A STUDY OF THE EFFECTIVENESS OF CONCEPT MAPPING IN TEACHING SCIENCE AT THE MIDDLE SCHOOL LEVEL

Ngu Wah Soe[1] and Swe Swe Nyunt[2]

Abstract

The main purpose of this research is to study the effectiveness of concept mapping in teaching science at the middle school level. A concept map is a schematic device for representing a set of interrelated, interconnected conceptual meanings. There are three essential steps to create concept maps: (a) a list of concepts, (b) lines that represent the relational links between these concepts, and (c) labels for these linking relationships. In this study, Ausubel's model of meaningful learning was applied to develop the lesson plans including concept maps that implement into experimental study. According to the format of that design, (7) sample lessons of learning materials were constructed. The target population is Grade Seven students from Basic Education High School, Dagon Township and Basic Education High School, Mingaladon Township. Simple random sampling method was used. Therefore, (120) students and (4) science teachers participated in it. The instruments in this study were a pretest and a posttest. Learning materials were selected from Chapter (5), The Earth and Space, from Grade Seven science textbook. To study the effectiveness of concept mapping in teaching science, one of the true experimental designs, pretest-posttest control group design was used. The data were analyzed. 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 the science achievement of Grade Seven students who receive instruction with concept mapping and those who do not. The results also indicated that when students are exposed to concept mapping, they achieved significantly better in performing knowledge, comprehension and application level science questions than other students. It verifies that concept mapping in science teaching brings positive effects on students' science learning at the middle school level. Hence, concept mapping can be integrated in science teaching and learning in the classroom.

Keywords: concept map, science.

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Introduction

Education plays an essential role in everyone's life for bright future. Today, all countries aim to reach modernized education system. Science education is one of the pioneers in order to fulfill this aim. 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 (Collette & Chiappetta, 1989). The reasons behind the daily functioning can be explained through science. Science looks for different kinds of relationships such as relationships between different things, relationships between the properties possessed by several things, relationships between the parts of things, etc. Science teachers are responsible to help students in developing an adequate understanding of science concepts. One of the most important theories is Ausubel's theory of meaningful learning. According to this theory, meaningful learning occurs when complex ideas and information are combined with students' own experiences and prior knowledge to form personal and unique understandings. In this process, it can be said that concept maps are one of the most important teaching and learning tools that promote meaningful learning. Concept maps can represent the links of phenomena or ideas about any topics or any lessons of a subject. Negative attitudes towards the study of science are also increased. Besides, an overall lack of critical thinking skills is becoming more evident. In addition to this lack of critical thinking skills, many students are not interested in science because they believe it is boring. In an attempt to fill this gap, this research aims to study the effectiveness of incorporating concept mapping in teaching science at the middle school level.

Purposes of the Study

The purposes of this study are as follows:

1. To study the effectiveness of concept mapping in teaching science at the middle school level,
2. To compare the students' science achievement between students who receive instruction with concept mapping and those who do not, and
3. To give suggestions based on the findings from the study to improve science learning.

Research Hypotheses

1. There is a significant difference in the science achievement of Grade Seven students who receive instruction with concept mapping and those who do not.
2. There is a significant difference in the science achievement of Grade Seven students at knowledge, comprehension and application levels who receive instruction with concept mapping and those who do not.

Definitions of Key Terms

Concept Map: A concept map is a schematic device for representing a set of interrelated, interconnected conceptual meanings (Ebenezer & Connor, 1998).

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).

Review of Related Literature

In the modern world, knowledge of science becomes essential for everyone. Science provides a laboratory of common experience for development of language, logic, and problem-solving skills in the classroom. Science can be described as a particular way of thinking, developing thinking with a particular lens, and a particular way of knowing. Science is both a body of knowledge that represents current understanding of natural systems and the process whereby that body of knowledge has been established and is being continually extended, refined, and revised. One cannot make progress in science without an understanding of both. Likewise, in learning science one must come to understand both the knowledge and the process by which this knowledge is established, extended, refined, and revised. The body of knowledge includes specific facts integrated and articulated into highly developed and well-tested theories.

Learning science involves a number of distinct components that are acquiring science concepts, developing science skills and processes and appreciating the nature of science and the role of science in society. There are different perspectives on the process of science which are not mutually exclusive in considering how best to teach science. Each perspective can identify certain elements that need to be given their due attention. One of the key elements of a number of these viewpoints on science that can be summarized is as a process of logical reasoning about evidence. Science teaching directly inculcates such scientific perspectives among the students. Teaching is the process by which a person helps others to achieve knowledge, understanding, skills, and attitudes. With the help of the models of teaching, teachers can increase the capacity to reach more students, and create richer and more diverse environment for them. A teaching model is a good tool of teaching in which components are interrelated and arranged in a sequence. Ausubel's Model of Meaningful Learning will be used in planning the lesson for the study. Ausubel's theory consists of three phases of activity. Phase one is the presentation of the advance organizer, phase two is the presentation of the learning task or learning material, and phase three is the strengthening of cognitive organization. Phase three tests the relationship of the learning material to existing ideas to bring about an active learning process.

