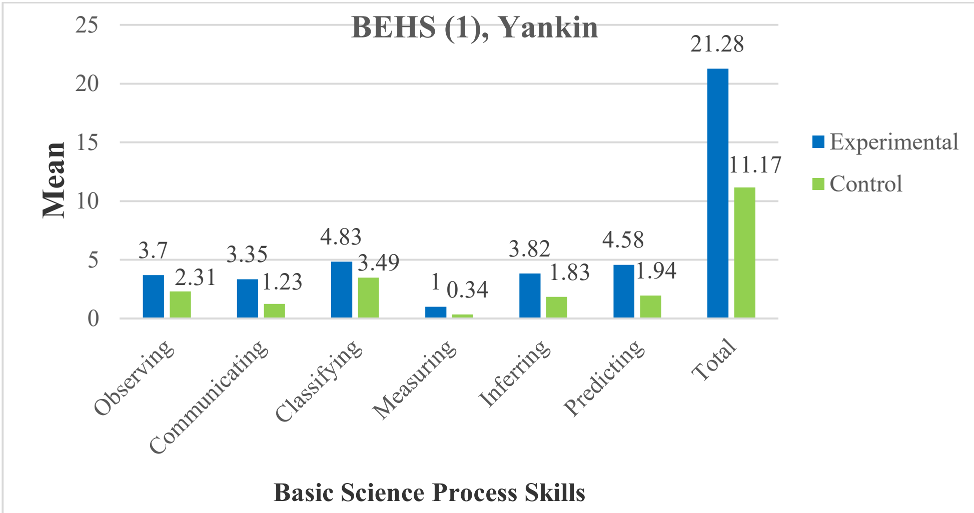

Figure 3: The Comparison of Means on Posttest for BEHS (1), Yankin

From figure (3), it can be found that the basic science process skills of the experimental group who were taught by active learning instructional strategies were significantly higher than that of the control group who were not taught by them in BEHS (1), Yankin. Interestingly, the measuring skill of both groups were lower than the others. To add this, the difference between the communicating, inferring and predicting skills of the experimental and control groups was greater than the difference between observing and classifying skills.

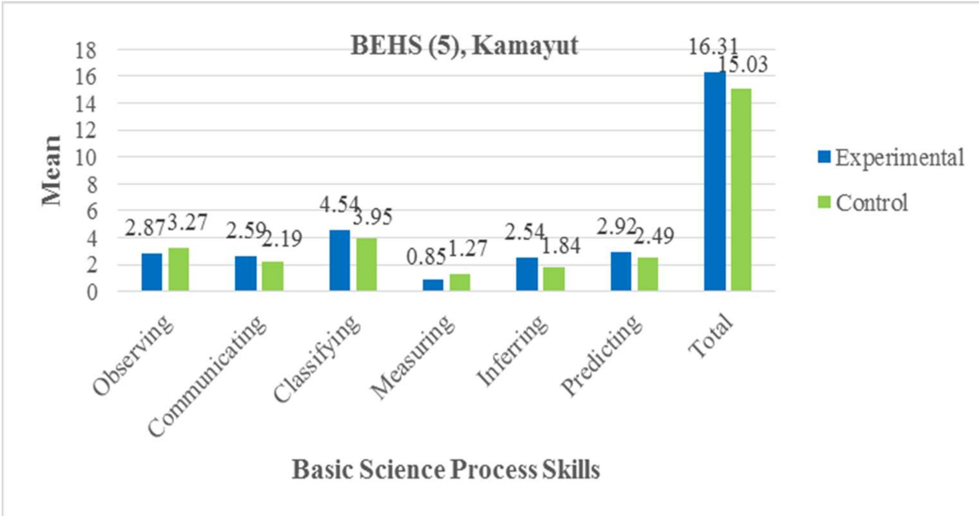

Figure 4: The Comparison of Means on Posttest for BEHS (5), Kamayut

In BEHS (5), Kamayut, the experimental group who received active learning instructional strategies outperformed the control group who did not receive it in communicating, classifying and inferring skills. In this way, by analyzing statistically, the control group performed better than the experimental group in observing, measuring and predicting skills.

Findings for Students' Attitudes towards Learning Science by Active Learning Instructional Strategies

In order to find out the attitudes of students towards active learning instructional strategies, a questionnaire of students' attitudes was administered to experimental students after giving the treatment. The data are expressed in percentage based on the students' answers (see Table 5).

Table 5: Students' Attitudes towards Learning Science by Active Learning Instructional Strategies (ALIS)

