An Investigation into the Effectiveness of a Learning Cycle Model in Middle School Science on Students' Scientific Literacy

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Abstract

The main purpose of the present study is to investigate the effectiveness of a Learning Cycle Model in middle school level students' science learning. Learning Cycle used in this study has seven phases; that is the 7E Learning Cycle Model. This model requires instruction to involve the following discrete elements: elicit, engage, explore, explain, elaborate, evaluate, and extend (Eisenkraft, 2003). It is an experimental research. Treatment was based on instructional design of 7E Learning Cycle Model. According to the format of that design, (6) sample lessons of learning materials were constructed. The target population was Grade Eight students from Basic Education High School, Kyeemyindaing Township and Basic Education High School, Insein Township. Simple random sampling method was used. Therefore, (120) students and (4) science teachers participated in it. The instrument used in this study was a posttest. Learning materials were selected from Chapter (5), Earth and Space, from Grade Eight Science Textbook. To study the effectiveness of 7E Learning Cycle Model in science learning, one of the true-experimental designs, posttest only control group design was used. Independent samples *t* test was used to test the hypotheses of this study. The result of this study shows that there was a significant difference in achievement between science learning of grade eight students who received learning with 7E Learning Cycle Model and those who received learning with formal instruction that uses currently. The results indicated that the experimental group achieved significantly better than the control group in performing at knowledge, comprehension and application level science questions. So, it verifies that Learning Cycle Model brings positive effects on students' science learning at Middle school level. That is why, Learning Cycle Model can be integrated in science teaching and learning in the classrooms.

Keywords: Learning Cycle Model (7E), Science, Scientific Literacy

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Introduction

Education introduces people to value aspects of the culture of society as well as aspects of culture that are important for the members of that society. According to Marek and Cavallo (1997), the central purpose of every school activity should lead students to develop their thinking abilities. Such aspects should form part of the education of the children today and are more likely through the practical approaches. In studying science education, Tamir recognized that inquiry has been central to the learning process in secondary school science (Bybee & Trowbridge, 1990).

In a classroom, the teacher may encourage students to think of science as problem solving, observation and description of the real world, discovery, seeking the truth, studying nature, turning facts into theories, organizing knowledge, using logic, or studying the universe. Learners involved in answering questions that challenge their prior knowledge about the environment are growing in science literacy and knowledge. According to the National Science Teachers Association, the major goal of science teaching is the development of scientific literacy for all people. A major emphasis for education for scientific literacy must be placed on the processes of scientific inquiry (Bybee & Trowbridge, 1990).

Students who are scientifically literate are able to not only follow scientific procedures, but they also understand, explain, and apply their knowledge. The road to a more scientifically literate society begins with the opportunity for all students to develop a better understanding of fundamental science concepts, principles, and ways of thinking. One of the inquiry-based learning instructional strategies for helping students to learn concepts while fostering cognitive development is the learning cycle (Karplus, 1977). Many versions of the learning cycle appear in science curricula with phases ranging in number from three to five to seven. Regardless of the quantity of phases, every learning cycle has at its core the same purpose (Settlage, 1999). Learning cycle used in this study has seven phases; that is the 7E learning cycle model. The 7E learning cycle model requires instruction to include the following discrete elements: elicit, engage, explore, explain, elaborate, evaluate, and extend (Eisenkraft, 2003). The main purpose of current experimental study is to investigate how learning cycle model effects on students' scientific literacy in science learning. More specifically, this study will examine 7E learning cycle

model in grade eight science learning for the improvement of students' scientific literacy.

Purposes of the Study

The main purpose of this study is to investigate the effectiveness of a learning cycle model in middle school science students' learning. The specific objectives are as follows.

(1) To compare science achievement between the students who are taught by 7E learning cycle model and those who are not received it

(2) To point out the effectiveness of 7E learning cycle model in the middle school science learning

(3) To give suggestions for improving teaching and learning in the middle school science.

Research Hypothesis

1. There is a significant difference in achievement between science learning of grade eight students who received learning with 7E learning cycle model and those who received learning with current instruction.

