THE EFFECTS OF CONCEPT-BASED TEACHING ON STUDENTS' ACHIEVEMENT IN SCIENCE AT THE MIDDLE SCHOOL LEVEL

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Abstract

The major purpose of this research was to study the effects of concept-based teaching on students' achievement in science at the middle school level. Concept-based teaching is defined as a student-centered learning environment that fosters the development of reasoning skills using concepts. The experimental designed adopted in this study was a true experimental design, namely, posttest only control group design. For this study, an experimental study was used to investigate the effects of concept-based teaching. In this experimental study, the subjects were Grade seven students selected from No (1) BEHS Insein and No (2) BEHS Mayangone. For this study, (120) Grade Seven students were selected from both schools by random sampling method. These students were divided into two groups: control and experimental. The experimental group was treated with concept-based teaching and the control group was taught as formal instruction. After that, a posttest was administered to two groups. Independent samples *t*-test was used to test whether there was a significant difference between these two groups. Examination of the means and *t*-test at No (1) BEHS Insein (*t=12.19*, *df* = 58, MD=14.90, ****p*<.001) and No (2) BEHS Mayangone (*t*=13.08, *df*=58, MD=4.90, ****p*<.001) indicated that students who were taught by concept-based teaching demonstrated significantly better than those who were taught as formal instruction. In this study, (15) items questionnaires were used to observe the students' attitudes towards general science learning through concept-based teaching. The results showed that the students expressed their willingness to learn in concept-based teaching and they had positive attitudes towards this concept-based teaching. Research findings proved that concept-based teaching has positive contribution to the science teaching at the middle school level.

Keywords: concept, teaching, concept-based teaching, science, achievement

Introduction

The main aim of education is to help the children to learn their living and to make them dependent. Treagust (1995, cited in Trundle, 2009) suggests that children's conception stem from and are deeply rooted in the child's daily life context. Science education enables students to resolve their sorts of needs and consist of activities for giving the individuals the suggestions, skills and attitudes including scientific processes. Concept-based teaching focuses on continually moving students toward deeper conceptual understanding. With concept-based teaching, once the students understand the primary concept and have gained further knowledge can be applied in new environment and situation. One part of this study is also to explicate the conception of concepts based on recent developments in cognitive science and to bridge this view with views about the nature of scientific knowledge.

Aims

- The main purpose of this study is to investigate the effects of concept-based teaching on students' achievement in science.

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The specific purposes are as follows,

- To compare students' science achievement between experimental group and control group.
- To investigate the attitudes of students from experimental group on concept-based teaching in science.
- To give suggestions based on the data obtained for improving science teaching and learning at the middle school level.

Research Questions

Q1: Are there any significant differences in science achievement of students who receive learning with concept-based teaching and those who do not receive?

Q2: Are there any significant differences in science achievement of experimental group and control group in answering knowledge level questions?

Q3: Are there any significant differences in science achievement of experimental group and control group in answering comprehension level questions?

Q4: Are there any significant differences in science achievement of experimental group and control group in answering application level questions?

Q5: Can concept-based teaching make increase in scientific attitudes of students?

Scope of the Study

The following points are the scope of the study:

- This study is geographically restricted to Yangon Region.
- This study is limited to the selected chapter of Grade Seven general science textbook and is conducted in two sample schools in Yangon Region.
- Participants in this study are (120) Grade Seven students from the selected schools within the school year (2018-2019).
- This study is limited to the content areas from Grade Seven science textbook to investigate students' science achievement.

The methods uses in this study are concept-based teaching and formal instruction method.

Definition of Key Terms

Science "Science is the study of knowing about the universe through data collected by observation and controlled experimentation (Carin & Sund, 1989)."

Concept "A concept is a thought, an opinion, an idea, or a mental image (Good, 1959)" Broad, abstract ideas that, when used in a concept-based curriculum, are taught throughout the curriculum (Gidden et al., 2015)."

Teaching "Teaching is the act of instructing in an educational instruction;

Teaching is the act of providing activities, materials, and guidance that facilitate learning in either formal or informal situations. (Good, 1959)

Concept-based Teaching "Concept-based teaching is defined as a student-centered learning environment that fosters the development of reasoning skills using concepts."

Achievement "Achievement is the result of what an individual has learned from some educational experiences (Traver, 1970, p.447)."

Reviewed of Related Literature

Concept learning is one of the intellectual skills. It involves the ability to apply knowledge across a variety of instances or circumstances. Intellectual skills differ from declarative knowledge involves a memorization of an association between two or more entities. There are two distinctly different kinds of concepts: concrete and abstract. Concrete concepts are known by their physical characteristics, which may be discerned by any of senses-sight, smell, taste, touch, or hearing. Some of them, such as "bull market," have no appearance. They are abstract concepts, sometimes called defined concepts. In the actual design of instruction when teachers know the level of sophistication of learners the teacher may wish to consider whether the teachers are teaching a particular concept at the concrete or the abstract level because the way the teachers address the two types is somewhat different. Concept learning is not also the application of a principle that contains the concept. Learners who have acquired concepts are also able to supply their own examples of the concepts and apply the concepts appropriately in day-to-day encounters.

