Doctoral Thesis

Analysis and Support of EFL Reading Comprehension with Kit-build Concept Map

(キットビルド概念マップによる外国語としての英語の読解の分析と支援)

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ABSTRACT

Reading comprehension in English as Foreign Language is a complex task, requiring a number of different cognitive skills and processes that enable the reader to understand the meaning of the text. Students with difficulties in reading comprehension demonstrate impairments on a number of language tasks. For some learners of EFL, reading comprehension in English can be difficult because they can understand each word individually, but when the words are merged into coherent phrases, they still fail to understand the context as it should. Reading a reading material for EFL readers requires more effort because they are more attached to texts or more frequently required to read the same texts than native readers. Several researchers have tried to build a Learning System to simplify this problem. The effectiveness of the Learning System has been investigated for a variety range of learners.

There are three categories of cognitive processes that affecting the output of learning from text. The first category and the most important is the *selection process* where it involves applying the selective attention to relevant information. The second category is the *internal connection* process where it involves organizing the presented/ selected information from the text. The last category is the *external connection* process which require to relating the presented/ selected information to the prior knowledge that is stored in the memory.

Concept maps are interactive instruments used for information organization and representation. The Concept map has two principal sections. The first component is the concepts that have formed like a circle or boxes of some kind, and the other parts are the connecting line that consists of terms that connect two concepts together. Concept map can fully facilitate the cognitive processes in Reading, but

there is the potential for a failure in the processes when they failed to select the selective information exposed to them and the other cognitive process will also be failed since the selective process is the main key.

To solve the problem, we are using a closed-end version of the concept maps called Kit-build concept map (KB-map). This means that the student cannot build their concept and link, because the system provides it from the dissembled expert map. This approach will avoiding the failure in reading since the selective process is being done by the expert/ teacher. Learners can focus to the text recognition and the structure of the text. As it has the same aspect as the expert map, the closed-end approach can also be easily taken into the automated diagnosis of the learners ' built map. Hence, it will be feasible to find a difference between them from the diagnosis result form.

Previous researchers found that, Concept map learners are more bound to the appearance order of the text while KB-Map learners are not. It still remains unclear what kind of style did the KB-map user use. There are possibilities of ways to construct KB-maps; randomly or based on a certain pattern. The first goal of this research is to confirm the reading style differences between concept map and KB map user. The second aim of this study is improving the learning support on KB-map by adding a new function called source-connection. The aim of this function is to encourage learners to confirm their understanding with the reading material in the form of the map of learners. It helps learners to validate each proposition by establishing a relation between a proposal and a sentence of the reading material.

This thesis consists of five chapters. In **Chapter 1**, the research context and motivation are described, following by research questions, research goals, and the general structure of the thesis. **Chapter 2** consists of the theoretical background that support this study. In **Chapter 3**, we conduct an experiment to analyze the characteristic of concept-map user and KB-map user. Next, **Chapter 4** we are conducting another experiment to measures the improvement that was added in the

KB-map. The improvement was aiming to improve the learner's understanding by making clarification of their own understanding. The new function facilitates learners to identify the proposition deeper. We are encouraging them to link the proposition they've made with the reading material. In **Chapter 5**, we made a conclusion, experimental limitation and future work than can be used for further research

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LIST OF PUBLICATIONS

Publications

Journal Articles

JISE 2019: Andoko, BS., Hayashi, Y., Hirashima, T. (2019). An Analysis of Concept Mapping Style in EFL Reading Comprehension from the Viewpoint of Paragraph Structure of Text. *The Journal of Information and Systems in Education 18 (1), 63-68*

RPTEL 2020: Andoko, BS., Hayashi, Y., Hirashima, T., Asri, AN. (2020). Improving English Reading for EFL Readers with Reviewing Kit-build Concept Map. *Research and Practice in Technology Enhanced Learning (RPTEL) 15, 7, 1-19.*

International conference paper

ICSITech 2017: Andoko, BS., Hayashi, Y., Hirashima, T. (2017). Analysis of the concept mapping style in EFL reading comprehension comparison between kit-build and scratch-build concept mapping from the viewpoint of paragraph structure of text. *2017 3rd International Conference on Science in Information Technology (ICSITech),* 622-625

ICCE 2019: Andoko, BS., Hayashi, Y., Hirashima, T., Asri, AN. (2019). Reading assistance for EFL readers with Kit-build concept map with source-connection. *ICCE 2019 - 27th International Conference on Computers in Education, Proceedings vol. 1, 706-708*

Source and Original Work

Original material of my own from the above publications has been included in this thesis, with a citation to the appropriate publication appearing at the beginning of each chapter. Other external sources are cited, with the bibliography appearing at the end of the thesis.

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1 Introduction

Reading is one of important activities to get knowledge or information. In other words, reading is one of the gateways to knowledge. It is an active and fluent process involving both the readers and the reading material in building meaning [1]. It is also noticed as an active task where readers are making selection from a range of words, derive from the text and the situational context that are constructing a model of meaning that reflects, more or less the same, the meaning designated by the writer [2]. Word recognition becomes the foundation of reading, and all other processes are dependent on it [3]. Available information is mostly written in English, which becomes a problem for students from non-English-speaking countries. Such students should master English first in order to understand the information. , Stanley [4] said that one of the major problems for the second language (L2) readers is that they may view the reading material as samples of language rather than information. L2 reader may have an inadequate or inappropriate orientation with the content and the structure of the text [5]

1.1 Reading Comprehension for EFL

For some learners of English as Foreign Language, reading comprehension in English can be difficult, many times they failed to understand the meaning as intended by the writers. It is not surprising, therefore, that students with reading comprehension difficulties show impairments on a range of language tasks. When word reading ability and written vocabulary knowledge are controlled, poor comprehends demonstrate deficits on higher-level skills relative to same-age good comprehends.