The teaching of science involves not only the teaching of concepts but also the teaching of the ways in which concepts are related. For teaching and learning to be successful, students are expected to acquire not only new knowledge in sufficient depth, but also to retain this knowledge for a long period of time after instruction. This situation can be best facilitated by concept maps. Novak and Gowin (1984) have developed a theory of instruction that is based on Ausubel's meaningful learning principles that incorporates "concept maps". Ebenezer and Conner (1998) stated that a concept map is a schematic device for representing a set of interrelated, interconnected conceptual meaning. In other words, it is a semantic net-work showing the relationships among concepts in a hierarchical fashion. Concept maps are intended to represent meaningful relationships between concepts in the form of propositions. Propositions are two or more concept labels linked by words in a semantic unit. In its simplest form, a concept map would be just two concepts connected by a linking word to form a proposition. Ebenezer and Connor (1998) produced a list to construct a concept map.

1. Choose a passage from a science textbook.
2. Circle or underline the main concepts in this passage.
3. List all the concepts on paper.
4. Write or print the concepts on small cards or stickers so that the concepts can be moved around. If teachers prefer to use a computer-based semantic network, use Sem Net, Learning Tool, Text Vision, CMap, or Inspiration software (Jonassen, 1996).
5. Place the most general or all inclusive concepts on the top of the paper.
6. Arrange the concepts from top to bottom (from most general at the top to most specific at the bottom) so that a hierarchy is indicated. In constructing this hierarchy, place concepts next to each other horizontally if they are considered to have equal importance or value.
7. Relate concepts by positioning linking verbs and connecting words on directional arrows. Support the concepts with examples.
8. Have members of a cooperative group critically analyze the concept map to improve on and further extend your ideas.

Concept maps can be constructed in the classroom using three different approaches by using concept words supplied by the teacher, identifying the concepts from an information source, and from their own personal knowledge. According to the University of Illinois, US (2002), there are four major categories of concept maps. These are distinguished by their different format for representing information.

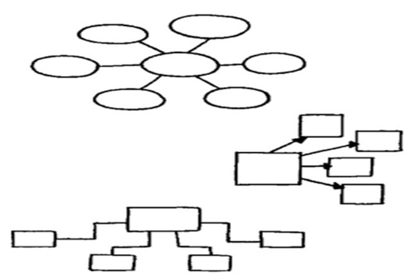

Figure 1: Spider Concept Map

The "spider" concept map is organized by placing the central theme or unifying factor inthe center of the map. It looks a bit like a spider's web, as its name suggests.

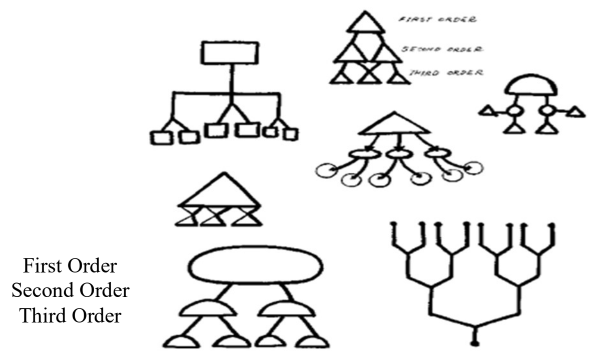

Figure 2: Hierarchy Concept Map

The hierarchy concept map presents information in a descending order of importance. The most important information is placed on the top. Distinguishing factors determine the placement of the information.

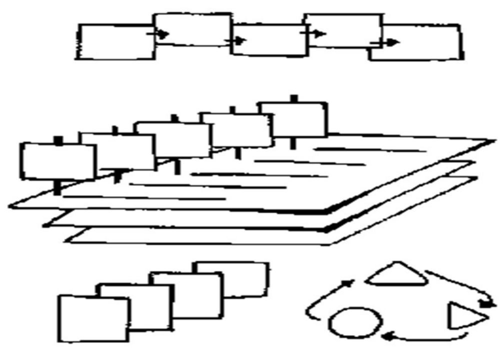

Figure 3: Flowchart Concept Map

The flowchart concept map organizes information in a linear format.