No	Item	School	Percentage (%)				
			1	2	3	4	5
Factor (1) Students' attitudes towards active learning instructional strategies							
1	Learning by doing is more enjoyable than learning from teacher's demonstration.	No (1)	-	-	12.5	40	47.6
		No (5)	5.12	7.5	10.2	20.5	56.4
		Total	**2.53**	**3.79**	**11.39**	**30.37**	**51.89**
2	Learning by ALIS is pleasurable.	No (1)	-	-	5	40	55
		No (5)	5.12	2.56	7.5	41.02	43.58
		Total	2.53	1.26	6.32	40.5	49.36
3	The process of learning is satisfied during learning by ALIS.	No (1)	2.5	5	40	30	22.5
		No (5)	2.56	-	20.5	46.15	30.76
		Total	**2.53**	**2.53**	**30.37**	**37.97**	**26.58**
4	Learning in groups supports to build good relationship with classmates.	No (1)	-	-	27.5	20	52.55
		No (5)	2.56	7.5	2.56	17.94	69.23
		Total	1.26	3.79	15.18	18.98	60.75
5	Learning by doing actively improves confidence in exam.	No (1)	-	2.5	32.5	22.5	42.5
		No (5)	2.56	2.56	2.56	15.38	76.92
		Total	**1.26**	**2.53**	**17.72**	**18.98**	**59.49**
Factor (2) Advantages from learning with active learning instructional strategies							
6	Learning by ALIS can help to grasp the concepts of science.	No (1)	2.5	5	5	32.5	55
		No (5)	-	5.12	2.56	46.15	46.15
		Total	**1.26**	**5.06**	**3.79**	**39.24**	**50.63**
7	Knowledge can be applied in solving daily life problems.	No (1)	2.5	5	30	40	22.5
		No (5)	7.5	2.56	15.38	20.5	53.84
		Total	5.06	3.79	22.78	30.37	40.5
8	The facts and concepts can be retained longer.	No (1)	2.5	10	12.5	50	25
		No (5)	2.56	5.12	7.5	25.64	58.97
		Total	**2.53**	**7.59**	**10.12**	**37.97**	**41.77**
9	ALIS can stimulate the desire to actively participate in learning.	No (1)	-	5	25	40	30
		No (5)	-	2.56	25.64	23.07	48.71
		Total	**-**	**3.79**	**25.31**	**31.64**	**39.24**
		No (5)	2.56	2.56	10.2	28.20	56.41
10	Learning by doing can give an assistance to learn the lesson easily.	No (1)	-	5	22.5	27.5	45
		No (5)	2.56	2.56	10.2	28.20	56.41
		Total	**1.26**	**3.79**	**16.45**	**27.84**	**50.63**
Factor (3) Students' values towards science							

No	Item	School	Percentage (%)				
			1	2	3	4	5
11	ALIS can increase interest in learning science.	No (1)	2.5	-	22.5	37.5	37.5
		No (5)	2.56	2.56	12.82	33.33	48.71
		Total	**2.53**	**1.26**	**17.72**	**35.44**	**43.03**
12	ALIS can stimulate curiosity about science.	No (1)	-	7.5	25	40	27.5
		No (5)	7.5	5.12	12.82	23.07	51.28
		Total	**3.79**	**6.32**	**18.96**	**31.64**	**39.24**
13	The lessons of science are related with daily lives.	No (1)	2.5	5	27.5	35	30
		No (5)	2.56	5.12	5.12	33.33	52.5
		Total	**2.53**	**5.06**	**16.45**	**34.17**	**41.77**
14	Learning by ALIS can improve reasoning skill.	No (1)	2.5	12.5	12.5	40	32.5
		No (5)	2.56	-	20.5	25.64	51.28
		Total	**2.53**	**6.32**	**16.45**	**32.91**	**41.77**
15	The knowledge of science can be constructed by ourselves.	No (1)	-	-	35	20	45
		No (5)	-	10.2	10.2	25.64	53.84
		Total	**-**	**5.06**	**22.78**	**22.78**	**49.36**

Note. No (1) = BEHS (1), Yankin,
No (5) = BEHS (5), Kamayut

Summary of Results

The results of research study from the two selected schools were as follows:

1. There were significant differences between the experimental groups who were taught by active learning instructional strategies and the control groups who were taught by teacher directed learning on the scores of science achievement in two selected schools.
2. There were significant differences between the experimental group who were taught by active learning instructional strategies and the control group who were not taught by them on the scores of questions measuring students' basic science process skills in BEHS (1), Yankin.
3. There were significant differences between the experimental group who received active learning instructional strategies and the control group who did not receive them on the scores of the questions concerning with students' communicating, classifying and inferring skills in BEHS (5), Kamayut. However, there was no significant

difference in observing, measuring and predicting skills between the two groups.

4. Experimental students' attitudes towards active learning instructional strategies are as follows:
    - 89% of the students feel happy and can grasp the concepts of science.
    - 82% of the students prefer learning by doing to learning from teacher demonstration.
    - 79% of the students retain the facts and concepts of science longer than before.
    - 78% of the students feel more familiar with their classmates, can learn easily and improves confidence to sit for exam.
    - 75% of the students can relate the lesson of science with daily life activities.
    - 74% of the students improve their reasoning skills.
    - 72% of the students construct the knowledge of science by observing and investigating by themselves.
    - 70% of the students apply knowledge of science in solving daily life problems, improve their motivation to actively participating in learning and their curiosities about science.
    - 64% of the students are satisfied their learning process.

Interpretation of Research Findings

Findings of this research study was summarized as follows:

1. It was found that active learning instructional strategies had positive effect on science teaching at the middle school level.
2. It was observed that learning science by active learning instructional strategies had been more effective than learning science by teacher directed learning.