Meyer in 1984 [6] describe a method to facilitate the three categories of cognitive process that affecting the corresponding outcomes of learning from text. The three categories are:

1. Selection

The selection process is where readers conducting a selective attention to relevant information. Normally, readers might restrict their attention to topic sentences and definitions unless aided to attend the other information. This process contribute to be the greatest effect on learning facts. The way student making selection can determine the student performance in learning.

2. Internal Connection

   This activity describe how readers are able to organize the presented information. They might construct list but they may build a more coherent structure. This activity should produce a presented text structure.

3. External Connection

   This activity is making a connection between the presented information to the prior knowledge that stored in the memory.

Many or anybody can read a text but can hardly grasp what the writing was all about. This is because the reader was not supplying any details. Why is that? This was when the reader was merely reading the text without knowing the content. It thus defeats the purpose of reading as a way of gathering information. Reading would be a significant avenue of learning [7]. But if we don't understand what we read, we won't be able to know or recall.

1.2 Graphical Strategy in Reading Comprehension

A popular strategy for reading comprehension is a graphical strategy. The underlying principle of graphical strategies is converting linear textual statements into a nonlinear graphic presentation [8]. The tree structure that appears after the construction has a similarity to the macrostructure of the text, and it is easy to retain and retrieve [9]. Graphical strategies made by the learners themselves can promote autonomous learning and enhance the depth of learning, but these will be time-consuming for training. This kind of task will also demand effort and can usually lead to a cognitive

load and negative affect in learning outcomes [10]. To be able to construct it, learners must first determine importance concepts and make the relations between the concepts. Moreover, the whole structure will become summarized information in the shape of an information tree, which could be one of the reasons why graphical strategies are successful in reading comprehension.

Some researcher in Language learning suggested that to be successful in Reading Comprehension; a graphical display must be somehow reconstructed by the reader as a meaningful language [11, 7]. Other researchers also suggested that teachers should spontaneously create an instructional scaffolding-cueing, prompting, analogies, metaphors, questioning, elaborations, and remodeling that can provide or give access to the students with the necessary information that will help them to restructure their understandings [12].

A graphic strategy is a common approach to be used in reading strategies. It can be used as a preview phase before reading, throughout the reading process, and at the phase after reading [13]. The whole text structure and the interrelations among concepts are shown in the graphic with a visual method that provides readers a clear and prime understanding of what is being read [14]. One of the graphic strategies is the concept map [15].

Concept mapping offers a graphic strategy that provides readers with new approaches to reading that are different from traditional [8] and also lets learners organize information through visual aids [16]. That kind of action can stimulate their metacognitive awareness [8]. Concept Map can accommodate the three categories described earlier. However, concept mapping can also promote some difficulties; they can be idiosyncratic in terms of design that they require some expertise to learn, and because of their complexity, they may not always assist memorability [17]. Learners may also failed to make selection. Failure in the selection category will effecting failure

to another two categories. Making a correct selection is an important process. Based on that reason, we are using the KB-map.

KB-map is a closed-end of concept map, where learners can focus on the structure of the text. The selecting process of text for learners will be conducted by the expert/ teacher. The process then will be replace into the recognition process [18]. Learners will focus on the other two categories, Internal and external connection.

There is no doubt that English for a Non-English-speaking country is very important, because of its difficulties, we are trying to contribute by offering some solution to be used in learning English. This study focuses on Kit-build concept mapping (KB-map) [22, 23, 18] as learning support for reading comprehension of English. In terms of understanding measured by the comprehension test right after the reading process, the KB-map has been proven to have the same efficiency as a normal concept mapping method [24]. Firstly, we will investigate the effectiveness of KB-map in reading comprehension of English from the viewpoint of concept map construction style and secondly we propose to add a learning support function in KB-map for reading comprehension, in which learners connect the concept map with the source text to facilitating learners to make confirmation of their understanding.

2 Background

2.1 Reading Process

Reading is an intellectual operation. Reading meanings are numerous. Reading is when someone looks into a written text and begins processing the knowledge from the linguistic message in writing. In the Adapted Linguistic Longman Dictionary read as follows:

1. "Precise a written text to understand its contents. This can happen in silence (silent reading). The interpretation of that outcome is called understanding reading".
2. Reading a text written aloud (oral reading). This can be achieved with or without a material comprehension.

Another meaning of Collins English Learner's Dictionary is that reading is an act of observing and point of understanding. This is very real since reading requires using vision to grasp, and make meaningful, many words in a sentence. The same goes for every sentence to understand the full text.

Besides all the dictionary definitions, there are several people still make definitions. He describes reading as a method according to William [19], by which one looks at and understands what has been written. In her book Anthropology of Poetry for Young People, Rohani Ariffin [20] describes reading as a highly personal practice that is performed mostly in silence or loud.