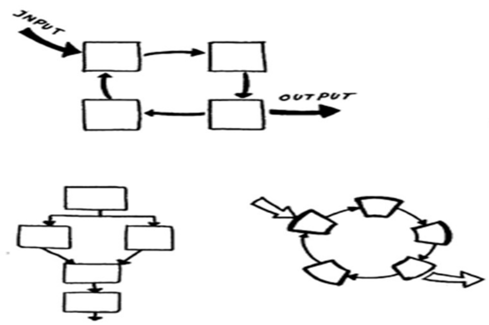

Figure 4: Systems Concept Map

The systems concept map organizes information in a format which is similar to a flowchart with the addition of 'INPUTS' and 'OUTPUTS'. It uses critical thinking skills along with problem solving skills.

Special Concept Maps include the following format types.

(a)

(b)

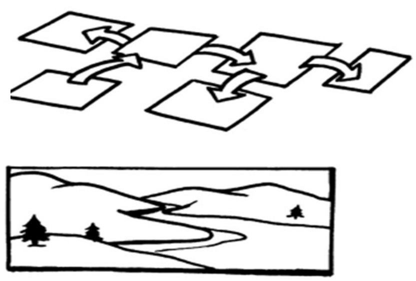

Figure 5: Picture Landscape Concept Map

These maps present information in a landscape format.

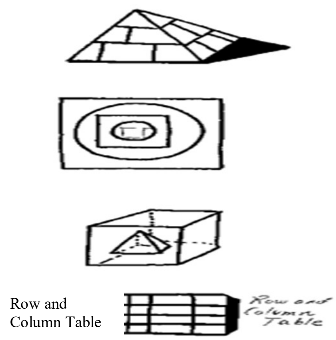

Figure 6: Multidimensional / 3-D Concept Map

These describe the flow or state of information or resources which are too complicated fora simple two-dimensional map.

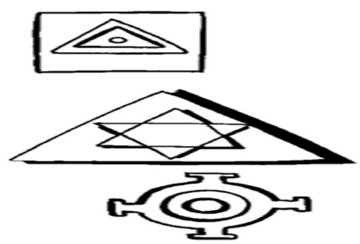

Figure (7) Mandala / Mandala Concept Map

(Source: University of Illinois at Urbana-Champaign. College of Agricultural, Consumer and Environmental Sciences, 2002)

Research Method

Participants

All participants in this study were Grade Seven students. This study was conducted in Yangon Region. Two districts, west and north districts, in this region were selected in random. After that, one high school from each district was selected and there were two sample schools. The participants in this study were selected by random sampling method and they were randomly assigned to experimental and control groups. A total of (120) Grade Seven students and (4) science teachers participated in it.

Instrument

The instruments were constructed in accordance with the selected research design to conduct this experimental research. Therefore, a pretest was used based on Chapter (2, 3 & 4) and a posttest was constructed based on Chapter (5) from Grade Seven general science textbook prescribed by the basic education curriculum, syllabus and textbook committee. The items used for the pretest were composed of (5) true/false items, (5) completion items, (5) multiple choice items, (5) short question items, and (5) long question items. Test items were based on Chapters from (2) to (4) of Grade Seven general science textbook and the allocated time for this test was (45) minutes. The total marks for this test were (50). The format of lesson plan was based on Ausubel's model of meaningful learning. It includes three phases. They are presentation of the advance organizer, presentation of learning task or learning material, and strengthening of cognitive organization. The activities involved are designed to increase the clarity and stability of the new learning material. The learning materials are the lessons from Chapter (5) "The Earth and Space". It was subdivided into (7) learning periods. A posttest involved five sections which are (5) true/false items, (5) completion items, (5) multiple choice items, (5) short question items, and (5) long question items. Test items were based on the content areas in Chapter (5) of Grade Seven general science textbook.

Procedure

In order to study the effectiveness of concept mapping in science learning, one of the true experimental designs, such as the pretest-posttest control group design was used in this study. Validity for the instruments was determined by the teachers who studied those specializations for more than fifteen years. After getting the validity of these instruments, a pilot study was conducted in December, 2016 to determine whether the instruments are applicable or not. Validity tells about the appropriateness of a test whereas reliability tells about the consistency of the scores produced. Based on the pilot study results, the reliability for each instrument was calculated by Cronbach's alpha (α) value, which determines how all items on a test relate to all other test items and to the total test, above (0.7). Therefore, these instruments were applicable for this study. After the pilot study, the experiment was launched in January 2017.The duration of this research lasts about three weeks. At the end of the study, a posttest was conducted simultaneously. The posttest scores were analyzed using independent samples *t* test of Statistical Package for the Social Sciences (SPSS). The data were analyzed by using a descriptive statistics (mean, standard deviation, percentage) and independent samples *t* test. The independent samples *t* test was used to compare the achievement of students who are taught through the use of concept mapping and that of students who are taught without concept mapping at knowledge, comprehension and application levels.