Definition of Key Terms

Learning Cycle Model (7E): Learning Cycle is an instructional model or approach based on inquiry-based learning. 7E Learning Cycle Model includes seven phases (Eisenkraft, 2003).

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

Scientific Literacy: Scientific literacy has been defined as a social process, not only requiring opportunities for students to read and write but also to communicate with others about their ideas (Krajcik & Sutherland, 2010).

Review of Related Literature

Learning Cycle Model

An instructional methodology that is founded on constructivist learning theory should be aware of the following key points: (1) a student's prior knowledge is a key factor affecting future learning because what a student already knows interacts with a new conception; (2) students construct meaning through interactions with others, with materials, and by observation and exploration of interesting and challenging activities; (3) students needs to build their understanding around core concepts and big ideas (Brooks and Brooks, 1999, cited in Fetsco & McClure, 2005). The learning cycle is an inquiry-based instructional approach or model with its roots on constructivist perspective. Karplus (1977) declared that the learning cycle is an effective inquiry-based instructional strategy for helping students to learn concepts and conceptual systems while fostering cognitive development. The learning cycle incorporates the Piaget's Theory of Cognitive Development into a succinct methodology of learning: experiencing the phenomena or concept (Exploration Phase), applying terminology to the concept (Concept Introduction), and the application of the concepts into additional conceptual frameworks (Application).

In 1962, Atkin and Karplus developed it as a Learning Cycle with three parts: exploration, invention, and discovery. In the late 1980s, Rodger Bybee (1977), modified the Learning Cycle by changing the terminology in some significant ways and then added two more dimensions (cited in Gallagher, J. J., 2007). The result was the 5E model. The 5E Model is made up of five distinct parts and can be an extremely effective learning approach. This model gives students the opportunity to raise questions and put abstract experiences in communicable form. They can expand on previously learned concepts making the connection to other concepts. The five parts of this lesson design are:

1. Engage — During this segment of the lesson, the teacher may use a relevant scenario or a simple experiment activity to capture students' interest, get them thinking about the subject matter, and stimulate their thinking.
2. Explore — Students are given the opportunity to design and implement their own investigation. Through observations, forming hypotheses, recording data, organizing their findings, creating graphs, and other

forms of communication their results, students then share their findings. Generally, students work in groups. The explore phase is student-centered with the teacher acting as facilitator by providing materials, giving directions, asking questions and encouraging students' discovery.

3. Explain — The teacher introduces facts, models, laws, and theories to the students during this phase. The facilitator teacher guides the discussion as he/she works with the children to organize data, look for patterns, make comparisons, and identify problems. Students are helped with scientific vocabulary and guided in formulating questions to help them explain the results of their exploration.
4. Elaborate — At this point of the model, a transfer of learning from one concept to another should take place with students applying their new knowledge. In other word, this elaborate phase of the learning cycle provides an opportunity for students to apply their knowledge to new domains, which may include asking new questions and making new hypothesis (Eisenkraft, 2003). These applications help extend and expand students' understandings and apply the concept to everyday life experiences.
5. Evaluate — To make sure the students have understood the subject matter, the students and the teacher employed the evaluate phase. Students and teachers conduct assessments that are not only formative but are also summative of students' learning.

Arthur Eisenkraft (2003), project director of the Active Physics program, expanded on the 5E by adding two additional phases. He divided the Engage phase to include an Elicit phase. While it is important to engage students in inquiry, it is also important for the teacher to understand students' prior knowledge. This can be accomplished by asking productive questions that elicit students' understanding about a concept. Eisenkraft also added the Extend phase at the end, which allows students to challenge what they have already learned. Students can then practice the transfer of learning. Eisenkraft explains the second addiction as follows: "The addiction of extend to the elaborate phase is intended to explicitly remind teachers of the importance for students to practice transfer of learning. Teachers need to make sure that knowledge is applied in a new context and is not limited to simple elaboration" (Eisenkraft, 2003, p.59).Adopting a 7E model ensures that eliciting prior understandings and opportunities for transfer of learning are not omitted. The goal of 7E learning model is to

emphasize the increasing importance of eliciting prior understandings and the extending, or transfer, of concepts (Eisenkraft, 2003). Identification of learner misconceptions becomes an important part of the Engage phase of the Learning Cycle. Student investigations designed to assist the learner in restructuring new understanding are the focus of both the Explore and Explain phases of the Learning Cycle. The intent of the Extend and Apply phase is to provide students with opportunities to transfer their reconstructed understanding of concepts to different situations. Emphasis should be on applications to situations and events in everyday living.