2.2 Reading Purpose

Reading is very important to second language learning, great efforts have been made to improve reading skills. Although many approaches have been encouraged to improve students ' reading skills, reading is still something that appears troublesome. Students cannot comprehend English. These problems arose because according to

Nurweni [21], the students lack vocabulary, hardly understand the words, and less interest in English subject matter. If the student lives in a family where English is a common language to them, mostly spoken by family members then the student will have the benefit of being introduced to the language. Unlike a student with no experience with English in his family where English is seen as a strange language to be spoken, this kind of atmosphere demodulates his motivation to learn the language.

Additionally, school is also one of the factors contributing to the reading incompetence. This is where teacher's job is to promote the language to the students. Some teacher just might not fully use English during English class especially in the primary school. This is just because the instructor wanted to match her level with the students and a lot of code switching is used as a result. This early exposure to the lack of classroom use of English causes serious effect as they continue to study at a higher education level. English is not essential to them. Even if they do, they can still code the turn as their teacher did during their time of schooling.

2.3 Reading in English

2.3.1 Reading Comprehension

Reading comprehension is a complex task that includes a number of different cognitive skills and processes that enable the reader to construct the meaning of the text [25].

The relation between higher-level and lower-level skills and text comprehension have been demonstrated in both correlational and longitudinal studies. Concurrent measures of vocabulary, working memory, inference making, and comprehension monitoring are related to reading comprehension skills [26]. Longitudinal studies have shown that vocabulary and working memory [27] and word reading, grammatical awareness and vocabulary are related to later reading comprehension.

Impairments have been found on measures of working memory [27], inference making, narrative production [28, 25] and comprehension monitoring [29, 30]. Weaknesses in syntactic knowledge and processing have also been reported [31, 32]. When vocabulary, word reading accuracy and/or non-word reading can vary, lower-level lexical weaknesses in exception word reading and semantic processing are also apparent [33]. Thus, there are many language factors that might be causally related to reading comprehension level and the development of this skill.

A general structure of reading systems should more fully reflect reading by linking word-level processes to the higher-level processes that are the subject of comprehension research, Perfetti [34] (see Figure 1) visualize The Reading Systems Framework and makes the following claims regarding reading:

1. Three types of sources of knowledge are used in reading: linguistic knowledge, orthographic knowledge, and general knowledge (world knowledge, including knowledge of forms of text, for example, genres of text).
2. Reading processes - decoding, word recognition, meaning retrieval, constituent construction (sentence parsing), inferencing, and comprehension monitoring - use these sources of information in both restricted ways (e.g., decoding uses orthographic and phonological knowledge but not general knowledge) and interactively (e.g., inferences use general knowledge and the propositional sense derived from sentences).
3. Such processes arise within a cognitive environment that has pathways between perceptual and long-term memory systems and limited resources for processing.

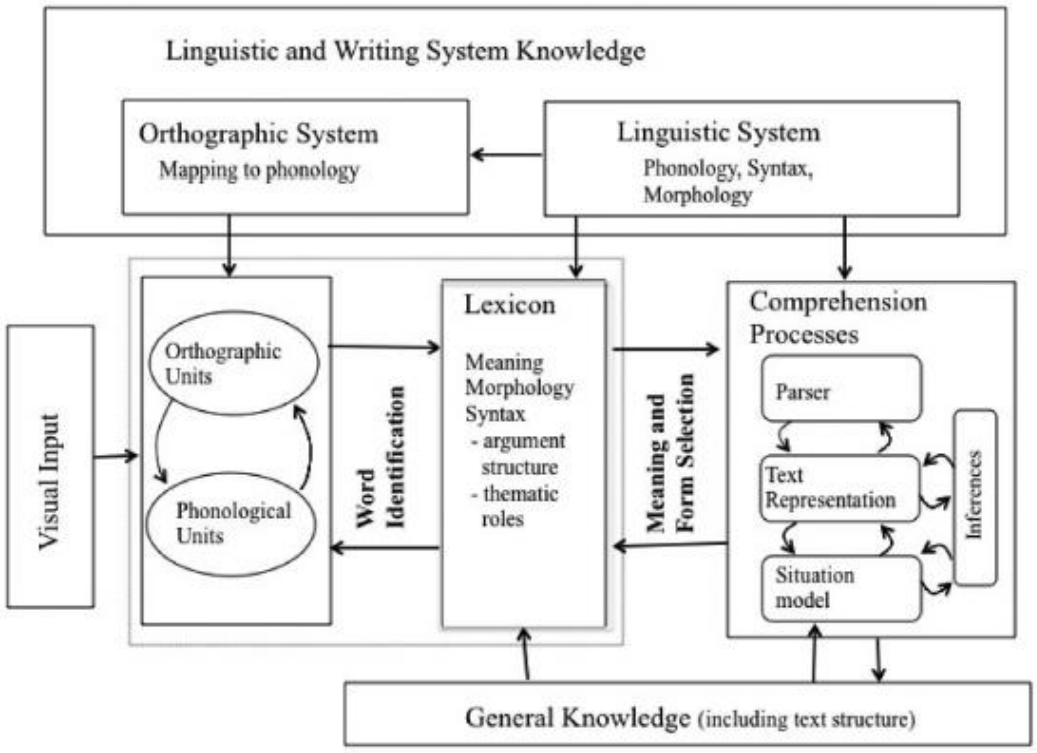

Figure 1. The Reading Systems Framework by Perfetti [34]

2.3.2 EFL

For some EFL readers, reading comprehension in English can be a challenging activity because they may understand each word separately, but when the words are combined into meaningful ideas, they often failed to understand the meaning as it should [35]. Reading comprehension in English of native readers and English as a foreign language (EFL) readers is different. Understanding a reading material for EFL readers requires more effort because they are more attached to texts or required to read the same texts more frequent than native readers [36, 37].