3. It was found that active learning instructional strategies had been more effective than teacher directed learning in terms of academic achievement.
4. It was revealed that the science achievement of the experimental groups who received active learning instructional strategies had been more effective than that of the control groups who did not.
5. It was found that active learning instructional strategies had been effective in fostering students' acquisition of basic science process skills.
6. It was observed that students who received active learning instructional strategies outperformed those who did not receive them in basic science process skills.
7. It was revealed that active learning instructional strategies improved students' positive attitudes towards learning science.

Conclusion

Discussion and Suggestion

According to the results of the study, it was found that teaching science by using active learning instructional strategies was significantly effective on the science achievement of the students. It may be because of the fact that active learning instructional strategies provided students enough opportunities to participate in learning and construct science knowledge by themselves. Moreover, it could stimulate the students' interest to actively participate in activities, problem solving and discussion.

This result is consistent with the finding of Farajallah and Alarjani (2012) who found that there were significant differences between the control groups who learned by traditional teaching methods and the experimental groups who learned by active learning method. This research pointed that using active learning had impacts on rising the achievement level of the low achievement students and increased the learner's motivation towards education.

Moreover, the result showed that active learning instructional strategies could bring about an effective improvement of students' basic science process skills in BEHS (1), Yankin. It may be because of the fact that students actively participated in doing experiments, observations and creation of new knowledge by themselves. Another reason may be that they actively presented their findings of experiments, observations and discussion to others.

However, according to the result of study, teaching science by using active learning instructional strategies were effective in the improvement of students' communicating, classifying and inferring skills in BEHS (5), Kamayut but were not effective in observing, measuring and predicting skills of the students. The cause may be that the basic mathematics knowledge of the participants in the experimental group were very low and they had less past experiences to forecast the forthcoming events based on previous knowledge than the control group.

This result is consistent with the finding of Ghumdia and Adams (2016) who found that inquiry-based method, one of the active learning instructional strategies, was more effective in fostering students' acquisition of science process skills than the lecture method. This research pointed that allowing students to engage in various learning activities enabled them to find out and develop their knowledge of the abstract concepts individually or in groups.

Furthermore, the findings of students' attitudes towards active learning instructional strategies showed that through learning by using these strategies, students learned the concepts and information that was in the area of their interest and remembered the information and connected it with their own experiences and applied it in their daily life to make what they have learned a part of their own self and their being. This result is consistent with the findings of Momani et al. (2016) also studied the attitudes of teachers towards active learning instructional strategies. The finding of his study indicated that over ninety percent of the teachers agreed that active learning strategies improved students' communication, enhanced their motivation and created desirable attitudes towards interaction in class.

Some suggestions concerning with using active learning instructional strategies in teaching science are expressed as follows: the teacher

- must provide the students an opportunity to engage in learning materials
- must create an active, dynamic, interactive and conducive learning environment
- should present the problems or activities that resembles with the ones that they are encountering in their daily lives
- should provide authentic tasks to develop basic science process skills of students
- must serve as facilitator, organizer and partner in active learning
- should nurture the students to become active learners, presenters and critical thinkers

Recommendations

This research study only focused on the development of teaching of science at the middle school level and the development of students' science achievement. In this study, as the size of sample is small and the duration of experiment is short, this result may not be generalized to a larger population. Thus, further research studies should be carried out nationally representative samples and in a longer duration to validate the results of present research. Moreover, basic science process skills of students at the primary or high school level and in other subject areas should be studied by using the remaining active learning instructional strategies to get a reliable and valid result.

Conclusion

Science as a practical subject provides the students an opportunity to solve their daily life's problems and contribute to national development by integrating and applying their knowledge, skills and attitudes. Therefore, the science teacher must provide the activities which students carry out in scientific investigations to enable the acquisition of scientific knowledge and skills. To obtain these, science process skills are central because they are procedural skills, experimental and investigating science habits of mind or scientific inquiry abilities.

Moreover, the learning process is also student's responsibility which helps him exert more effort and the optimal investment of his abilities and take advantage of the supporting educational environment of active learning which links the student with the subject he is learning. It is known that active learning instructional strategies also depend on self-activity and positive participation of the learner, in which he searches scientific facts and concepts using a range of activities and scientific processes under the supervision and guidance of the teacher. Furthermore, the result of this study showed that active learning helped students enjoy learning and gave them the ability to acquire knowledge and science process skills. Moreover, it was found that it had been effective in the science achievement of the students.

Even though there are pros and cons in using active learning instructional strategies, many researchers showed that using these strategies in teaching science can meet the goals of both science teaching and education. It is known that one of the goals of education is to nurture students to be active, independent and lifelong learners. Active learning can meet this goal because actively participating in learning, problem solving, observation, investigation and communicating knowledge and experiences fulfills sound knowledge, enriches valuable experiences and then develops skills and abilities for further learning that leads to independent and lifelong learners. It also meets the right of human being as everyone has a basic right to the full development of their minds and of their capacities for learning. Thus, active learning instructional strategies should be applied at all levels of science teaching in basic education in Myanmar.

To sum up, according to the result of this study, using active learning instructional strategies in teaching science is effective in the academic achievement of science students. Moreover, these strategies can give an assistance to develop students' basic science process skills and improve positive attitudes towards learning science. Therefore, science teachers should integrate active learning instructional strategies to be effective in teaching science. According to the nature of topics, science teachers can choose the suitable strategies among active learning instructional strategies to reach their students' learning goals.