Quantitative Research Findings

The results of both groups for posttest are presented as follows.

Table 1: Independent Samples *t* Test Result for Posttest Scores

Posttest Scores	Group	N	M	SD	MD	t	df	Sig. (2-tailed)	p
Total Scores	Experimental	60	35.27	6.94	7.05	6.44	118	.000***	***p < .001
	Control	60	28.22	4.87					
Knowledge Level Scores	Experimental	60	11.98	1.69	0.78	2.84	118	.005**	**p < .01
	Control	60	11.20	1.30					
Comprehen-sion Level Scores	Experimental	60	9.92	2.18	1.75	4.90	118	.000***	***p < .001
	Control	60	8.17	1.70					
Application Level Scores	Experimental	60	13.37	4.23	4.52	6.78	118	.000***	***p< .001
	Control	60	8.85	2.96					

This table shows that the groups of experimental students who received a new treatment were found to have higher achievement in science learning than the groups of controlled students who did not.

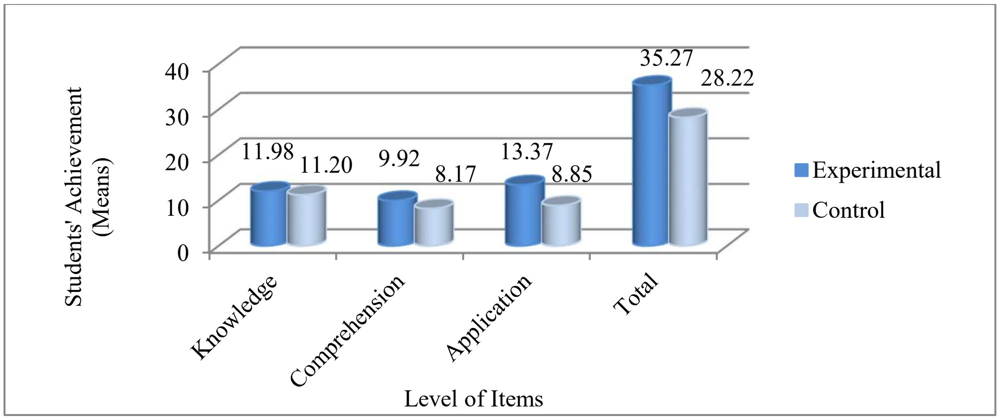

Figure 8: Graphic Illustration for Means in Posttest

This figure shows the posttest scores for all the levels of items as well as overall scores. Based on the data obtained, it can be interpreted that the experimental groups have higher achievement on the cognitive tests than the control groups. Therefore, the students of the experimental groups gained a significant effect on three levels; knowledge, comprehension and application. As such, it can be said that the experimental treatment or concept mapping has a significant positive effect on Grade Seven students' science learning. In addition to the information on statistical significance, it is important to know the size of the effect. The effect size is a numerical way of expressing the strength, or magnitude, of a reported relationship, be it causal or not. In this study, the effect size is calculated by the formula of Cohen's d $=\frac{\bar{X}e-\bar{X}c}{SDe+SDc/2}$(Gay and Airasian, 2003). By substituting the respective values, the effect size was (1.19). A numerical value of (1.19) indicates that the treatment had a strong treatment effect. Moreover, a positive effect size points that the students who received concept mapping performed better than the students who did not. That is why learning through the linkage of science concepts can enhance students' achievement to some extent.

Conclusion

Discussion

This research was to study the effectiveness of concept mapping in teaching science at the middle school level. The research findings showed that concept mapping is effective in improving students' science achievement. The major reason of this result is that concept mapping helps students to build and organize knowledge on a given topic. To be able to construct science concept maps, a teacher must find out the linkage or relationship of learned concepts into major concept. Therefore, the teacher needs to possess insight. It was found that students were happy and alive while concept mapping because it provides opportunities for active involvement of students in their learning process and hence, also improve their thinking ability.

When comparing posttest scores on knowledge level, it was found that there was a significant difference between the experimental and control groups in both sample schools. According to this result, it can be interpreted that it seems easier to retain memory to produce meaningful learning, when information is presented in vision formats while learning science concepts.

When considering students' comprehension about science concepts in the posttest items, students who did not learn through concept map could not capture the science concepts that water pollution was due to wastes and vehicles, warm air is lighter than cool air and types of clouds. One possible reason could be that they memorize those facts without having meaningful learning.