Essential Conditions of Learning Concepts

The essential conditions in a concept lesson are the features that promote generalization and discrimination and reduce over- and under generalization. Although the most critical features of a concept lesson lie in the events within the body of the lesson, we will describe important features within each of four main components of the lesson.

Two General Strategies of Concept Instruction

Concept instruction may follow one of two general strategies: a predominantly generative strategy or more supplanted one. One type of generative strategy is termed as inquiry approach. It is contrasted to a more typically supplanted strategy called an expository approach. Neither approach is particularly better than the other but one may be more appropriate than the other depending upon the context, the learners, and the learning task.

An inquiry strategy is often referred to as an expository strategy or a discovery approach. An inquiry strategy presents examples and no examples of the concept and prompts the learners to induce or "discover" the concept underlying the instances. Joyce and Weil's (1986, cited in Smit, & Ragan, 1999) "concept attainment model" is an example of an inquiry approach to teaching concepts. In this strategy learners are presented with a group of matched examples and no examples in verbal, auditory, or visual form.

An expository approach presents the concept, its label and its criteria attributes earlier in the sequence than in the inquiry approach. Expository instruction, like inquiry instruction, presents many examples and no examples: however, these instances follow a discussion of the expanded instructional events employs a more expository sequence.

(1) Introduction
(2) Establish Instructional Purpose
(3) Preview Lesson
(4) Process Information and Examples
(5) Focus attention
(6) Practice
(7) Evaluate Feedback

Employ Learning Strategies

Some strategies that a learner may employ in acquiring concepts have already been mentioned- elaborating by inventing one's own examples and isolating attributes and highlighting these attributes in some way. This strategy may be built "built into instruction" provided by the learner, promoted by the instruction, or a combination of all three. An approach to concept instruction proposed by Tessmer, Wilson, and Driscoll (1990, cited in Smit, & Ragan, 1999) emphasizes the use of analogies, learning strategies, and thinking strategies. It is discussed four strategies: the development of concept "tree" or "map," analogies, mnemonics, and the use of imagery.

Learning Science Concepts with Analogies

Analogies help learners understand new concepts by highlighting similarities to familiar ones. Glynn Russel and Noah (1997, cited in Alice, 2011) defined analogy as a strategy that helps students form initial mental models of key science concepts by facilitating introduction of the concepts in ways that are concrete, meaningful and relevant to students. According to Ruhl (2003, cited in Alice, 2011) an analogy is a comparison of something unfamiliar with something familiar in order to explain a shared principle. Like a bridge that spans the gap between what a teacher wants, a student to learn and what the student already knows. An analogy builds on the framework of the learners' existing knowledge so they are not starting from scratch. Sani (2006, cited in Alice, 2011) opined that analogy is one of the teaching strategies within the constructivist frame that has evidently proved effective in preventing and overcoming poor performance and wrong perception of the students. Venvile and Thiele (1992, cited in Alice, 2011) and Sani (2006, cited in Alice, 2011) reported three benefits of the use of analogies as a teaching technique for abstract concepts. These are: (i) it provides visualization of abstract concepts (ii) it helps compare similarities of the students' real world with the new concept; and (iii) it has a motivational function.

There are two domains of analogy: the analogue domains that exist in memory from which the analogy is drawn and the target domains which contain the science concepts under study that form the instructional objectives of the analogy (Sarantopoulos and Tsaparlis, 2004, cited in Alice, 2011). Analogies are of various types depending on the nature of what they represent and the problem they are intended to solve in the teaching and learning situation.

Teaching-With-Analogy model is preferred to other Analogy model for this study because the model simplifies a difficult concept or idea, provides a variety of approach to link an unfamiliar idea with and visualizes a structure or process. Above all, it puts into consideration the prior knowledge of the learner, which constructivist view that meaningful learning must necessarily involves students in integrating new information or knowledge with pre-existing schemata (Millar, 1989, cited in Alice, 2011). To maximize the benefit of analogies, the teaching with analogies model introduced by Glynn, Duit, and Thiele (1995, cited in Alice, 2011) consist of six operations as follow:

1. Introduce the target concept.
2. Cue the student's memory to the analogous situation
3. Identify the relevant features of target and analogy.
4. Map the similarities between the analogy and the target concepts
5. Identify where the analogy breaks down
6. Draw conclusions (Alice, 2011).

Method and Procedure

The research design for this study was true experimental design (Posttest-only control group design). All participants in this study were Grade Seven students. This study was conducted in Yangon Division. Two districts were selected in random. One township from each selected district was also selected in random. One high school from each township was selected. Participants in this study were selected by random sampling and they were randomly assigned to control group and experimental group. Experimental group learned with the Concept-Based teaching and the control group received the formal instruction. The achievements of experimental and control group were compared by using the independent samples '*t*' test.

Instruments

The instruments used for this study were test items for posttest and attitude questionnaire for students' attitude towards concept-based teaching.