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Appendix A

Pretest (Test for Students' Previous Knowledge in Science)

q|rwef;ausmif;om;? ausmif;olrsm;
odyÜHbmom&yfwGif&Sdaom odrIe,fy,ftm;
tMudKppfaq;vTm

ar;cGef;tm;vHk;ajzqdkyg/

cGifhjyKcsdef / / (45) rdepf

1/ atmufygwdkUudk rSefvSsif(rSef)? rSm;vSsif(rSm;)[k tajzae&mwGif a&;yg/

(1) tjrpfr&Sdaom &dk;&Sif;aom yifpnfESifh ao;i,faom t&Gufi,frsm;&Sdaom tyifrsm;onf zef;tkyfpkwGifyg0ifonf/

(2) ykZGefonf ausm&dk;&Sdowå0gtkyfpkwGif yg0ifonf/

(3) qm;aysmf&nfrS qm;udk jyefvnf&&Sd&ef taiGUysHjcif;enf;udk oHk;onf/

(4) oHvdkufacsmif;rsm;\ rsdK;wl0if&dk;pGef;rsm;onf qGJiifMujyD; rsdK;rwlaom0if&dk;pGef;rsm;on f wGef;uefMuonf/

tajzjznfh&

(1)-------

(2)-------

(3)-------

(4)-------

(5)-------

(5) acgif;ay:&SdqHyifESifh aywHudkyGwfwdkufjcif;jzifh aywHwGif oHvdkuf"mwf &&SdEdkifonf/

tajzjznfh&ef

2/ atmufygazmfjycsufwdkU\ tajzrSeftu©&mudk tajzjznfh&efae&mwGif a&;yg/

(1)
wå0grsm;udk
trsdK;tpm;cGJ&mwGif
ydkrdkípepfusap&ef
¤if;wdkY\((u) aexdkif&ma'o
(c) zGJUpnf;yHkvu©Pmrsm;
(*) pm;aomufyHk)t&
cGJjcm;xm;onf/

(2) yvufwDerfonf ((u) owåK
(c) owåKr[kwfaomj'yfpif
(*) j'yfaESm) jzpfonf/

(3) aomufa&oefUxkwfvkyfonfh
enf;onf ((u) t&nf
ppfjcif;enf; (c)
taiGUysHjcif;enf;
(*)aygif;cHjcif;enf;)
jzpfonf/

(4) tvkyfvkyf&ef
pdkufxkwf&aomtm;udk ((u)
pdkuftm; (c) yGwftm; (*)
&dk;&dk;puf) [k ac:onf/

(5) tvif;wef;rsm;onf
MunfhrSef\ rsufESmjyifudk
awGUxdí tvif;jyefaomtcg
¤if;udk ((u) tvif;auGUjcif;
(c) yHkrSeftvif;jyefjcif; (*)

o

(1)-------

(2)-------

(3)-------

(4)-------

(5)-------

ysHUa&mtvif;jyefjcif;) [k ac:onf/

3/ atmufazmfjyygwdkU\ tajzrSefudk tajzjznfh&ef ae&mwGif a&;yg/

tajzjznfh&t

(1)--------

(2)--------

(3)--------

(4)--------

(5)--------

(1) xif&Sm;qHk;aom ouf&SdtrsdK;tpm;rsm;rSm owå0grsm;? tyifrsm;ESifh ------ wdkUjzpfonf/

(2) yfjymjrIyftvG,fwulxGufaoma&udk------[kac:onf/ q

(3) efUpifaom rdk;a&onf ------ jzpfonf/ o

(4) yifnDaMu;rHkay:aom yHk&dyfonf ------ jzpfonf/ j

(5) Hvdkufwpfck\ oHwdkoHprsm;udk qGJiifEdkifaom ¤if;\ ywf0ef;usifrS tuGmta0;udk ------ [kac:onf/ o

4/ atmufygar;cGef;rsm;udk ajzqdk&efay;xm;aomae&mwGif vdk&if;omajzqdkyg/

(1) owåKj'yfpif (2) rsdK;udk azmfjyyg/

----

(2) oJrIefUESifh vTpmrIefUa&mxm;aom aysmf&nfrSa&udk cGJxkwfvdkvSsif rnfonfhenf;jzifh cGJxkwf&rnfenf;/

----

(3) ausm&dk;rJUowå0gtkyfpkrsm;\ trnfrsm;udk azmfjyyg/

----

(4) tDem;&Sm;qdkonfrSmtb,fenf;/

----

(5) vSsyfjyufjcif;ESifh rdk;csKef;oHonf wjydKifeufwnf; jzpfay:aomfvnf; vSsyfjyufjcif;udk tvsifjrif&ovm; (odkUr[kwf)

rdk;csKef;oHudk tvsifMum;&ovm;/
tb,faMumifhenf;/

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5/ atmufygar;cGef;rsm;udk ajzqdkyg/

(1) oMum;aysmf&nfrS oBum;udk jyefvnf&&Sd&ef rnfonfhenf;udk toHk;jyK&rnfenf;/ jyKvkyfyHktqifhqifhudk azmfjyyg/