In determining students' applicability of science concepts, a few of controlled students cannot suggest the actions that are needed to prevent the loss of marine animals. They cannot even describe correctly the causes of water pollution by the actions of humans in a sequence. The reason for this is that they have been accustomed to memorizing and regurgitating information and facts. It is obvious that most students learn aspects of learning materials as isolated elements of knowledge instead of well-structured and integrated domain-specific structures. This lack of integration is suspected to be at the root of students' difficulties concerning concept learning and application of those concepts. Formation of concepts and use of them are of critical importance for the students to be successful in learning science.

Studies conducted by Asan (2007) with fifth-grade students also found that concept mapping was an effective strategy for raising students' science achievement. The results of the current study support this previous research and suggest that concept mapping can help to improve students' science achievement at the middle school settings in Myanmar.

Concept mapping improves academic performance of students due to their active involvement in learning, discussion, sharing of concepts and removal of misconceptions. According to Ausubel, meaningful learning is promoted by the understanding of hierarchical relationship and linkages between concepts. This is the main goal of concept mapping strategy, in which students are taught to identify the network of relationships between concepts rather than recitation. This can be seen obviously in this study. To sum up, the results of this study have shown the effectiveness of concept mapping in order to lead the teachers to adopt concept maps in teaching of general science.

Suggestions

Based on the research findings, concept mapping should be integrated in teaching and learning general science and it is recommended that concept mapping is beneficial in enhancing the achievement of Grade Seven students. Although it is easy to use for teaching and learning, it should be cautioned that students sometimes face the problems when developing concept maps for the first time. Therefore, before the students practice in constructing concept maps, science teachers should lead and introduce concept maps until they are familiar with the nature of concept. Meanwhile, pictures accompanying with words should be used instead of words only. It is also interesting to note that the concept mapping had an advantage when picture cards are used. Students should be taught how to construct concept maps on their own for various topics in general science because this improves the cognitive structures of the students.

It is urged to include concept maps and concept mapping activities in the general science textbooks at the middle school level in order to enhance students' comprehension and linkage of concepts. Concept maps should be used when the subject matter of a unit is hierarchical and basically conceptual. Moreover, it should be prepared for the teachers to incorporate the concept maps in teaching general science with respect to its philosophical background, theoretical basis and practical usage. It is suggested that sufficient time must be provided to construct the concept maps for the students. Since it is very time consuming to develop a concept map, teachers should practice with caution in incorporating concept mapping in instruction. It is appropriate to use one unit at a time to reduce the cognitive load and demands of the concept mapping technique.

A qualitative or quantitative research is recommended for the exploration of those variables that affect learning patterns of male and female students. As described in related literature, there are several kinds of concept maps. Each of these patterns facilitates to retain science concepts in memory. For the lessons like the formation of clouds, it was found that picture landscape concept maps were effective in promoting students' understanding in general science subject. Therefore, picture landscape concept maps should be used in such lessons.

Although developing Novak's style concept maps in Myanmar was difficult, it was found that it can enhance students' performance in general science subject at the middle school level. Since the science subjects that are taught in high school level are in English, it is suggested that other research studies should be conducted widely in the subjects such as physics, chemistry, biology, and so on. Lastly, technology is becoming increasingly important at present. Moreover, with the increase of technology, there has been a heightened interest on the effect of computer-based/multimedia learning in science. Therefore, other possible further studies would be to integrate computer-generated graphic organizers using inspiration software so that they could benefit from the incorporation of multimedia learning. However, it should be aware of the fact that this inspiration software can be used only in English language. Hence, this possible study should be conducted for science subjects that are taught in English.

Conclusion

Since a key principle of educating is to begin with what the students already know, finding this out is a very important initial step in any educational endeavor to satisfy the needs of students of the twenty-first century. It is imperative for students to be able to identify relationships between concepts and understand their connections in science learning. Concept mapping is a unique way of representing information. There are three essential steps to create concept maps that include (a) a list of concepts, (b) lines that represent the relational links between these concepts, and (c) labels for these linking relationships. So, the procedure for concept mapping starts with the generation of a list of concepts through brainstorming usually by focusing on interesting issues or lessons or questions. In this study, eleven science concept maps were used at each phase of Ausubel's model of meaningful learning. According to the results of this study, teachers should apply concept mapping in combination with this model in teaching and learning of general science in the middle school settings. In educational settings, concept mapping have been used to aid people of every age.

Concept maps encourage student-teacher interaction when creating it together as teacher-guided group activity. Additionally, after learning this technique, students get used to establish links between concepts rather than recalling concept separately. It can be used effectively for the revision of a topic. It develops the confidence level of the students. One of the benefits of using concept map is that it can provide the clarity of the concepts. It is a good way to work and prepare for the tests since it gives a big picture of the science concepts. It should be acknowledged that the use of concept mapping is an important skill for students to truly grasp scientific concepts and understand science phenomena. Concept mapping can help students sustain their relational knowledge, and guide how to learn science effectively. To sum up, the results of this study support the research hypothesis, "there is a significant difference in the science achievement of Grade Seven students who receive instruction with concept mapping and those who do not". Consequently, the use of concept mapping while learning science can accomplish the objectives of teaching general science. Hence, concept mapping is an effective tool that helps teachers to teach and students to learn more meaningfully in both teaching and learning general science at the middle school level in our country.