Language textbooks seem to play a pivotal role in educational system of every country. In Indonesia's University, ELT textbooks are used widely and serve as syllabus and

main guideline for teachers. The textbooks taught are designed and prepared by the teacher's English group. Based on the textbook content, the students are evaluated formatively and summative. A big problem in language teaching which our students encounter is that the tasks included in their textbooks do not give them enough practice in the skills they will need. In short, the textbooks somehow lack the variety of communication tasks which can motivate and give learners a purpose for doing them.

2.4 Style and Strategy in Reading Comprehension

The goal of reading is to learn, or to draw meaning from what you are reading. Experienced readers take this for granted and may not recognize the skills required to understand reading. The awareness method is both collaborative, as well as pragmatic. Instead of passively reading text, readers need to analyze it, internalize it, and make it their own. In order to read with comprehension, emerging learners must be able to read with some ability and obtain specific instructions on reading comprehension strategies [38].

2.4.1 Reading strategy

The cycle of comprehension of text starts before children can read, when someone read a picture book to them. We listen to the words, see the pictures in the book, and may begin to equate the words on the page with the phrases we hear and the concepts they represent. Students need training, practice, and input to learn comprehension strategies. The main techniques for comprehension are listed below.

1. Using Prior Knowledge/Previewing

   This approach requires readers to enable their background knowledge and use that knowledge to help them understand what they are reading. Background knowledge is made up of a person's encounters with the environment (including what he or she has read), together with his or her understanding of how written text functions, including word recognition, print concepts, word sense, and how

text is structured. Studies has shown that current knowledge of readers is important in assessing their ability to understand what they read.

According to the schema theory [39], as people learn about the world, they create a large network of structures of knowledge or schemes, with each schema linked to many more. As a person gains new information through learning and reading, these schemas grow and change. For example, a very young child's dog scheme might contain only her or his understanding of the family pet - a little white, furry, and fun to play with. As the kid receives more experiences in a variety of settings with a variety of dogs, the dog scheme extends and refines. It may be related to other schemes - types of dogs; dog colors; food dogs eat; areas where dogs live when the family is on holiday; Dangerous dogs; who veterinarians are; and locations of dog shows.

2. Predicting

   As students make predictions about the text, they are about to read they set expectations based on their prior knowledge of similar subjects. As they read, they will mentally revise their predictions as they gain more information. It allows students to use text-based details such as titles headings, pictures and diagrams to predict what will happen in the plot. When making predictions, students can see what happens next in the text, based on their previous knowledge. Predicting helps children to think ahead critically and ask questions. It also allows students to better understand the story, make connections to what they're hearing, and engage with the text.

3. Identifying the Main Idea and Summarization

   Summarizing is very important for students to learn in their primary school years. The definition of summarizing is when we take large collections of texts and minimize them, making sure that the main points and the general idea of the article are included [40]. The aim of this approach is to get the main ideas

out of the way and to concentrate on key details. The textbook would provide an overview of where this technique could be used.

4. Questioning

   Through a question approach, students will be able to increase their awareness dramatically. By answering and asking questions, students are interested in learning and communicating with the text. Students will learn to ask questions before, during and after reading to help build understanding. This approach is effective in increasing student engagement in the classroom. When conducting a whole community lesson, the questioning technique could be a very effective tool for getting all students involved. Questioning is not just taking place while reading. The technique can also be used to develop deeper knowledge of lessons learned or discussions [41].

5. Making Inferences

   Making an inference is to use what you know to make a guess about what you don't know or read between the lines. Readers who draw inferences use the hints in the text along with their own experiences to help them figure out what is not explicitly said, making the text personal and memorable. Helping students to make texts unforgettable will help them gain more personal pleasure in reading, reading the text more objectively, and understanding and applying what they have read. Researchers have reported that thoughtful active proficient readers are metacognitive; they think about their own thoughts while reading. They can recognize when and why the context of the text is not apparent to them and can use a variety of strategies to solve problems of comprehension or deepen their understanding of the text [12].

6. Visualizing

   Visualizing improves reading comprehension skills as students develop a more in-depth understanding of the text, they read by deliberately using words to

create mental images. As students gain more deliberate experience with this ability, the visualization of text becomes automatic. Students who visualize when they read not only have a better reading experience but can remember what they have read for longer periods of time [42]. Visualizing text as it is read or heard often provides a personal link between the reader / listener and the text. Readers who can visualize the characters they read about, for example, might become more interested in what they read. It makes reading experience more meaningful and promotes continued reading. Students may develop their visualization skills by reading aloud, engaging in small group reading events, or listening to text. To promote imagination, turn out the lights and ask students to close their eyes while they listen. Frequently pause to allow students to share their photographs and mental images with the classroom. The ability to generate visual images from texts is becoming increasingly important as students move from richly illustrated storybooks to "chapter books" with very few images.

Reading strategy use among learners of English as a foreign language (EFL) is one of the most important areas of foreign language (FL) strategy research. Students who actively use their reading comprehension strategies can understand and recall more information from what they read and acquire higher-level language proficiency. The focus of our study was to develop and validate a model used for EFL reading strategy.