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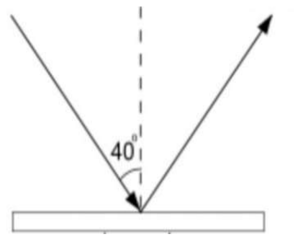
(2) tvif;jyefed,mrudk azmfjyyg/ ¤if;ed,mrt& þy
jyefaxmifhuc


40°

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Appendix B

Posttest (Science Achievement Test)

q|rwef;ausmif;om;? ausmif;olrsm;

odyÜHbmom&yfwGif&Sdaom

Basic Science Process Skills **ppfaq;vTm**

cGifhjyKcsdef/ / (1) em&D

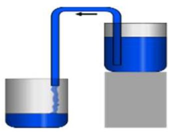
1/ atmufazmfjyygwdkU\tajzrSefudk

tajzjznfh&efay;xm;aomae&mwGifa&;yg/

(1) yHkwGifyg0ifaom ypönf;ud&d,mrsm;rSm

a&wdkifuD? a&yHk;i,fESifh -------

wdkUjzpfMuygonf/



ar;cGef; (1) tajzjznfh&ef

(2) avzdtm;udk

usEkfyfwdkUrjrif&aomfvnf;

ar;cGef; (2) tajzjznfh&ef

------ jzifh prf;oyfod&SdEdkifygonf/

(3) þonfrSm -------a'owGif

MuHKawGUae&aom vu©Pm&yfjzpfonf/

ar;cGef; (3) tajzjznfh&ef

(4) urÇmUajrjyifteD;wGif tvsm;? teH?

tjrifh (3)rDwm&Sdaom ajcmufaoGUaom

ar;cGef; (4) tajzjznfh&ef

(5) {&d,m 150 pwk&ef;pifwDrDwm&Sdaom pm;yGJcHkay:wGif oufa&mufaeaom av\ tav;csdefyrmPrSm ------- jzpfonf/

ar;cGef; (5) tajzjznfh&ef

(6) ysdK;yifav;rsm; a&epfaoqHk;ae&onfh taMumif;&if;rSm -------

a pfonf/

ar;cGef; (6) tajzjznfh&ef

(7) ajymif;zl;yifrsm;rS t&Gufrsm;onf nId;EGrf;í tndka&mifoef;vmonfrSm ----- -- aMumifh jzpfEdkifygonf/

ar;cGef; (7) tajzjznfh&ef

(8) opfyifrsm;aygrsm;pGm aygufa&mufaeaoma'owGif a&aiGUyg0ifrIyrmP ------- ygonf/

ar;cGef; (8) tajzjznfh&ef

(9) rsufESmjyif{&d,m ------- ay:odkU zdaeaom av\zdtm;udk avzdtm;[k

ar;cGef; (9) tajzjznfh&ef

(10) tu,fí pdkufcif;twGuf

rdk;a&vHkavmufrIr&Sdygu a&udk ------

ar;cGef; (10) tajzjznfh&ef

ay;ydkUEdkiffygonf/

2/ atmufygar;cGef;rsm;udk

vdk&if;omajzqdkyg/

(1) rdk;onf;xefpGm

&GmoGef;aeaoma'oESihf

rdk;acgifaoma'owdkUudk cGJjcm;jyyg/

(u) (c) (*)

(C) (i) (p)

rdk;onf;xefpGG	rdk;acgif

ar;cGef;(1)t

m&Gmaoma'o	aoma'o

(2) a&aiGUyg0ifrIrsm;aomjrdKUESifh a&aiGUyg0ifrIenf;aomjrdKUrsm;udk cGJjcm;jyyg/

(u) &efukef (c) rEÅav; (*) oHwGJ (C) xm;0,f (i) jyifOD;vGif

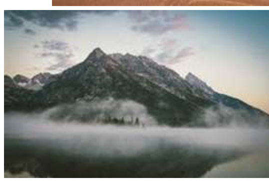
ar;cGef;(2)

a&aiGUyg0if Irsm;aom	a&aiGUyg0ifrIenf;aom jrdKU

(p) acsmif;om

(3) a&aiGUyg0ifrIrsm;aoma'oESifh a&aiGUyg0ifrIenf;aoma'orsm;udkcGJjcm;jyyg/

(u) **(c)** **(*)**



(C) **(i)**

a&aiGUvg0ifrIrsm;aom ar;cGef;(3)t	a&aiGUyg0ifrIenf;aom a'o

(p)

(4) tylvGefuJrIaMumifh ysufpD;aeaom oD;ESHyifrsm;udk cGJxkwfazmfjyyg/



(u) (c) (*)



(C) (i) (p)

ar;cGef;(4)t

tylvGefuJrIaMumifh ysufpD;aeaomoD;ESHyif rsm;	tjcm;taMumif;&if; ifh ysufpD;aeaomoD;ESI rsm;

(5)
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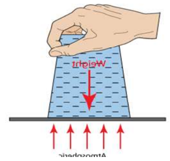
mif;udk atmufygt&m0w¦KwdkUteuf
rnfonfwdkUESifh prf;oyfEdkifoenf;/



(u) (c) (*)