(a) Posttest

This test was constructed to measure general science achievement of the students. It consisted of true or false items, completion items, multiple choice items, short question and long question items. Test items were constructed based on the Chapter (5) from the Grade Seven General Science Textbook. The test items were constructed according to the advice and guidance of the supervisor. In order to get validation, the copies of the table of specification and posttest questions were distributed to five experts who have special knowledge in science from Department of Methodology. According to their suggestions, the test items were modified again. The allocated time for this test was (90) minutes, and the given marks were (50). The reliability coefficient Cronbach's Alpha was used to determine whether each test item was appropriate or not. Its value was (0.79).

(b) Attitudes towards Concept-Based Teaching

In this study, (15) items were used to observe the students' attitudes towards general science learning through concept-based teaching. The questionnaire was constructed according to the advice and guidance of the supervisor. In order to get validation, the copies of questionnaire were distributed to five experts. According to their suggestions, the questionnaire was modified again. Pilot test was conducted with (10) students. The reliability coefficient Cronbach's Alpha was used to determine whether each item was appropriate or not. Its value was (0.84).

Results

For quantitative research findings, data were recorded systematically. These data were analyzed by using the independent samples *t*-test to compare the differences between the experimental and the control groups.

Table 1 "*t*" Values for Posttest Science Achievement Scores

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
School 1	Experimental	30	32.80	5.63	14.90	12.19	58	.000***
	Control	30	17.90	3.61				
School 2	Experimental	30	41.87	4.95	16.30	11.34	58	.000***
	Control	30	25.57	6.11				

Note: ****p*< .001

The results showed that there was a significant difference on the overall scores of science achievement of the students who were taught by concept-based teaching and those who were taught as formal instruction in each school (See Figure 1).

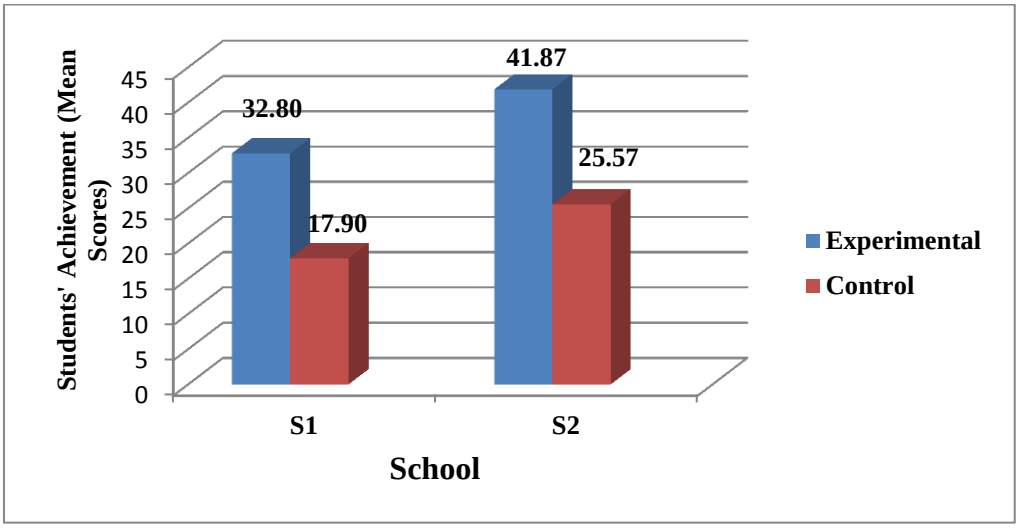

Figure 1 The Comparison of Means on Science Achievement

According to the findings, it can be interpreted that the use of concept-based teaching has significant effect on the overall science achievement of students. Thus, the concept-based teaching positively contributed to the science teaching methodology at the middle school level.

Table 2 "*t*" Values for Scores on Knowledge Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
School 1	Experimental	30	11.73	1.41	4.90	13.08	58	.000***
	Control	30	6.83	1.48				
School 2	Experimental	30	12.33	0.95	3.10	8.21	58	.000***
	Control	30	9.23	1.83				

Note:. ****p*< .001

Results of knowledge level questions showed that the means of the experimental groups were significantly higher than that of the control groups in each school. It showed that there was a significant difference on the scores of knowledge level questions of the students who receive concept-based teaching and those who do not receive as formal instruction in each selected school.

Table 3 *t* Values for Scores on Comprehension Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig. (2-tailed)
School 1	Experimental	30	11.60	2.20	3.73	6.98	58	.000***
	Control	30	7.87	1.92				
School 2	Experimental	30	14.03	1.81	4.43	8.40	58	.000***
	Control	30	9.60	2.25				

***Note: ****p* < .001**

According to the scores on comprehension level questions, the means of the experimental groups were significantly higher than that of the control groups in each selected school. It

showed that there was a significance difference on the scores of the comprehension level questions of the students who were taught by concept-based teaching and those who were taught as formal instruction in the selected schools.

Table 4 "*t*" Values for Scores on Application Level Questions

School	Group	N	M	SD	MD	*t*	*df*	Sig.(2-tailed)
School 1	Experimental	30	9.47	3.53	6.27	8.75	58	.000***
	Control	30	3.20	1.71				
School 2	Experimental	30	15.50	2.92	8.77	10.66	58	.000***
	Control	30	6.73	3.42				

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

As regards with the scores on the application level questions, the means of the experimental groups were significantly higher than that of the control groups in each school. It showed that there was a significant difference on the scores of the application level questions of the students who were taught by concept-based teaching and those who were taught as formal instruction in each selected school.