Research Method

Participants

This study is geographically restricted to Yangon Region. The required sample schools were selected by using simple random sampling method. One of the Basic Education High Schools was selected from Kyeemyindaing Township which represents inner city area. Another Basic Education High School was selected from Insein Township that represents inner-suburb area in Yangon Region. Grade Eight students were chosen as sample from those high schools for this research study. From each high school, (60) students were randomly selected. Therefore, a total of (120) Grade Eight students were selected as samples for this study. They were divided into two groups and each group consisted of (30) subjects. Moreover, (4) science teachers who are teaching science were also participated in this study. All teachers possess same qualification, services and teaching experiences.

Instruments

The instruments were constructed in accordance with the selected research design. Therefore, learning materials or sample lessons that are based on the instructional design of 7E Learning Cycle Model, and a posttest and its marking scheme were used.

Learning Materials

Science content presented in the course of Grade Eight General Science is composed of six chapters and chapter (5), “Earth and Space” was selected for learning materials of research study. This chapter mainly contains two subheadings such as (1) Environmental Prevention and (2)

Space and Weather. From the first subheading, Water Pollution and Diminution of Sea Creatures were selected to develop into sample lessons for new instructional design. Extended materials were based on Grade Eight Science textbook in consistence with the cognitive development level of the students. These materials were pictures, charts, photographs, newspapers, as well as relevant information that were taken from the science reference books. They were not only text-based materials but also related additional materials.

Procedure

First, an instructional design for 7E learning cycle model was studied. Based on this design, (6) sample lessons were developed. The sample lessons were validated with (3) experts in this field. After completing the required instruments, a pilot study was started with the total of (22) students in BEMS which is situated in Dagon Township, Yangon Region. By the results of the pilot study, both pilot teaching and pilot testing (Cronbach alpha = 0.76), the instruments were ready to conduct an experiment in the selected sample schools. Then, the experimental research was carried out in the selected sample High Schools. From those selected sample schools, Grade Eight students were randomly selected with the help of their headmaster and classroom teachers.

The research used the true experimental design of posttest-only control group design: RXO (Randomization, Treatment, and Test). Based on the true experimental design, Grade Eight students were selected randomly and divided into two equivalent groups. The selected teachers were also assigned to each group randomly. In experimental group, the treatment was received with 7E learning cycle model based sample lesson. The teachers who participated in experimental group have to learn the activities of learning cycle model, prior to beginning the study. The experimental group receives a new treatment and the control group receives formal method of teaching. For each phase of the learning cycle, different activities were developed based on Water Pollution and Diminution of Sea Creatures. Each class was taught five periods per week. A period lasts forty-five minutes. This research study lasts (2) weeks from mid January to end of January. At the end of the research period, a posttest was administered to both groups simultaneously. Posttest answer papers were checked by using making scheme. The results of posttest scores were analyzed by using independent samples *t* test of SPSS 22.0.

Quantitative Research Findings

Table 1. Independent Samples *t* Test Result Showing Posttest Scores

Posttest Scores	**Group**	**Samples**	**Mean**	**Standard Deviation**	**Mean Differences**	***t***	***df* (N-2)**	**Sig. (2-tailed)**	***p***
S	G	N	$\bar{X}$	SD	MD	*t*	*df*	Sig. (2-tailed)	*p*
Total Scores	Experimental	60	35.22	7.98	7.32	5.16	118	.000	***$p<.001$
	Control	60	27.9	7.54					
Knowledge Level Scores	Experimental	60	5.32	1.73	0.57	1.88	118	.062	n.s
	Control	60	4.75	1.56					
Comprehen-sion Level Scores	Experimental	60	15.15	4.09	2.72	3.57	118	.001	**$p < .01$
	Control	60	12.43	4.25					
Application Level Scores	Experimental	60	14.77	3.91	4.05	5.6	118	.000	***$p<.001$
	Control	60	10.72	4.01					