2.4.2 Comprehension Monitoring

Comprehension monitoring is an ongoing activity that evaluates and regulates the understanding of an individual from a written (or spoken) text [43, 36]. Furthermore, comprehension monitoring is defined as a metacognitive process affected by person, strategy, and task variables [44]. This activity encourages students to become active during the process of understanding in reading the section [45]. Comprehension

monitoring becomes one of the strategies used in reading comprehension because of its ability to enhance learning.

Moreover, comprehension monitoring consists of two parts of processes: (1) being aware of the quality and degree of the understanding of an individual and (2) knowing what to do and how to do it when one finds a comprehension failure. Expert readers are better than the novice ones when using the available resources like looking back to the text to solve the problem. Alessi, Anderson, and Goetz [46] claimed that the lack of knowledge in the consequence of deficits or losing information could be restored almost completely when using an induced look-back strategy on the part of college students. They also found that the monitor of a good reader not only occurs in comprehension monitoring but also becomes the key to restoring the lost comprehension. Monitoring takes a big role to differentiate between expert and novice readers.

2.4.3 Reading Style

2.4.3.1 Sentence by sentence

The Sentence-by-sentence style is one of the common style that being used in the activity of learning for reading in EFL reading comprehension [47], in which learners can understand the text as separate sentences only, not as a whole structure. Less proficient readers seemed to monitor at word-level by using intra-sentential information while more proficient readers seemed to be able to use inter-sentential information and take a more holistic approach [27].

2.4.3.2 Paragraph Remaining

Paragraph remaining (PR) is also used to measure the learner's construction style. This value measures how much a leaner makes propositions within the same paragraph continuously. This is calculated based on the concept map a learner made and the counting of staying the same paragraph if he or she is possible. For example, at the

example 2 in Table 1, the learner totally made two propositions related to the first paragraph and three propositions related to the second paragraph. He firstly made propositions related to the second paragraph. Then, he had two options to make a proposition related first and second paragraph, that is, possibility is 1 in the table. Actually, he made the paragraph related to the first paragraph, which means he did not make propositions continuously in the same paragraph, so this is not counted. On the other hand, if made a proposition related to the second paragraph, it would be counted. PR is calculated as the division of the count by the possibility in order to formalizing among sessions.

Table 1. Paragraph Remaining calculation example

	Example1			Example2		
step	possibility	paragraph	score	possibility	paragraph	score
1	false	1	0	false	2	0
2	true	1	1	true	1	0
3	false	2	0	true	2	0
4	true	2	1	true	2	1
5	true	2	1	false	1	0
PR			1			0.33

2.5 Concept Map

Novak defined a tool called concept map. The defined definition is: Concept maps are graphical tools used for organizing and representing knowledge. There are two main parts to the concept map. The first part is the concepts that shaped like a circle or boxes

of some type, and the other parts are the connecting line that consists of words that are connecting between two concepts. That word on the line describes the relationship between them and referred to as linking word or linking phrase. It specifies the relationship between two concepts [48].

For most definitions, the label in a concept is a word, although sometimes it use + or percent symbols and sometimes use more than one word. Propositions are assumptions about some universe phenomenon or event that occur naturally or are created. Propositions include two or more related concepts that are used to attach words or phrases to form concrete statements. These are also called logical units or meaning units. Figure 2Figure 2 shows an example of a concept map which describes the concept map structure and illustrates the characteristics described above.