(C) (i) (p)

ar;cGef;(5)t

avzdtm;&SdaMumif; prf;oyfír&aomt&m0w¦K	avzdtm;&SdaMumif; prf;oyfír&aomt&m0w¦K

(6) ajcmufaoGUoefU&Sif;aom
zefcGufwpfckxJodkU a&cJwHk;av;rsm;
xnfhxm; ygutcsdeftwefMumvSsif
tjyifbufzefom;wGif rnfodkUawGU&oenf;/

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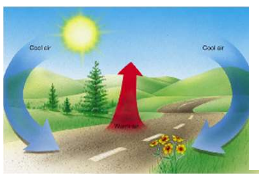
(7) þyHkrSoifavhvmawGU&Sd&aom tcsufudk
jyefvnf&Sif;jyyg/



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(8) avwGifzdtm;&SdaMumif;
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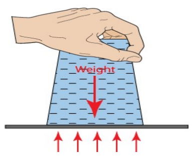
ypönf;ud&(--
rnfodkUaw(--



(9) avrIwfxm;aomylaygif;ESifh
avavsmhxm;aomylaygif;wGif
rnfonfuydkav;oenf;/ tb,faMumifhenf;/

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(10) þyHkrS oifavhvmawGU&Sd&aom taMumif;&if;rsm;udk azmfjyyg/

4/ atmufygar;cGef;rsm;udk ajzqdkyg/

(1) a'owpfckwGifvaygif;rsm;pGmrdk;&GmaevSsif ¤if;\aemufqufwGJtjzpf pdkufysdK;a&;wGif rnfonfhqdk;usdK;rsm; jzpfyGm;Edkifoenf;/

--

(2) rdk;av0oESihf ZvaA'nTefMum;rIOD;pD;XmerS tcsdeftcg r[kwf rdk;&GmoGef; rnf[k aMunmxm;vSsif oif\oD;ESHyifrsm;twGuf rnfonfhMudKwif jyifqifrIrsm; jyKvkyfxm;&rnfenf;/

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(3) rdrdtdrf&Sda&wdkifuDrSa&udk tjcm;a&yHk;i,frsm;odkU ajymif;a&TUvdkvSsif rnfonfh ypönf;ud&d,mudk toHk;jyK&rnfenf;/ jyKvkyfyHktqifhqifhudk a&;yg/

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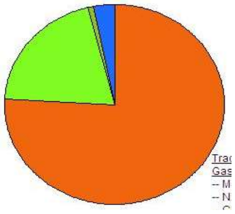
(4) þpuf0dkif;onf avxkwpfckvHk;udkudk,fpm;jyKí ¤if;wGif EdkufMxdK*sif 76%? atmufqD*sif 19%? tm*GefESifh tjcm;"mwfaiGU 1% yg0ifvSsif a&aiGUyg0ifrI yrmPonf rnfrSsjzpfrnfenf;/



(5) þa'owGifMuHKawGUae&aom ab;tEÅ&m,fonf rnfonfh taMumif; &if;rsm; aMumifh jzpfEdkifoenf;/ xdktajctaersm;aMumifh pdkufysdK;a&;wGif rnfonfh qkd;usdK;rsm; jzpfyGm;Edkifygoenf;/

Appendix C

Lesson Plans

Lesson Plan (1) for Experimental Groups

pmoifcsdef (1)

1/ twef; - q|rwef;

2/ bmom - taxGaxGodyÜÜH

3/ oifcef;pmacgif;pOf - tcef; (5) urÇmajrMuD;ESifh tmumo

(i) tmumoESifh rdk;av0o

(1) a&cdk;a&aiGU\ obm0

4/ tcsdef - (45) rdepf

5/ a,bk,s OD;wnfcsuf - a&cdk;a&aiGU\ obm0jzpfwnfrIESifh ywfoufaom todynmrsm; &&Sdap&ef/

6/ tao;pdwfOD;wnfcsuf - avxkxJwGif a&aiGU&SdaMumif;vufaw GU prf;oyfvkyfaqmifwwfap &ef/

- a&cdk;a&aiGUrSt&nftjz pfodkUajymif;vJ&onfh taMumif;&if;udk aqG;aEG;wifjywwfap&ef /

- **aiGU&nfzGJUjcif;tm; t"dyÜg,f zGifhqdkwwf ap&ef/**

7/ oifMum;? oif,lrI - **a&cJwkH;? zefcGuf? ta&mifwiftqD? taxmuftuljyKypönf;rsm; yvyfpwpf tdwf? vkyfief;rSwfwrf;pm&Guf**

8/ Teaching Method - Problem Solving Strategies (Inquiry)

9/ oifMum;? oif,lrI vkyfief;pOf

oifenf; tqifh	oifMum;rIvkyfief;pOf	oif,lrIvkyfief;pOf	oifaxmufulypönf;	tcsdef
Introduction	- **ausmif;om;OD;a& (5) a,mufwpftkyfpk jzifh tkyfpkzGJUy**	- **tkyfpkzGJUygrnf/** -	- **zefcGuf?**	**(5) rdepf**