The table shows the result of the independent samples *t* test. This table shows the sample size, the mean scores, standard deviation, mean difference, *t* value, degree of freedom, Sig. (2-tailed) and the *p* value for each group. The mean scores on the overall posttest were (35.22) and (27.9). Then, the mean scores on knowledge level, comprehension level and application level of posttest in those two comparison groups were (5.32) and (4.75), (15.15) and (12.43), as well as (14.77) and (10.72) respectively. This table shows that the groups of experimental students who received a new treatment were found to have more effective achievement in science learning than the groups of controlled students who received usual or traditional treatment.

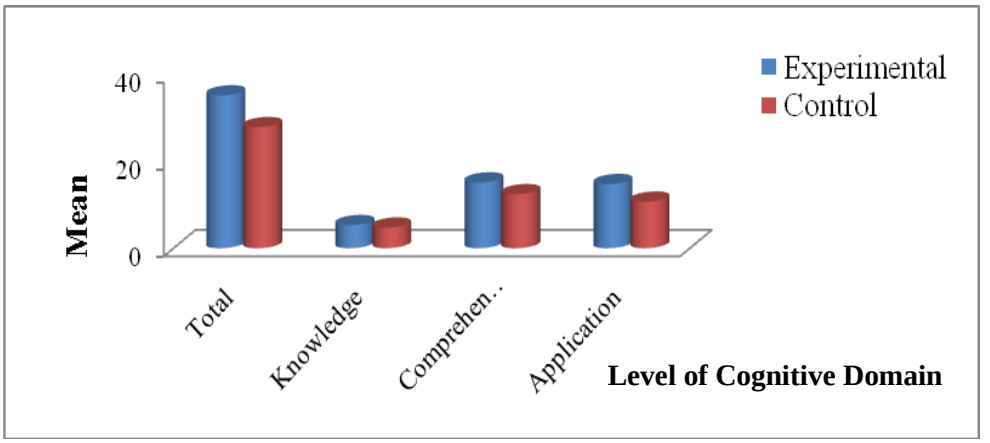

Figure 1. Graphic Illustration for Mean Scores in Posttest

Figure 1 shows graphic illustration in posttest mean scores for all levels of items as well as overall scores. So it can be interpreted that the experimental groups have better achievement on those cognitive tests than the control groups. Therefore, the students of experimental groups gained a significant effect due to the new treatment for two levels; comprehension and application. And there was no significant difference between the experimental group and control group on knowledge level in two selected schools. Therefore, the result of this study supports to the research hypothesis; 'there is a significant difference in achievement between science learning of grade eight students who received learning with 7E learning cycle model and those who received learning with current instruction.' Thus, teaching with learning cycle model is more effective than formal teaching.

Discussion

Statistical results verified that learning cycle model was superior in improving students' science achievement. Another result was observed that the students in experimental group can be more performed in answering the comprehension level and application level questions than those in control group. Due to the positive effect of learning cycle model on improvement of students' science achievement support the idea that students may learn how to think better, and then criticize and reason into subject matter. The 7E learning cycle model in which students free to express their ideas, consider alternative opinions and join discussions, cooperative work with peers and

extend their knowledge about the environment, is one of the good strategies fostering students' scientific literacy. The science teachers became aware of promoting students to think and criticize given them lifelong skills, rather than short-term gains in memorized concepts or information. The 7E learning cycle model involves the following discrete elements: elicit, engage, explore, explain, elaborate, evaluate, and extend. Each phase of the 7E learning cycle model, students were encouraged to think critically and explore about their environment.