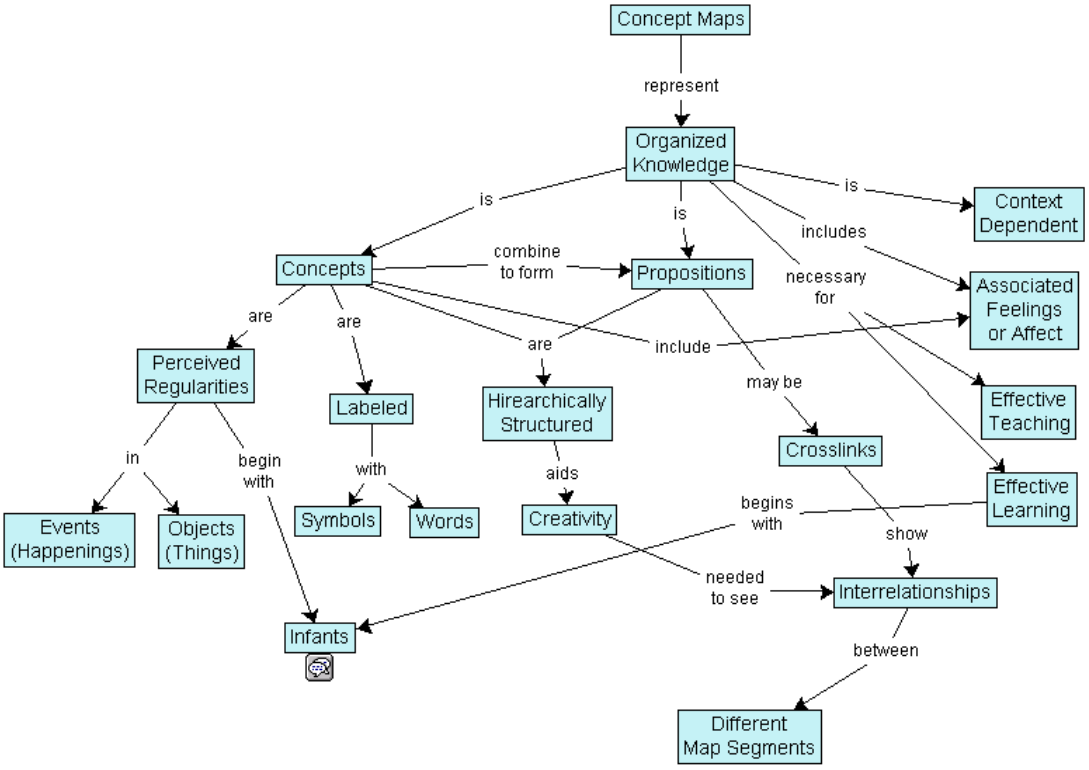

Figure 2 A concept map showing the key features of concept maps

Another characteristic of concept map is that the concepts are represented in a hierarchical fashion with the most inclusive and general concepts at the top of the map, and the more General, less general terms hierarchically arranged below. The hierarchical structure for a given knowledge domain often depends on the context in which that knowledge is applied or considered. The concept map may relate to some situation or event which we attempt to understand by organizing information in the form of a concept map, thereby providing the context for the concept map.

The use of cross-links is another significant feature in concept maps. These are relationships or connections between concepts in the concept map, in different segments or domains. Cross-links help to see how a concept is linked to a concept in

another domain shown on the map in one domain of information shown on the map. Cross-links also reflect imaginative strides on the information producer's part when creating new knowledge. In encouraging creative thinking, there are two features of concept maps that are important: the hierarchical structure depicted in a good map, and the ability to search for and define new cross-links.

A final function that may be applied to concept maps are specific examples of events or object that help explain a given concept's significance. These are not usually included in ovals or frames, because they are specific events or objects and do not represent concepts (see Figure 3).

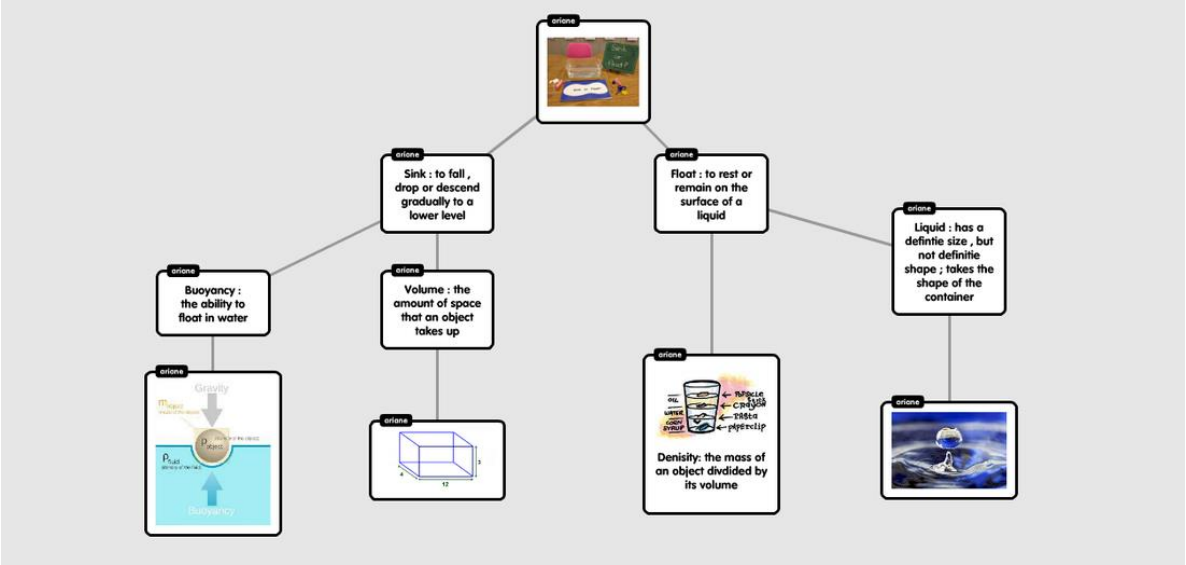

Figure 3 Concept map with objects

Novak and Canas [48] describe that a meaningful learning requires three condition:

1. Conceptually the information to be learned must be transparent and illustrated with terms and examples relevant to the prior knowledge of the learner. Concept maps can be helpful in meeting this requirement, both by defining large general

concepts retained by the learner prior to instruction on more specific concepts, and by assisting in the pacing of learning activities by increasingly more explicit knowledge which can be rooted in the creation of conceptual frameworks.

2. The learner must have prior knowledge related to this. For virtually every domain of subject matter, this requirement can be met after age 3, but it is important to be careful and clear in constructing concept structures if one wishes to provide precise detailed knowledge in subsequent lessons in any area. Therefore, we see conditions (1) and (2) as interrelated and both relevant.
3. The learner must choose for practical learning. The one condition under which the teacher or mentor has only indirect control is the students ' incentive to choose to learn by trying to incorporate new meanings into their prior knowledge, rather than merely memorizing concept descriptions or propositional statements or computational procedures. The indirect control over this option is mainly used in instructional approaches and evaluation strategies. Instructional strategies which facilitate meaningful learning by linking new knowledge to existing knowledge of the learner. Also promoting effective learning is the assessment approaches that allow learners to connect concepts they hold to new ideas.