After using the concept-based teaching, in order to find out the attitudes of students who learned by concept-based teaching, a questionnaire concerned with their attitudes on the concept-based teaching was used (See Figure 2).

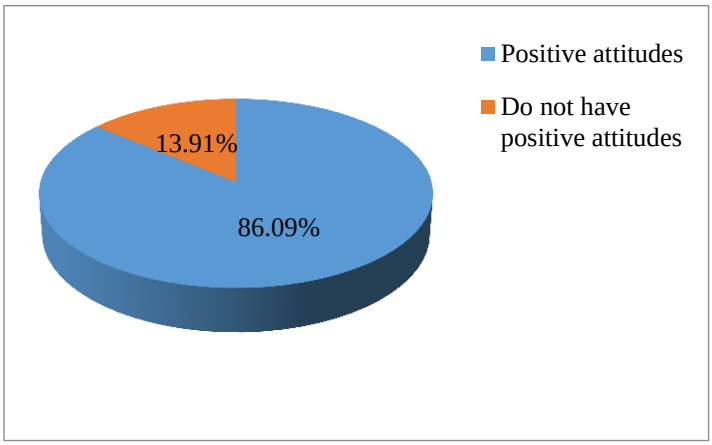

Figure 2 Total Percentage of Students' Feelings, Beliefs and Attitudes towards

Concept-Based Teaching

According to the results of (15) items five-point Likert-scale, (86.09%) of the students have positive attitude and (13.91%) have negative attitude towards concept-based teaching. In this study, it can be interpreted that scientific attitudes of students can be increased by using with concept-based teaching. By relating previous experiences with the new experiences, it can promote their logical thinking skills. Moreover, students learned scientific concepts with extra activities that are related to the lesson. Therefore, they have mastered their learning.

Discussion

According to the results of this study, it was found that the posttest mean score of experimental group was significantly higher than that of the control group for each school. This result pointed out that concept-based teaching had significant effect on science achievement of

the students. Concept-based teaching gives the fruitful effects on science instruction at the middle school level. Although it is emphasized on student-centered teaching, the teacher plays a vital role to use it in the classroom appropriately. Concept-based teaching helps learners understand new concepts by highlighting similarities to familiarities ones. Teaching materials and teaching activities were effectively prepared for the students in experimental group to be effective and efficient in teaching. In formal, the teacher taught science by presenting facts and information, imparting knowledge and emphasizing main points with a little students' involvement in teaching learning situation.

According to the comparison of mean scores on knowledge level questions for all the selected schools, the finding showed that there were significant differences between experimental group and control group. This means that teaching science by concept-based teaching could bring about the improvement of students' memorization rate and recall the information more easily. This result is consistent with Alice (2011) who found that Teaching-With-Analogy improves students' academic performance and retention of evolution concepts.

According to the comparison of mean scores on comprehension level questions for all the selected schools, the finding showed that there was a significant difference between experimental group and control group. It can be said that concept-based teaching could bring about the improvement of students' conceptual understanding. This result is in line with Hinai, & Balushi, (2015) who remarked that analogy-based instruction impact on immediate and postponed science achievement.

As for the comparison of means scores on the application level questions for all the selected schools, the finding showed that there were significant differences between experimental group and control group. It can be concluded that students from experimental groups improve higher order thinking skills and can transfer what they have learned at school to real-life situations. This finding is in line with Frazier, (2013) who noted that concept-based teaching promotes emergence and progress of their conceptual understanding. This finding is also consistent with Ospanova, (2018) who noted that concept-based teaching increased students' critical thinking and improves their performance and higher order thinking.

According to (Figure 2), all students in experimental groups feel that they can make connections between scientific concepts and their life-world experiences, they can visualize the abstract concepts and they become more conceptual understanding on science by concept-based teaching. 96.6 percent of students feel more enjoyment by teaching science with concept-based teaching and that they can realize the concepts by thinking. 95 percent of students are interested in science by teaching related with concepts and 93.3 percent of students feel that they can get the chance to learn the main concepts. 90 percent of students feel more curiosity by using material related to the subject. 88.3 percent of students feel that they can understand the main concepts and they can understand the gained concepts by linking with real life. 86.6 percent of students feel that they can develop interesting in science by concept-based teaching. 83.3 percent of students feel that they can realize the meaning and value of science subject. 81.7 percent of students can get habit to investigate the environment and 80 percent of students feel that they can apply the previous knowledge by integrating with the new knowledge. 78.3 percent of students can describe environmental concepts by linking with own experience and 76.7 percent of students can understand unfamiliar concepts compared with familiar concepts. 73.3 percent of students can get more enjoyment to learn the other subject with concept-based teaching.

According to this result, 86.09 percent of students have positive attitudes and 13.91 percent of students have negative attitudes toward concept-based teaching.

Generalization can be drawn that the concept-based teaching can enhance positive attitude towards science teaching. Thus, the science teachers should use concept-based teaching in science classroom.