The first E of the 7E learning cycle, the Elicit, students were taught about their prior experiences on the subject matter. It is important for the teacher to discover what students already know about the subject so that their misconceptions can be elicited and then corrected. During the Explore phase, students in the experimental group worked in small group and explored the answers about their environmental problems concerned with the content materials in the current study. At the Explain phase of 7E learning cycle, students shared and explained their findings with the teachers and the other group. At the last Extend phase, the students in the experimental group performed in transferring their learned knowledge to new concepts. Another finding was observed that the students were provided opportunity to have the ability to think the learned materials by comparing with their environment, aware their environmental problems clearly, analyzes their environmental conditions, and extend their knowledge about learned materials to make preventions for their environmental pollution. As a conclusion, the 7E learning cycle model used in this study helped teacher to identify the prior knowledge of students about the subject matter and provided opportunities for students to think critically on their ideas. Moreover, the students are no longer passive learners and hopefully retention is increased. The new treatment or 7E learning cycle model provides the context in which students in experimental group are motivated to improve their scientific thinking, monitoring ability, curiosity, problem solving, critical thinking and questioning skills. It will support to become scientifically literate citizens who are valuable younger generation of the country. So, science teaching and learning can have great effects by integrating 7E learning cycle model in science classroom.

Suggestions

The goal of 7E learning cycle model is to emphasize the increasing importance of eliciting prior understandings and the extending, or transfer, of concepts (Eisenkraft, 2003). Thus, learning cycle model should be used when the teacher wants students to construct their own knowledge and to extend this knowledge to other ideas. The teachers should use the learning cycle model to reach higher order skills of Bloom's Taxonomy. On the basis of this study, some suggestions can be provided for future research. The effect of 7E learning cycle model can be studied for different grade levels. The 7E learning cycle model can be implemented for whole semester with several units not only in science lessons but also in other subject areas. This study can be replicated in different school types with a larger sample size to increase generalizability and for different age groups. Further studies can be conducted to assess the effectiveness of this model in various school situations on improvement of students' scientific literacy. Similar research concerning student-centered instructional strategies should be provided to improve teaching competencies in classroom environment.

Conclusion

In the early years of the 21st century, the science education community must respond to several challenges, one of which is helping citizens to develop a greater knowledge and appreciation for resources and environmental issues. Students will function as citizens who must apply their understanding and ability to new and unique situations, including those related to natural resources and the environment. Being scientifically literate about natural resources and the environment is essential to all citizens. In 7E learning cycle model, students free to investigate materials before any new terms are introduced or applied in new contexts. Teacher provides students with a chance to explore on their own and she becomes the facilitator by providing appropriate materials for students to explore. The Extend phase gives students opportunity to see the relationship between what they have just learned how it applies to their own life. The findings of this study showed that instructions which combine inquiry-based learning activities and group work can lead to improvement of students' thinking skills. According to the Piaget's theory of intellectual development, thinking skills develop between the ages 0-16 years (Lawson, 1993, cited in Mecit, 2006). Thus, all levels of education, teaching thinking skills must be at the

center of the teaching-learning process. The instruction should be designed in a way that students are persuaded that the making inferences, criticizing other's perspectives and drawing conclusions are more useful than simply recalling the written knowledge in textbooks. Based on the experience and data from this study, it is suggested that traditional institutions need to implement more supervised teaching using learning cycle models, active learning approaches in classrooms.

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APPENDIX A

Sample Lesson for 7E Learning Cycle Model: Grade Eight, Science

၁။ သင်ခန်းစာခေါင်းစဉ်(၂)	–	အခန်း(၅)ကမ္ဘာမြေကြီးနှင့်အာကာသ
		မြေကမ္ဘာပတ်ဝန်းကျင်ထိန်းသိမ်း
		ကာကွယ်ရေး
	–	**ရေညစ်ညမ်းရသည့်အကြောင်းရင်းများ**
၂။ အချိန်	–	၄၅ မိနစ်
၃။ သင်ယူမှုဦးတည်ချက်များ		
(က) ယေဘယျဦးတည်ချက်	–	ရေညစ်ညမ်းရသည့်အကြောင်းရင်းများကို နားလည်လာစေရန်။
(ခ) အသေးစိတ်ဦးတည်ချက်များ	–	ရေညစ်ညမ်းရသည့်အကြောင်းရင်း များကိုရှင်းပြ တတ်စေရန်။
	–	ရေညစ်ညမ်းမှုကိုဖြစ်စေသော အကြောင်းရင်း များကိုအသေးစိတ် ရေးသားဖော်ပြတတ်စေရန်။
	–	မိမိပတ်ဝန်းကျင်ရှိရေများညစ်ညမ်း နေမှုကိုဆွေးနွေးတင်ပြတတ်စေရန်။
၄။ သင်ကြားမည့်နည်း	–	**7E Learning Cycle Model (Eisenkraft, 2003)**
၅။ သင်ထောက်ကူပစ္စည်းများ	–	စက်မှုလုပ်ငန်းများကြောင့်ရေညစ် ညမ်းနေပုံ ပြကားချပ်
	–	ဓာတုပိုးသတ်ဆေးများကြောင့် ရေညစ်ညမ်း နေပုံပြကားချပ်
	–	စွန့်ပစပစ္စည်းများကြောင့် ရေညစ်ညမ်း နေခြင်း သရုပ်ပြကားချပ်
	–	ရေနံယိုစိမ့်မှုများကြောင့် ရေညစ်ညမ်း လာခြင်း သရုပ်ပြကားချပ်