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Sample Lesson Plan for Grade Seven Science through the Use of Concept Mapping

1/ oifcef;pmacgif;pOf / tcef;(5) urÇmajrBuD;ESifhtmumo

ajrurÇmywf0ef;usifxdef;odrf; umuG,fa&;

/ **tmumoESifhrdk;av0o**

2/ tcsdef / 45 rdepf

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4/ oifMum;^oif,lrIjzpfpOf / Learning through the Use of Concept Mapping

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(4) wdrftaMumif; todonmuGif;qufyHk

6/ oifMum;rnfhtpDtpOf

oifMum;rIy HkpH	**q&mhvkyfief;pOf**	**ausmif;om;rsm; vkyfief;pOf**
Introduction (Revision the Previous Knowledge) **oifMum;NyD;aom**	**oifMum;cJhNyD;aom yifv,faeowå0grsm; avsmhenf; qHk;yg;vmrIh taMumif;rsm; udkjyefvnfaqG;aEG;jcif;**	**ajzqdkcsufrsm;** ❖ ESpfpOfzrf; ,lEdkifaomig;ta&twGufcGJwrf;rsm;

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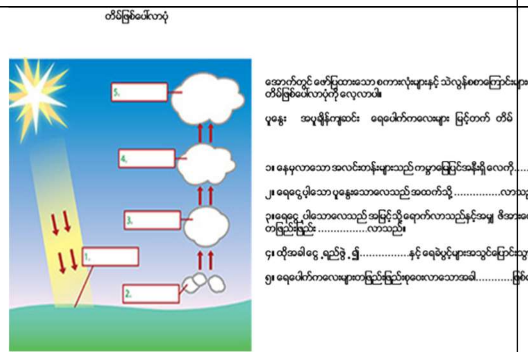
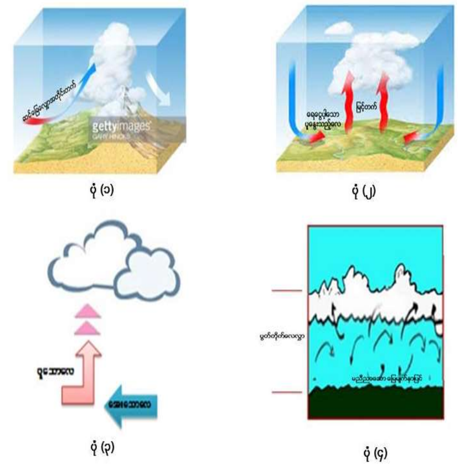
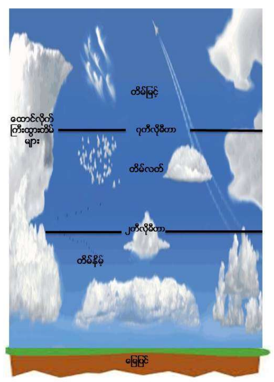
Phase Two Presentation of Learning Task or Material **oif,l&rnfh vkyfief; odkUr[kwf**	**ay;xm;aomtodonmuGif;qufyHkudkavhvmapjcif;/**	**&&dSrnfhaqG;aEG;oif,lrI&v'frsm;udkwifjyjcif;/** (1) ylaEG;

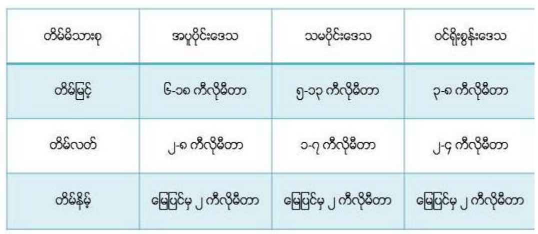
oifMum;rIy HkpH	q&mhvkyfief;pOf	ausmif;om;rsm; vkyfief;pOf
taMumif;t&m rsm;udkazm fjyjcif;	 **yHk (1) wdrfjzpfay:vmyHk todonmuGif;qufyHk(Concept Map - 1)** **ESpfa,mufwpfzGJUpDzGJUíaqG;aEG;avhvmapjcif;** ❖ wdrftrsKd;rsKd;wdkU\yHkrsm;? wdrftrsKd;rsKd;wdkU\trnfrsm;ESifht"dyÜm,frsm;ygaomuwfrsm;udkay;xm;í ,SOfwGJapjcif;? &&dSvmrnfh&v'frsm;udk aqG;aEG; wifjyapjcif;/	(2) jrifhwuf (3) tylcsdefusqif; (4) a&aygufuav;rsm; (5) wdrf **&&dSrnfhaqG;aEG;oif,lrI&v'frsm;udkwifjyjcif;/** (1) awmifwufwdrf (2) tylysHwufwdrf (3) ava0SUwdrf (4) avpdkifqHkwdrf