Conclusion

The main purpose of this research was to study the effects of concept-based teaching on students' achievement in science at the middle school level. Quantitative study was mainly used to compare students' science achievement between two groups; experimental group and control group. The students were selected by simple random sampling method. The instruments used in this research were a posttest to measure students' science achievement and a questionnaire to measure students' attitudes toward concept-based teaching.

Firstly, an experimental design was used to study the effects of concept-based teaching on students' achievement in science at the middle school level. Generalization can be drawn on the basis of results. According to posttest results, the means of students who were taught by concept-based teaching were significantly higher than those who were taught as formal instruction. It can be concluded that concept-based teaching improves students' memorization, conceptual understanding and critical thinking skills. Moreover, it is also interpreted that students can apply learning concepts in new situations. Thus, this concept-based teaching can achieve success in teaching science. Secondly, an attitude questionnaire was done to study the students' feelings, attitudes, experiences and opinions about science teaching with concept-based teaching. Students described that they were very happy and satisfied by using concept-based teaching also promoted their conceptual understanding.

According to the result of this study, concept-based teaching methods are useful methods in teaching-learning process. Teaching is effective when students relate prior knowledge to new one to understand the subject matter. Concept-based teaching helps students to think by themselves and identify their misconceptions. It also helps students to visualize abstract concepts and think about the relationships between different concepts. It can facilitate learning by explicitly integrating new and old knowledge and make students to visualize the relationships between target concepts which can lead students to learn meaningfully.

Concept-based teaching focuses on core concepts that foster knowledge and facilitates learning. The traditional method merely connects students to the source of information which may or may not be retained for a longer period of time, whereas, conceptual learning focuses on making the students understand the core idea so as to retain the information as valuable knowledge which they can apply throughout their lives.

A concept-driven education focuses on developing an effective approach to teaching and learning; empowering young people or a lifetime of learning, independently and in collaboration with others and preparing a community of learners that engage with global challenges through inquiry, action, and reflection. Concept-based teaching can introduce students to universal rules and engaged them in the true process of learning. It can help students create a connection with their prior experience creating a deeper connect with the understanding of content knowledge which further help students in responding to their learning with appropriate actions.

To improve science education, teaching learning situations and teaching approaches are very important. Students' engagements are central role to improve science education. The concept-based teaching is the bridge between theory and practices. Students can apply theory in their real life situations. This teaching promotes deeper understanding of scientific concepts. Moreover, this concept-based teaching is applicable to all students. Therefore, it is an applicable and useful method for the development of science teaching.

Moreover this study showed that students' learning based on their prior knowledge and concepts was more effective than learning as formal instruction. It improves not only students' learning rate but also promotes their thinking ability. Moreover, this result recommends many science teachers to achieve their teaching learning situation more effectively. The effective use of the concept-based teaching has significant effect on the overall science achievement of the students. Therefore concept-based teaching surely has positive contribution to the science teaching at the middle school.

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References

Alice, J. (2011). *Effects of Teaching-With-Analogy on academic performance and retention of evolution concepts among Nigeria certificate in education biology students*. Retrieved November 21, 2018, from http://kubanniabu.edu.ng>jspui>bitstream

Al-Hinai, M., & Al-Balushi, S. (2015). *Reflecting analogy-based instruction to enhance immediate and postponed science achievement*. Retrieved December 26, 2018, from shalushi@squ.edu.om

Carin, A & Sund, R. B. (1989). *Teaching science through discovery*. Coiumbus: Merrill Publishing.

Frazier,J. (2013*) Benefits of concept based learning that helps to retain knowledge longer*. Retrieved January 2, 2019, from http://www.outlookindia.com/newsscroll/.benefits-of-concept-based-learning-that-helps-to-retain-knowledge-longer/113773

Gay, L. R., & Airadian, P. (2003). *Educational Research*: *Research Competencies for Analysis and Application*. (7 th ed.). New Jersy: Merrill Prentice

Gidden, JF, et al. (2015). *Selecting concepts for a concept-based curriculum: application of a benchmark approach.* Retrieved July 27, 2018, from https://www.ncbi.nlm.nih.gov/m/pubmed/22849765

Good, C. V. (1959). Dictionary of education (2nd ed.).New York: McGraw-Hall.

Ospanova, N.(2018). *The influence of concept-based teaching on high school students' research skills. HAMK Unlimited Journal*. Retrieved December 27, 2018, from https://unlimited.hamk.fi/ammatillinen-osaaminen-ja-opetus/concept-based- teaching-and-research-skills

Smit, P. L., & Ragan, T. J.(1999*). Instructional Design* (2 nd ed.). Hoboken: John Wilkey & Sons. Inc.

Traver, John P.(1970) *Fundamentals of educational psychology.* Scrantom, Pensyvania: International Textbook Company.