2.6 Kit-Build Concept Map

Kit-build Concept Map is a kind of concept map that is using a closed-end approach, unlike the concept map that is using an open-end approach. The KB-map is a closed-end concept map. It means that the student cannot create their concept and link since it is provided by the system from the dissembled expert map. This kind of approach may reduce teacher workload and learning complexity. However, sometimes, learners make an incorrect proposition because of their capabilities on processing texts, and it would be more difficult if they have some time limitation to complete all the processes

(classroom situation). The closed-end approach can also be easily taken into the automatic diagnosis of the constructed map of the learners because it has the same component as the expert map. Therefore, finding a difference among them from the diagnosis result form will be feasible. Using the provided component, learners can construct a map limited by the component itself, unlike the concept maps where learners can freely create the component and the map by themselves.

Several main phases are available in the KB-map: the first phase is goal map building, the second phase is learner map building, and the third phase is a KB analyzer. Goal map building is a phase where the instructor or the teacher or the expert will construct the map from the information source or reading material, and this map will then be called a goal map. Thereafter, the goal map will be dissembled into parts or components consisting of nodes and links called kit. Learner map building is a phase where the learner will reconstruct the map from the provided node and link, and the constructed map by the learners will be called learners' map. In this reconstruction process, learners can only reconstruct a proposition into the map from the provided link and node, and they cannot create any new links or nodes. The KB analyzer phase is where the teacher or the instructor or the expert will check the learners' map compared with the goal map. The analysis will automatically be provided by the system by using the exact matching method. The exact matching method compares each proposition on the goal map and learner's map (see Figure 4).

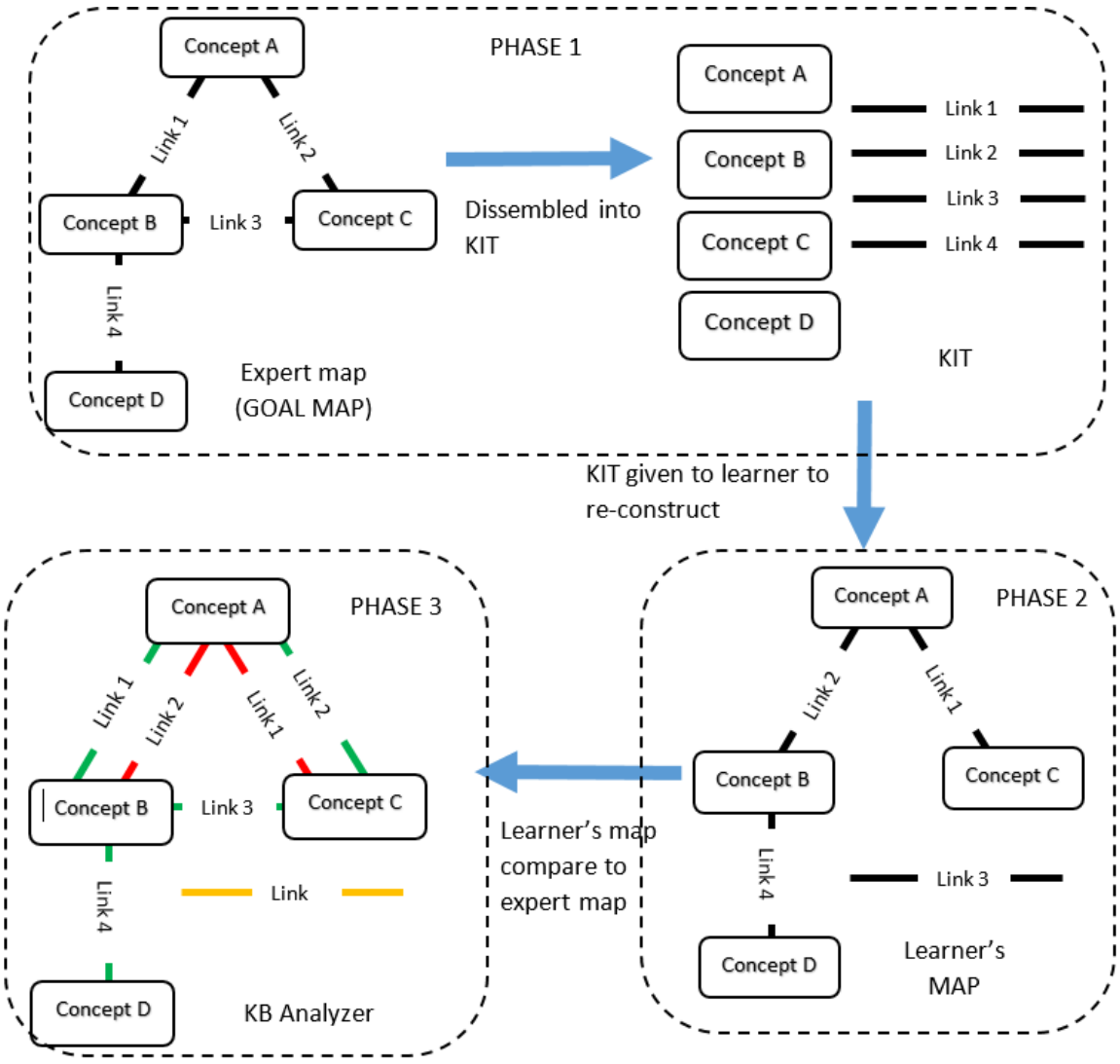

Figure 4. KB-map lifecycle

2.6.1 Goal Map Building

The teacher is required to create the initial concept map, this initial concept map, then will be called as Goal map. The Goal map must represent the teacher understanding of a reading material. The teacher also needs to measure the level of learner's ability so the teacher can adjust the Goal map (see Figure 5). After finishing the goal map, the

system will dissemble the Goal map into Kits (see Figure 6) and those kits will be given to the learners.