oifMum;rIy HkpH	**q&mhvkyfief;pOf**	**ausmif;om;rsm; vkyfief;pOf**
	 **(1)awmifwufwdrf-** a&aiGUygaom wdrfpdkifwpfck onfawmifukef;jrifhudk jzwfausmfwdkufcwfonfhtcg awmifukef;jrifh\qifajcavQmtwdkif; wufoGm;NyD; jzpfay:vmaom wdrfrsKd;udk awmifwufwdrf [kac: onf/ **(2)tylysHwufwdrf-** a&aiGUygaom ylaEG;onfh av onf tjrifhodkUwufoGm;NyD; a&aiGUrsm; t&nfzGJU ojzifh jzpfay:vmaom wdrfrsKd;udk tylysHwuf wdrf[k ac:onf/ **(3)ava0SUwdrf–** rnDnmaom ajrrsufESmjyifay:odkY avjyif;rsm; wdkufcwfaomtcg ava0SUavayGrsm;	

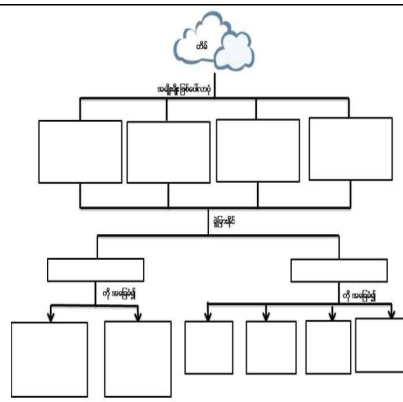
oifMum;rIy HkpH	**q&mhvkyfief;pOf**	**ausmif;om;rsm; vkyfief;pOf**
	jzpfay:vmNyD; yGwfwdkufavvTm twGif;&dSavwdkY onfa&maESmoGm;onf/ xdktcg ,if;avvTm\ atmufydkif;onfydkíylaEG;v mNyD; tay:ydkif;onf ydkíat;vmonf/ ydkíat;aom avtay:ydkif;rS a&rsm;aiGU&nfzGJUNyD;jzpf ay:vmaomwdrfrsKd;udk ava0SY wdrf[kac:onf/ **(4)avpdkifqHkwdrf-** xkxnftm;jzifh BuD;rm;aom avpdkifrsm;onf tvsm;vdkufa&GUvsm;NyD; ,if;wdkY rsufESmcsif;qdkif awGUqHk&mwGifavrsm; wjznf;jznf; txufodkUwufonf/ rsKd;rwlaom avpdkifESpfck awGUqHk&mwGifydkí aEG;NyD;ayghyg;aom avonf at;í odyfonf;aom avtxufodkY wGef;ydkUjcif;cH &onf/ xdktcg ylaEG;ayghyg;aom avonf wjznf;jznf; tjrifhodkY a&mufoGm;aomtcg tylcsdefusqif; vmNyD; a&aiGUrsm;	**&&dSrnfhaqG;aEG;oif,lrI&v'frsm;udkwifjyjcif;/** • a,bl,syHko@mefESifhtjrifh (5)vTmxyfwdrfrsm; (6)tpktyHkvdkufwdrfrsm; • ajrjyifrStjrifhtvdkuf (7)wdrfedrfh? wdrfvwf? wdrfjrifh? axmifvdkuf BuD;xGm;wdrfrsm;

oifMum;rIy HkpH	**q&mhvkyfief;pOf**	**ausmif;om;rsm; vkyfief;pOf**
	aiGU&nfzGJUojzifh jzpfay: vmaom wdrfrsKd;udkavpdkifqHkwdrf[k ac:onf/ **wdrfrsm;cGJjcm;yHkudkqufvufavhvmapjcif;** ❖ wdrfrsm;\ yHkrsm;?cGJjcm;onfhtcsufrsm;? trnfrsm; ESifh t"dyÜm,frsm;ygaom uwfrsm;udkay;xm;í ,SOfwGJ apjcif;? &&dSvmrnfh&v'frsm;udk aqG;aEG; wifjyapjcif;/  ပုံ (၅)  ပုံ (၆)  ပုံ (၇) **(5)vTmxyfwdrfrsm;-**wdrf\ atmufajctvsm;onf wddrftjrifh xufBuD;onf/ **(6)tpktyHktvdkufwdrfrsm;-** wdrf\ atmufajc tvsm;onf wdrftjrifhavmufrBuD;ay/ **(7)wdrfedrfh? wdrfvwf? wdrfjrifh?**	**jznfhpGufaqG;aEG;csufrsm;udkrSwfom;apjcif;** (u)