Trundle, K. C, (2009). *Teaching science during the early childhood years.* Retrieved July 27, 2018, from http://www.researchgate.net/publication/237342472-Teaching-Science-During-the-Early-Childhood-Years

Appendix A

Sample Lesson Plan for Experimental Group

Sample Lesson Plan (1)

၁။အတန်း – ဆဋ္ဌမတန်း
၂။ဘာသာ – အထွေထွေသိပ္ပံ
၃။သင်ခန်းစာခေါင်းစဉ် – အခန်း(၅)ကမ္ဘာမြေကြီးနှင့် အာကာသမြေကမ္ဘာ ပတ်ဝန်းကျင် ထိန်းသိမ်းကာကွယ်ခြင်း လူသားနှင့်ပတ်ဝန်းကျင်
– ပတ်ဝန်းကျင်အပေါ် မှီတည်နေရသောလူသား
၄။အချိန် – ၄၅မိနစ်
၅။သင်ယူမှုဦးတည်ချက်များ
(က)ယေဘုယျဦးတည်ချက် – လူသားတို့ဘဝရှင်သန်ရေးအတွက် ပတ်ဝန်းကျင်ရှိ သက်ရှိ သက်မဲ့တို့အကြောင်း ကောင်းစွာသိရှိနားလည်၍အထူး အလေးထားထိန်းသိမ်း ကာကွယ်စောင့်ရှောက် တတ်စေရန်။
(ခ)အသေးစိတ်ဦးတည်ချက်များ – ပတ်ဝန်းကျင်သည် လူသားများအတွက် အရေးပါကြောင်း ဖော်ပြတတ်စေရန်။
– လူသားနှင့်ပတ်ဝန်းကျင် ဆက်စပ်နေပုံကို ရှင်းပြတတ်ရန်။
– လူသားတို့၏ လုပ်ဆောင်ချက်ကြောင့် ပတ်ဝန်းကျင်ပျက်စီး ဆုံးရှုံးရကြောင်း ရှင်းလင်းဆွေးနွေးတတ်စေရန်။
၆။သင်ထောက်ကူပစ္စည်းများ - Textbook, Chart, Worksheets, Photographs, Video File.

၇။သင်ကြားမည့်အစီအစဉ်

သင်ကြားမည့် အကြောင်းအရာ	သင်ကြားမည့် အဆင့်	ဆရာ့လုပ်ငန်းစဉ်	သင်ယူသူလုပ်ငန်းစဉ်
ပတ်ဝန်းကျင်အပေါ်မှီတည်နေရသော လူသား	-Introducing the target concept –အဓိက အသိသညာ ကို မိတ်ဆက်ခြင်း	–လူသားများအတွက်ပတ်ဝန်းကျင်သည် အရေးကြီးကြောင်း –လူသားများသည်ပတ်ဝန်းကျင်အပေါ် တွင်မှီခိုနေရကြောင်း –ပတ်ဝန်းကျင်ကိုထိန်းသိမ်းရန်လိုအပ်ကြောင်း –လူသားများကြောင့် ပတ်ဝန်းကျင်ပျက်စီးမှုများ ဖြစ်ပေါ်နိုင်ကြောင်း –ပတဝန်းကျင်ပျက်စီးမှုကြောင့်လူသားများအတွက်ဆိုးကျိုးဖြစ်ပေါ်နိုင်ကြောင်း	–ဆရာ၏မေးမြန်းချက်များကိုသေချာစွာနားထောင်၍ ပြန်လှန်ဆွေးနွေးဖြေကြားခြင်း
	-Cueing the students' memory –ကလေးများသိရှိပြီးသောအကြောင်းအရာများကိုလှုံ့ဆော်ပေးခြင်း	–ပတ်ဝန်းကျင်နှင့် လူသားများ ဆက်စပ်နေပုံကို လေ့လာ၍ ဆွေးနွေးစေခြင်း။ –နေအိမ်၊ ကျောင်းနှင့် ပတ်ဝန်းကျင်ဆက်စပ်နေပုံကို ဆွေးနွေးစေခြင်း။ –နေအိမ်နှင့်ကျောင်း ပတ်ဝန်းကျင်ပျက်စီးစေသော အကြောင်းအရာများအကြောင်း ဆွေးနွေးစေခြင်း။ – နေအိမ်၊ ကျောင်းနှင့်အတန်းပတ်ဝန်းကျင်ပျက်စီးမှုကြောင့် ဖြစ်ပေါ်လာနိုင်သော ဆိုးကျိုးများအကြောင်းဆွေးနွေးစေခြင်း။	–မိမိတို့နေအိမ်၊ ကျောင်းနှင့် အတန်းပတ်ဝန်းကျင်ကိုစူးစမ်းလေ့လာ၍ဆွေးနွေးခြင်း။ ပတ်ဝန်းကျင် ပျက်စီးမှုကြောင့် ဖြစ်ပေါ်လာနိုင်သော ဆိုးကျိုးများအကြောင်းဆွေး နွေးခြင်း။ – အမှိုက်များကို စည်းကမ်းမဲ့စွာ စွန့်ပစ်ခြင်းကြောင့်ပတ် ဝန်းကျင်ညစ်ညမ်းလာခြင်း။ –ၚင်းအမှိုက်များစုပုံလာခြင်းကြောင့်လေထုညစ်ညမ်းလာပြီး လူသားများကျန်းမာရေးထိခိုက်လာနိုင်ကြောင်းဆွေးနွေးခြင်း။