1. Determining the Problem	grnf/ - yxrOD;pGm zefcGufxJ wGifa&cJESi fh a& tenf; i,fxnfhjyD; tcsdef twefMumvsSi f tjyifbufzef om;wGif jzpfay:vmao majymif;vJr Iudk tkyfpkvdkuf aqmif&Guf avhvmap ygrnf/	tkyfpkvdk uf aqmif &Guf avhvmyg rnf/ - awGU&Sdcs ufrsm;udk rSwfom;yg rnf/	a&cJ? a&? vkyfie f;rSwf wrf;pm &Guf - vk yfief; rSwf wrf;pm &Guf	(5) rdep f
2. Hypothesizing		- awGU&Sdcs ufrsm;ESi fh ywfoufí quf vufpl;prf ;avh vm tajz&Sm & rnfh jyóemrsm; udkowfrSw fygrnf		
3. Planning to gather data	- xdkjyóemrsm ;rS oif cef;pmESif h qufpyf aom	Oyrm - zefcGuftj	- vkyfie f;rSwf wrf;pm	(15) rdep

4. Gathering data	jyóemrsm;u dk qufvuf pl;prf; tajz &Smapygrnf / - ypönf;ud&d, mrsm; udk tkyfpkvdkuf cGJa0jyD; vufawGUaqmi f&Guf apygrnf/ - vkyfief;pOf rsm;udk q&muMudKwif nTefMum;ay; ygrnf/	yifbuf wGifawGU& aoma&rsm; onf a&cGuf twGif;&Sd a&rsm; ,dkzdwfjc if;aMumif h vm;/ - rnfonfhae &mrS a&muf&Sdv moenf; - tb,faMumi fh a&muf&Sdv moenf; - jzpfEdkif acs&Sdaom taMumif;& if;rsm;ud k tkyfpkwGi f aqG;aEG;j yD;	&Guf vkyfief ;pOf(1) a&cJwHk ;? a&? ta&mifw ifqD vkyfief ;pOf(2) a&cGuf(2)cGuf? a&cJwHk ;?a&? yvyfpwp f cGuf? vkyfief ; rSwf	f (5) rdep f

5. Examining, Analyzing and Evaluating data 6. Accepting or Rejecting Hypotheses	- awGU&Sdcsuf rsm;? ajymif;vJrI rsm;udk vkyfief;rSw fwrf; pm&GuffwGif rSwfom; apygrnf/ - tkyfpkvdkuf aqmif&Guf csufrsm;udk	vkyfief;r Swfwrf; pm&GufwGi f rSwfom; ygrnf/ - vufawGUpr f;oyf aqmif&Guf ygrnf/ Oyrm - vkyfief;pO f (1) - zefcGufxJ odkU a&cJ ESifha& tenf;i,f xnfhjyD; vsSif ta&mifwif qD xnfhí oratmif arTygrnf/ - tcsdeften f;i,f apmifhMun fhygrnf/	wrf; pm&Guf - vkyfief ;rSwf wrf;pm& Guf	(5) rdep f

7. Generalizing	q&mu avhvm apmifhMunfh jyD; vdktyfonfh tul tnDrsm; ay;ygrnf/	vkyfief;pOf (2) - a&cGuf (2) cGufwGif a&cJESifh a&tenf;i,f xnfhygrnf/ - 'kwd,a&cGuftm; avvHkaomy vyfpwpf tdwftwGif; odkU xnhfygrnf/ - tcsdeftenf;i,f apmifhMunfhygrnf/ - ajymif;vJrIudkapmifh Munfhavhvmygrnf/		(10) rdepf

	- tkyfpkrsm;\ aqG;aEG; csufrsm;rSt "dutcsuf rsm;udkoify kef;ay:wGif pm&if;jyKpk ygrnf/ “þuJUodkUa&c dk;a&aiGU rsm;t&nftjz pfajymif;vJ oGm;jcif;rS maiGU&nf	- awGU&Sdcs ufrsm;udk vkyfief;r Swfwrf; pm&Guf wGiff rSwfom;yg rnf/ Oyrm - zefcGuftj yif buf&Sd a&onf zefcGuftw Gif;&Sd a&ESifh ta&mif rwlyg/ - yvyfpwpft dwf twGif;&Sd zefcGuf \ tjyifbufw Gif a&rsm;raw GU&yg/ -		

	zGJUjcif;jz pfonf” [kjcHKiHkoH k;oyfay;í &v'frsm;? vkyfief; aqmif&GufrI rsm;tay: a0zefoHk;oy fjcif;? tMuHnPfay;j cif;rsm; jyKvkyfygrn f/	**yvyfpwpft dwf rygaom zefcGuf \ tjyifbufw Gif a&rsm;awG U&onf/ - &&Sdxm;ao m awGU &Sd csufrsm;o nf jyóem\taj z jzpfEdkif \? rjzpf Edkif\udk tkyfpkwGi f; aqG;aEG;y grnf/ - aqG;aEG;j cif;&v'f ESifh csrSwfxm; aom jzpfEdkif**		

		acs taMumif;& if; rsm; udkufnDrI &Sd? r&Sdudk ppfaq;jyD ; ¤if;wdkY udk vufcHrI (odkUr[kw f) jiif; y,frIjyKv kyfygrnf - jyóem\ tajz rsm;udk aemufqHk; jcHKiHkoH k;oyfaumu f csufcsygr nf/ - tkyfpkwGi f;oHk;oyf csufrsm;u dk tjcm; tkyfpk		

		rsm;tm; rsSa0ygrn f/ Oyrm - zefcGuftj yifbuf wGifawGU& onfha&onf zefcGufwG if; &Sda&r[kw fyg/ - avxJ&Sd a&cdk; a&aiGUrsm ;rStoGif ajymif;jz pfay:vm jcif;jzpf onf/ - tb,faMumi fh qdkaomf ¤if;a&cdk ; a&aiGU rsm;onf at;aom zefom;		