၆။ သင်ကြားမည့်အစီအစဉ်

7E Learning Cycle Model	ဆရာ့လုပ်ငန်းနှင့်သင်ကြားမည့် အကြောင်းအရာ	ကျောင်းသားလုပ်ငန်း
Elicit (သင်ခန်းစာနှင့် ပတ်သက်သော အခြေခံ အသိသညာ ကို ထုတ်နှုတ်ယူ ခြင်း)	**သင်ကြားခဲ့ပြီးသောသင်ခန်းစာများကို ပြန်လည်ဆွေးနွေးခြင်း** ကမ္ဘာကြီးပူနွေးလာမှု၏ အကျိုးဆက်ဆိုးကျိုးများကိုဖော်ပြပါ။ ရာသီဥတုဖောက်ပြန်ပြောင်းလဲလာမှု ကြောင့်မည်သည်တို့ပိုဖြစ်ပွားလာသနည်း။ အက်စစ်မိုးများရွာသွန်းမှုကြောင့် မည်သည်တို့ညစ်ညမ်းသွားရသနည်း။	**တစ်ဦးချင်းစီ၏ မတူညီသော သိရှိပြီးအကြောင်းအရာများ** ❖ ကမ္ဘာကြီးပူနွေးလာမှုကြောင့် အက်ဆစ်မိုးများရွာသွန်းမှုနှင့်ရာသီဥတုဖောက်ပြန်ပြောင်းလဲမှုတို့ဖြစ်လာသည်။ ❖ ရာသီဥတုဖောက်ပြန်ပြောင်းလဲလာမှုကြောင့်တောမီးလောင်ခြင်း၊ရေကြီးခြင်း၊ မုန်တိုင်းများပိုဖြစ်ပွားလာသည်။ ❖ အက်ဆစ်မိုးများရွာသွန်းမှုကြောင့်ရေချိုသယံဇာတများညစ်ညမ်းသွားရသည်။
Engage (သင်ခန်းစာတွင် စိတ်ပါဝင်စားအောင် လုပ်ဆောင်ခြင်း)	နေရာဒေသအသီးသီးရှိ ရေများနည်းအမျိုးမျိုး ကြောင့်ညစ်ညမ်းလာရပုံများကိုပြသပေးခြင်း 	အဖွဲ့လိုက်လေ့လာကြခြင်းနှင့်ဆရာညွှန်ကြားသည်များကိုမှတ်သားထားခြင်း ရရှိရမည့်ဆွေးနွေးသင်ယူမှုရလဒ်များ ❖ အမှိုက်သရိုက်များနှင့် စွန့်ပစ်ပစ္စည်းများ ❖ စက်မှုလုပ်ငန်းများ ❖ စက်တပ်ယာဉ်များ ❖ ရေကြီးခြင်း ❖ အညစ်အကြေးများ စွန့်ပစ်ခြင်း