	-Identifying the relevant features –အဓိကအကြောင်းအရာကိုသတ်မှတ်ဖော်ပြခြင်း	– ကမ္ဘာကြီးသည် လူသားများ မပါဘဲ ဆက်လက်တည်တံ့နိုင်ကြောင်း –လူသားများသည်သဘာဝပတ်ဝန်းကျင်အပေါ်မှီခိုနေရကြောင်း –လူသားများ ကျန်းမာစွာ အသက်ရှင်နေနိုင်ရန်လိုအပ်ချက်များစွာရှိနေကြောင်း – အေရယ်ပင်လယ်ရေအိုင်ကြီး အဘယ်ကြောင့်သေးငယ်သွားရကြောင်း – အေရယ်ပင်လယ်ရေအိုင်ကြီးသေးငယ်သွားခြင်းကြောင့်ဖြစ်ပေါ်လာသောဆိုးကျိုးများအကြောင်း	– ကမ္ဘာကြီးနှင့် လူသားများ ဆက်စပ်ပုံ၊ ကမ္ဘာကြီးမရှိဘဲလူသားများအသက်မရှင်နိုင်ကြောင်း ဆွေးနွေး ခြင်း။ လူသားများ အနေဖြင့်သဘာဝပတ်ဝန်းကျင်ကိုမှီခိုနေရကြောင်းအသက်ရှူရန်လေကောင်းလေသန့်၊ သောက်သုံးရန်ရေချို ရေသန့်၊ စိုက်ပျိုးရန်မြေဆီလွှာ၊ စားသုံးရန် ပင်လယ်နေ သတ္တဝါများ၊ သတ္တုတွင်းထွက်များစသည်တို့ရှိပါမှလူများသည်ကျန်းမာစွာ အသက်ရှင်နေနိုင်ကြောင်း ဆွေးနွေးခြင်း။ စိမ်းစိုသာယာသော ရေမြေတောတောင်များနှင့်တကွသားရဲတိရစ္ဆာန်ကျေးငှက်သာရကာများပါရှိပါမှသာ လူသားများသည် စိတ်ပျော်ရွှင်ချမ်းမြေ့နိုင်ကြောင်း ဆွေးနွေးခြင်း။ –အေရယ် ပင်လယ်သည် ကမ္ဘာပေါ်တွင် စတုတ္ထအကြီးဆုံးရေအိုင်ဖြစ်ကြောင်း –(၆၈၀၀၀၀) စတုရန်းကီလိုမီတာကျယ်ဝန်းပြီး(၁၆)မီတာနက်ကြောင်းှင်းအိုင်ကြီးထဲသို့စီးဝင်သောမြစ်ကြီးနှစ်စင်းပေါ်တွင် ဆည်များ တည်ဆောက်၍ ဆည်ရေဖြင့် စိုက်ပျိုးရေး တိုးချဲ့လုပ်ကိုင်ခဲ့သည်။ ထို့ကြောင့် ရေစီးဝင်မလျော့နည်းခဲ့ရာအိုင်ကြီး၏ ပမာဏကျုံ့သွား ကြောင်း ဆွေးနွေးခြင်း။ – ရေပမာဏ နည်းလာမှုကြောင့် အပူချိန်မြင့်တက်လာပြီးမိုးရွာသွန်းမှုရေ့နည်းလာခြင်း၊ရေအိုင်အတွင်းရှိဆားဓါတ်ပါသော မြေများပျံ့နှံ့မှုကြောင့်စိုက်ပျိုးမြေများ ပျက်စီးခြင်းအကြောင်းဆွေးနွေးခြင်း။ –ရေချိုများညစ်ညမ်း၍ကျန်းမာရေးထိခိုက်ကြောင်းကိုပုံများ ကားချပ်များပြ၍ဆွေးနွေးစေခြင်း။
	-Mapping the similarities –တူညီသောအကြောင်းအရာများကိုချိတ်	–မိမိတို့အသက်ရှင်သန်ရန်ပတ်ဝန်းကျင်ရှိသက်ရှိသက်မဲ့အမျိုးမျိုးတို့အပေါ်၌မှီခိုနေရကြောင်း – နေအိမ်၊ ကျောင်းနှင့်ပတ်ဝန်းကျင်သည် လူသားများဆက်စပ်နေပုံ	–ဆရာ့၏ ဆွေးနွေးမှုကိုသေချာစွာနားထောင်၍ရရှိလာသောအချက်အလက်များကိုပုံများ၊ ကားချပ်များ၊ video များကိုလေ့လာ၍ ချိတ်ဆက်ဖော်ပြခြင်း။