		ESifhxdaw GU oGm; aomaMumif h t&nftjzpf ajymif;vJ oGm;jcif; jzpfygonf / - xdkUaMumif havxk xJwGifa&ai GU&Sd aMumif;odE dkifonf/		

Appendix D

Students' Attitudes towards Learning Science by Active Learning Instructional Strategies Questionnaire

atmufazmfjyygtaMumif;t&mrsm;udk zwfí oif\ oabmxm;tjrifESifh udkufnDaom tajzae&mwGif (√) jcpfyg/

1 = vHk;0oabmrwlyg/ 2 = oabmrwlyg/ 3 = rqHkk;jzwfwwfyg/

4 = oabmwlygonf/ 5 = vHk;0oabmwlygonf/

pOf	taMumif;t&m	1	2	3	4	5
taMumif;t&m (1) wufMuGpGmyg0ifaqmif&Gufoif,lenf;jzifh oif,l&jcif;tay: ausmif;ol? ausmif;om;rsm;\ oabmxm;						
1/	uREkfyfonf q&m?q&mrrsm;\ o&kyfjyoifMum;jcif;rS avhvm oif,l&onfxuf udk,fwdkifyg0ifaqmif&Guf avhvm&onfudk ydkíESpfoufygonf/					
2/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,l&jcif;udk aysmf&Tifrdygonf/					
3/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,laepOfwGif rdrd\ oif,lrIjzpfpOfESifh oif,lrIvkyfief;rsm;tay:wGif auseyfESpfoufrI&Sdygonf/					
4/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; wGif tkyfpkzGJU avhvm oif,l&jcif;jzifh uREkfyfwdkUoli,fcsif; tcsif;csif; ydkrdk&if;ESD; vmonf[k cHpm;rdygonf/					
5/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,l&mü uREkfyf onf oif,lrIvkyfief;rsm;wGif udk,fwdkifyg0if aqmif&Guf &jcif;aMumifh pmar;yGJwGif aumif;pGmajzEdkifrnf[k ,HkMunf					

pO f	**taMumif;t&m**	**1**	**2**	**3**	**4**	**5**
	onf/					
taMumif;t&m(2)wufMuGpGmyg0ifaqmif&Gufoif,l enf;rS ausmif;ol? ausmif;om;rsm; &&SdEdkifonfh tusdK;aus;Zl;rsm;						
6/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,l&jcif;rS taxGaxGodyÜHbmom&yf\tajccHoabmw&m ;rsm;udk em;vnf vmonf/					
7/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,l&jcif;rS &&Sd aom todynmrsm;tm;aeUpOfb0vdktifrsm;? jyóemrsm;udk ajz&Sif;&mwGif toHk;csEdkifonf/					
8/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,l&jcif;rS oifcef;pmyg taMumif;t&mrsm;udk ydkrdkMum&SnfpGm rSwfrd Edkifonf/					
9/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,laepOfwGif oif,lrIvkyfief;rsm;ü uREkfyf\ wufMuGpGmyg0ifaqmif&Guf vdkrIudk EId;qGay;ygonf/					
10 /	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,laepOfwGif uREkfyfonf oif,lrIvkyfief;rsm;ü udk,fwdkifyg0ifaqmif&Guf &jcif;aMumifh taxGaxGodyÜHoifcef;pmrsm;udk					

pOf	**taMumif;t&m**	**1**	**2**	**3**	**4**	**5**
	tvG,fwul oif,lwwfajrmufonf/					
taMumif;t&m(3)odyÜHbmom&yftay: ausmif;ol ausmif;om;rsm;\ wefzdk;xm;rI						
11/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,ljcif;jzifh taxGaxGodyÜHbmom&yfwGif pdwf0ifpm;rIwdk;vmygonf/					
12/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,ljcif;jzifh uREkfyf\taxGaxGodyÜHbmom&yfESifh ywfoufí qufvuf odvdkrIudk Edl;qGay;ygonf/					
13/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,laepOfwGif taxGaxGodyÜHbmom&yfrS oifcef;pmrsm;onf uREkfyfwdkU\ aeUpOfb0ESifh qufpyfrI&Sdonf[k ydkrdkxifjrifrdonf/					
14/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,ljcif;& aMumifh vufawGUb0wGif aMumif;usdK;qufpyfí aqmif&Guf Edkifonf/					
15/	wufMuGpGmyg0ifaqmif&Gufoif,lenf; jzifh oif,ljcif;jzifh taxGaxGodyÜHbmom&yfESifh ywfoufaom todynmrsm;udk udk,fwdkif&SmazGvmEdkifonf/					