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	 မည်သည့်အချက်များကြောင့်ရေထု ညစ်ညမ်း သွားရသည်ကို ဆွေးနွေးရန်အုပ်စုငယ်များဖွဲ့ခြင်း ပုံကိုကိုးကားဖြေဆိုရန်နှင့်စဉ်းစားဖြေဆိုရန် သင့်ပတ်ဝန်းကျင်တွင်ရေများညစ်ညမ်း နေသည်ကိုမြင်တွေ့ဖူးပါသလား။ မည်သည့်အကြောင်းရင်းများ ကြောင့်ရေများညစ်ညမ်းလာရ သနည်း။ဆွေးနွေးတင်ပြပါ။	
Explore (လေ့လာ ဖော်ထုတ် စေခြင်း)	ပေးထားသောပုံများကိုကြည့်၍ရေသ ယံဇာတများ ညစ်ညမ်းလာရသည့်အကြောင်း ရင်းများကိုစာရင်းပြုစုစေခြင်း	အုပ်စုဖွဲ့စာရင်းပြုစုထား သည့်ရေသယံဇာတများ ညစ်ညမ်းလာမှု အကြောင်းရင်းများ ❖ ရေကြီးခြင်း၊ အညစ်အကြေး များနှင့်စွန့်ပစ်ပစ္စည်းများ ❖ စိုက်ပျိုးရေးနှင့်မွေးမြူရေး လုပ်ငန်းများ ❖ စက်မှုလုပ်ငန်းများ ❖ ဓာတုပိုးသတ်ဆေးများ ❖ ရေနံများယိုစိမ့်မှု

7E Learning Cycle Model	ဆရာ့လုပ်ငန်းနှင့်သင်ကြားမည့် အကြောင်းအရာ	ကျောင်းသားလုပ်ငန်း
	 	
Explain (ရှင်းလင်းပြောပြစေခြင်း)	အရေးကြီးသည့်အချက်များကို ထပ်မံရှင်းပြခြင်းနှင့်ဖြည့်စွက်ရှင်းလင်းခြင်း ❖ စက်မှုလုပ်ငန်းများ ❖ စိုက်ပျိုး၊ မွေးမြူရေးလုပ်ငန်းများ ❖ သတ္တုတူးဖော်၊ ကျိုချက်လုပ်ငန်းများ ❖ အညစ်အကြေးနှင့်စွန့်ပစ်ပစ္စည်းများ ❖ စက်တပ်ယာဉ်များ ❖ အက်ဆစ်မိုးများရွာသွန်းမှု ❖ ရေကြီးခြင်းနှင့်သက်ရှိများသေကြေ ပျက်ဆီးပြီးအညစ်အကြေးများထွက်ခြင်း	ရရှိလာသောအချက်များကို တင်ပြဆွေးနွေးခြင်း ဖြည့်စွက်ရှင်းလင်းချက်များကိုရေးမှတ်စေခြင်း
Elaborate (အသေးစိတ်ဆက်	ရေများကိုညစ်ညမ်းစေမှုအများမှအနည်းအတိုင်း စီစဉ်၍အသေးစိတ်ဆက်လက်	အုပ်စုဖွဲ့ဆွေးနွေး၍ရရှိလာသောအကြောင်းရာများက အုပ်စုချင်း ဖလှယ်၍