	ဆက်ပေးခြင်း	–အသက်ရှူရန်–လေကောင်းလေသန့် –သောက်သုံးရန်–ရေချိုရေသန့် –စိုက်ပျိုးရန်–မြေဆီလွှာ –စားသုံးရန်–ပင်လယ်နေသတ္တဝါများ –အသုံးပြုရန်–သတ္ထုတွင်းထွက်များ –မိမိတို့ပတ်ဝန်းကျင်ပျက်စီးမှုကြောင့်မိမိတို့အတွက်ဆိုးကျိုးများဖြစ်လာနိုင်ကြောင်း –မြန်မာနိုင်ငံနေရာအတော်များများတွင် ဆည်များတည်ဆောက်၍စိုက်ပျိုးရေးလုပ်ငန်းများ ဆောင်ရွက်ခြင်းကြောင့် ရေကြီးရေလျှံမှုဖြစ်ပေါ်လာနိုင်ကြောင်း ချိတ်ဆက်ဆွေးနွေးစေခြင်း။ အရေယပင်လယ်ရေအိုင်ကြီး၏အခြေအနေကိုပုံများကို လေ့လာ၍ ဆွေးနွေးခြင်း။ အရေယပင်လယ်ရေအိုင်ကြီးသေးငယ်သွားခြင်းကြောင့်ဖြစ်ပေါ်လာနိုင်သောဆိုးကျိုးများအကြောင်းချိတ်ဆက်ဆွေးနွေးခြင်း။	
	-Identifying where the analogy breaks down –ဆက်စပ်သောအကြောင်းအရာနှစ်ခုကြားတွင်လိုအပ်ချက်များကို ရှာဖွေသတ်မှတ်ခြင်း	–နေအိမ်၊ကျောင်းနှင့်ကျောင်းပတ်ဝန်းကျင်ရှိလူသားများဆက်စပ်နေသကဲ့သို့ ကမ္ဘာကြီးနှင့်လူသားများဆက်စပ်နေပုံကို ဖြည့်စွက်ဆွေးနွေးပေးခြင်း။ –နေအိမ်၊ကျောင်းနှင့်အတန်းပတ်ဝန်းကျင်ပျက်စီးမှုကြောင့် ဖြစ်ပေါ်လာနိုင်သောဆိုးကျိုးများဖြစ်သလိုကမ္ဘာမြေပေါ်ရှိသဘာဝ ပတ်ဝန်းကျင်ပျက်စီးလျှင်လူသားများအတွက်ဆိုးကျိုးများဖြစ်လာနိုင်ကြောင်း ဆွေးနွေးခြင်း။ –အာရတိုက်ရှိ အရေယပင်လယ်အကြောင်း ဆွေးနွေးခြင်း။ –မြန်မာနိုင်ငံရှိဆည်များ အကြောင်းဆွေးနွေးခြင်း။ –ကျောင်းရှိစွန့်ပစ်အမှိုက်များကြောင့် အနီးအနားရှိ ရေအိုင်များ၏ ပမာဏလျော့ကျလာခြင်း။ –ပလပ်စတစ်များကြောင့် မြေဆီလွှာများပျက်စီးလာခြင်း။ –ရေများညစ်ညမ်းလာခြင်း အကြောင်းဆွေးနွေးခြင်။	–ပတ်ဝန်းကျင်ရှိအကြောင်းအရာများကိုလေ့လာ၍ကမ္ဘာပေါ်ရှိအဖြစ်အပျက်များကို လေ့လာ ဆွေးနွေးခြင်း။
	-Drawing conclusions about the target concept	–လိုအပ်သည်များကိုဆရာကဖြည့်စွက်၍ နိဂုံးချုပ်ဆွေးနွေးပေးခြင်း (၁)လူသားများကျန်းမာပျော်ရွှင်အသက်ရှင်နိုင်ရန်မည်သည်တို့လိုအပ်သနည်း။	–မိမိတို့သိရှိပြီးသောအသိသညာများကိုအခြေခံ၍နိဂုံးချုပ်ဆိုခြင်း။ (၁)လူသားများကျန်းမာပျော်ရွှင်အသက်ရှင်နိုင်ရန် အသက်ရှူရန်လေကောင်းလေသန့် –သောက်သုံးရန်–ရေချိုရေသန့်

	–အဓိက အသိသညာနှင့် ပတ်သက်၍ နိဂုံးချုပ်ခြင်း	(၂) အေရယ်ပင်လယ်ကြီးသည်အဘယ်ကြောင့်ပမာဏကျဉ်းသွားရသနည်း။ (၃)ရေအိုင်ပျက်စီးမှုကြောင့်လူသားတို့တွက်မည်သို့သောဆိုးကျိုးများခံစားရသနည်း။	–စိုက်ပျိုးရန်–မြေဆီလွှာ –စားသုံးရန်ပင်လယ်နေသတ္တဝါများ –အသုံးပြုရန်သတ္ထုတွင်းထွက်များလိုအပ်သည်။ (၂)အေရယ်ရေအိုင်ကြီးထဲသို့စီးဝင်သောမြစ်ကြီးနှစ်စင်း ပေါ်တွင်ဆည်များတည် ဆောက်၍ဆည်ရေဖြင့်စိုက် ပျိုးရေးတိုးချဲ့လုပ်ကိုင်ခဲ့သည်။ ထို့ကြောင့် ရေစီးဝင်မှုလျော့နည်း ခဲ့ရာအိုင်ကြီး၏ပမာဏသေးငယ်သွားရသည်။ (၃)ရေအိုင်ပျက်စီးမှုကြောင့် ရေပမာဏ နည်းလာ၍အပူချိန် မြင့်တက်လာပြီးမိုးရွာသွန်းမှုရော့နည်း လာခြင်း၊ ရေအိုင်အတွင်း ရှိဆားဓါတ်ပါသောမြေများပျံ့နှံ့မှုကြောင့် စိုက်ပျိုးမြေများပျက်စီးရသည်။