oifMum;rIy HkpH	q&mhvkyfief;pOf	ausmif;om;rsm; vkyfief;pOf
	axmifvdkufBuD;xGm;wdrfrsm;cGJjcm;onfhtcsufrsm; • **a,bl,syHko@mefESifhtjrifh** • **ajrjyifrStjrifhtvdkuf vdktyfonfhtcsufrsm;udkjznfhpGufay;jcif;/** (u) wdrfjrifh? wdrfvwf? wdrfedrfhwdkU\ ysrf;rQ atmufajcESifh tjrifhrsm;udka'otvdkufazmfjyjcif;/	
Phase Three Strengthening Cognitive Organization **oif,lxm;aomtaMumif;t&mtopfrsm;udk pkpnf;azmfjyjcif;**	**avhvmoif,lNyD;aomtaMumif;t&mrsm;udktoHk;jyKí ay;xm;aomyHkwGifjznfhapjcif;/**	**ESpfa,mufwpfzGJUpD pOf;pm;íajzqdkjcif;**



တိမ်မိသားစု	အပူပိုင်းဒေသ	သမပိုင်းဒေသ	ဝင်ရိုးစွန်းဒေသ
တိမ်မြင့်	၆-၁၈ ကီလိုမီတာ	၅-၁၃ ကီလိုမီတာ	၃-၈ ကီလိုမီတာ
တိမ်လတ်	၂-၈ ကီလိုမီတာ	၁-၇ ကီလိုမီတာ	၂-၄ ကီလိုမီတာ
တိမ်နိမ့်	မြေပြင်မှ ၂ ကီလိုမီတာ	မြေပြင်မှ ၂ ကီလိုမီတာ	မြေပြင်မှ ၂ ကီလိုမီတာ

oifMum;rIy HkpH	**q&mhvkyfief;pOf**	**ausmif;om;rsm; vkyfief;pOf**
	 **yHk(2)wdrftaMumif;todonm uGif;qufyHk(Concept Map- 2)**	
Evaluation **tuJjzwf ppfaq;jcif;**	**EIwfar;EIwfajzjyKvkyfppfaq;jcif;** ❖ wdrfjzpfay:vmyHkudk azmfjyyg/ ❖ wdrfrsm;udk ajrjyifrStjrifh tvdkuftkyfpkrnf rQcGJ jcm;xm;oenf;/ ❖ tylysHwuf wdrfqdkonfrSm tb,fenf;/	**wpfOD;csif;ar;cGef;rsm;ud kjyefvnfajzq dkjcif;** ❖ a&aiGUygaom avonf txufodk Yjrifhwufvm aomtcg zdtm;avsmh oGm;ojzifh xkxnf us,fjyefYvmN yD; tylcsdef usqif; oGm;aomtcg aiGU&nfzGJUí a&ayguf uav;rsm;ESif h a&cJ yGifh rsm; toGifajymif;

oifMum;rIy HkpH	**q&mhvkyfief;pOf**	**ausmif;om;rsm; vkyfief;pOf**
		oGm; NyD;wdrfjzpf ay: vmjcif;/ ❖ av;rsKd;cGJj ;xm;jcif;/ ❖ a&aiGUygaom ylaEG;onf avonftjrifh odkUwuf NyD; a&aiGUrsm;t &nf zGJUNyD;jzp f ay:vmaom wdrfudk tylysHwufwd rf [k ac:onf/
Conclusion **ed*Hk;csKy fqdkjcif;**	**oif,lNyD;aomtaMumif;t&mrsm;udktusOf; csKyfjyefvnfajymjyjcif;/** ❖ wdrftrsKd;rsKd;jzpfay:vmyHkudk todonmuGif;quf yHkjzifh jyefvnfajymjyjcif;/ ❖ wdrftrsKd;tpm;rsm;udk a,bk,syHko@mefESifhtjrifh tay:tajccHívnf;aumif;? ajrjyifrStjrifhtvdkuf vnf;aumif; cGJjcm;EdkifaMumif; tusOf;csKyf ajymjy jcif;/	**tajzrsm;** wdrftrsKd;tpm;rsm; ❖ awmifwufwdrf ❖ tylysHwufwdrf ❖ ava0SUwdrf ❖ avpdkifqHkwdrf