7E Learning Cycle Model	ဆရာ့လုပ်ငန်းနှင့်သင်ကြားမည့် အကြောင်းအရာ	ကျောင်းသားလုပ်ငန်း
လက်ခဲ့ထွင်ခြင်း)	လေ့လာစေခြင်း ❖ စက်မှုလုပ်ငန်းများ ❖ စိုက်ပျိုး၊ မွေးမြူရေးလုပ်ငန်းများ ❖ သတ္တုတူးဖော်၊ ကျိုချက်လုပ်ငန်းများ ❖ အညစ်အကြေးနှင့်စွန့်ပစ်ပစ္စည်းများ ❖ စက်တပ်ယာဉ်များ ❖ အခြားအကြောင်းရင်းများ	ဆွေးနွေးစေခြင်းအုပ်စုတစ်စုချင်းစီ၏မတူညီသော ဆွေးနွေးချက်အကြောင်းအရာများ ❖ စက်ရုံများမှ အန္တရာယ်ဖြစ်စေသည့် စွန့်ပစ်အရည်များနှင့် ဓာတုပစ္စည်းများစွန့်ပစ်ခြင်း ❖ ဓာတ်မြေဩဇာများနှင့်ဓာတုပိုးသတ်ဆေးများ အသုံးပြုခြင်း ❖ စက်ဆီချောဆီများကြောင့် ညစ်ညမ်းခြင်းစသည်တို့ဖြစ်သည်။
Evaluate (အကဲဖြတ်စစ်ဆေးခြင်း)	အတန်းတွင်းနှုတ်မေးနှုတ်ဖြေပြုလုပ်စစ်ဆေးခြင်း ❖ ရေညစ်ညမ်းစေသည့်အကြောင်းရင်း များကိုဖော်ပြပါ။ ❖ ရေညစ်ညမ်းမှုကိုသဘာဝအလျောက်ဖြစ်စေသော အကြောင်းရင်းများကိုဖော်ပြပါ။ ❖ စက်မှုလုပ်ငန်းများကြောင့်ရေညစ်ညမ်းလာပုံကိုရှင်းပြပါ။ ❖ ဓာတ်မြေဩဇာများနှင့်ဓာတုပိုးသတ်ဆေးများသည် မည်သည်ကိုပါညစ်ညမ်းစေသနည်း။	တစ်ဦးချင်းမေးခွန်းများကိုပြန်လည်ဖြေဆိုခြင်း ❖ စက်မှုလုပ်ငန်းများ၊ စိုက်ပျိုး၊ မွေးမြူရေးလုပ်ငန်းများ၊ သတ္တုတူးဖော်ကျိုချက်လုပ်ငန်းများ၊အညစ်အကြေးနှင့်စွန့်ပစ်ပစ္စည်းများ၊ စက်တပ် ယာဉ်များနှင့်အခြား အကြောင်းရင်းများစသည်တို့ဖြစ်သည်။ ❖ ရေကြီးခြင်းနှင့်သက်ရှိများသေကြေပျက်စီးပြီး အညစ်အကြေးများ ထွက်ခြင်းတို့ဖြစ်သည်။ ❖ စက်ရုံများမှအန္တရာယ်ဖြစ်

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		စေ သည့်စွန့်ပစ် အရည်များနှင့် ဓာတုပစ္စည်းများ စွန့်ပစ်ခြင်းကြောင့် ညစ်ညမ်းရသည်။ ❖ မြေပေါ်ရေသာမက မြေအောက်ရေကိုပါ ညစ်ညမ်းစေသည်။ မရှင်းလင်းသည်များကို ပြန်လည်မေးမြန်းခြင်း
Extend (ချဲ့ထွင်မေးခွန်းများဖြင့် တစ်ဦးချင်းလုပ်ငန်းပေးခြင်း)	အောက်ပါမေးခွန်းများကိုဖြေဆိုပါ။ (နှုတ်ဖြေ+ရေးဖြေ) ၁။ (က) ရေညစ်ညမ်းမှုဖြစ်စေသောအကြောင်းရင်းများမှ(၄)ခုကို ဖော်ပြပါ။ (ခ) သတ္တုတူးဖော်မှုလုပ်ငန်းများကြောင့်ရေညစ်ညမ်းရခြင်း ကိုရှင်းပြဖြေဆိုပါ။ (ဂ) သင့်ပတ်ဝန်းကျင်ရှိရေများညစ်ညမ်းနေသည်ကိုမြင်တွေ့ဖူး ပါသလား။ မည်သည့်အကြောင်းရင်းများကြောင့် ရေများ ညစ်ညမ်းနေရသည်ကိုဖော်ပြပါ။ ၂။ (က) ရေညစ်ညမ်းမှုကိုဖြစ်စေသော အကြောင်းရင်းများကို စာရင်းပြုစု၍ ဖော်ပြပါ။ (ခ) ရေများကိုညစ်ညမ်းစေမှုအများမှ အနည်းအတိုင်း စီစဉ် ဖော်ပြ၍နှစ်သက်ရာ (၃)ခုကိုအသေးစိတ်ရှင်းပြပါ။ (ဂ) သင်၏ ပတ်ဝန်းကျင်တွင် တွေ့မြင်ရသောရေညစ်ညမ်း ရသည့်အကြောင်းရင်းများကို ရေးသားဆွေးနွေးပါ။	