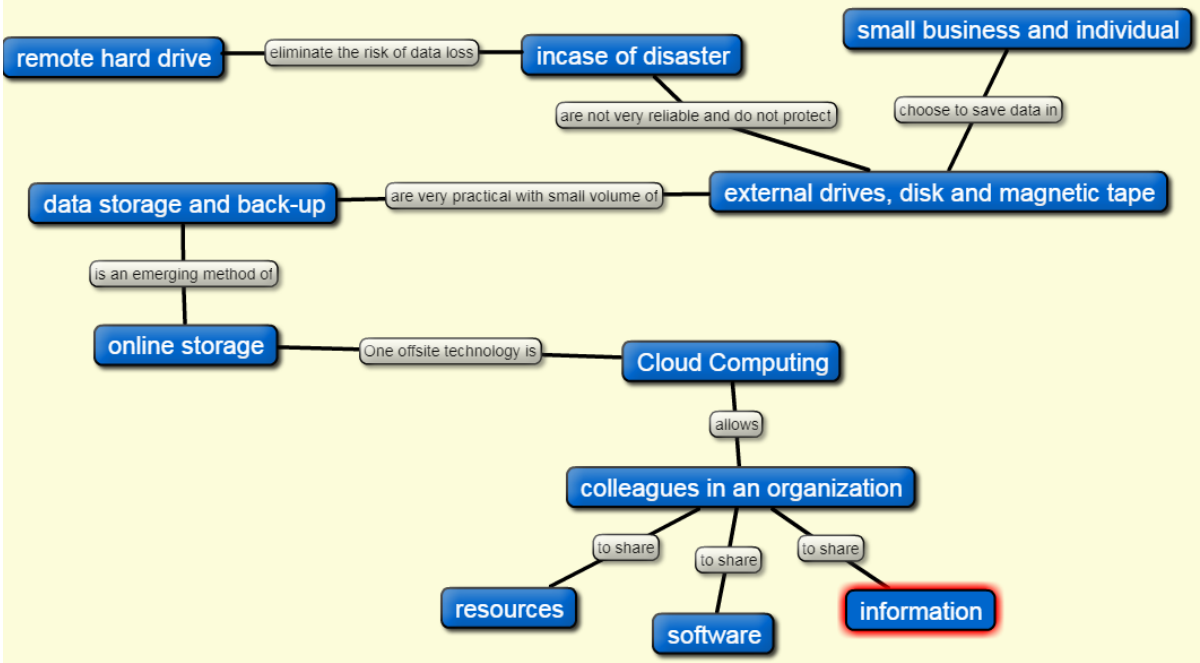

Figure 5 Example of Goal Map

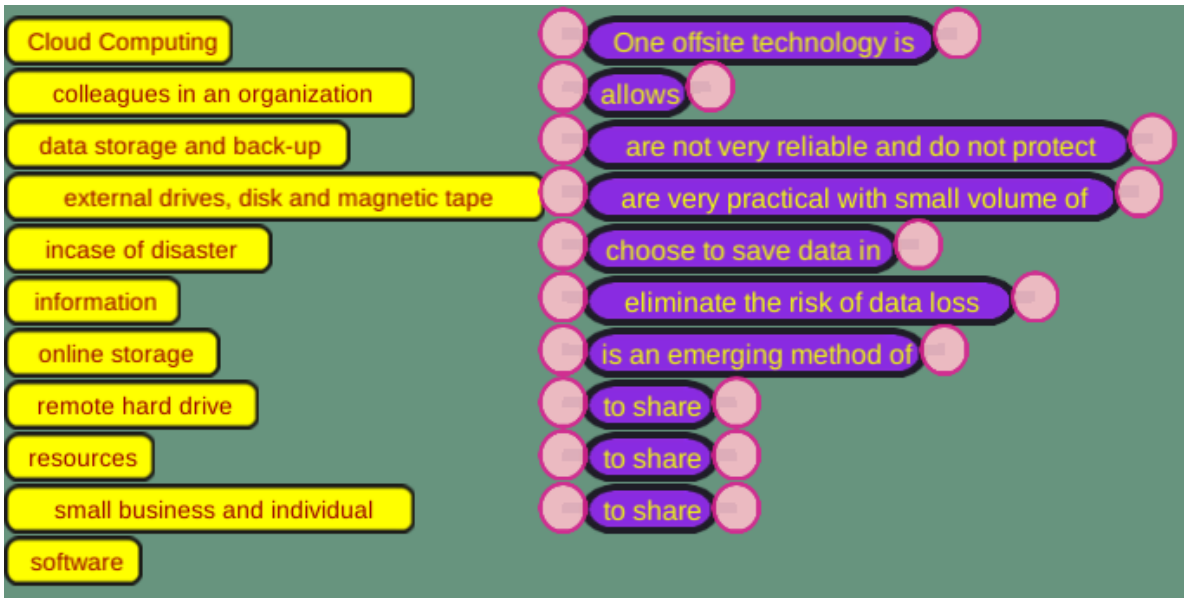

Figure 6 Dissembled of a Goal map called Kits

2.6.2 Learner's Map

In KB-map, learners are required to re-construct a map from the provided Kits (consist of concept and link). They cannot create a new concept or link. They can re-construct freely according to their understanding but limited by the provided Kits (see Figure 7).

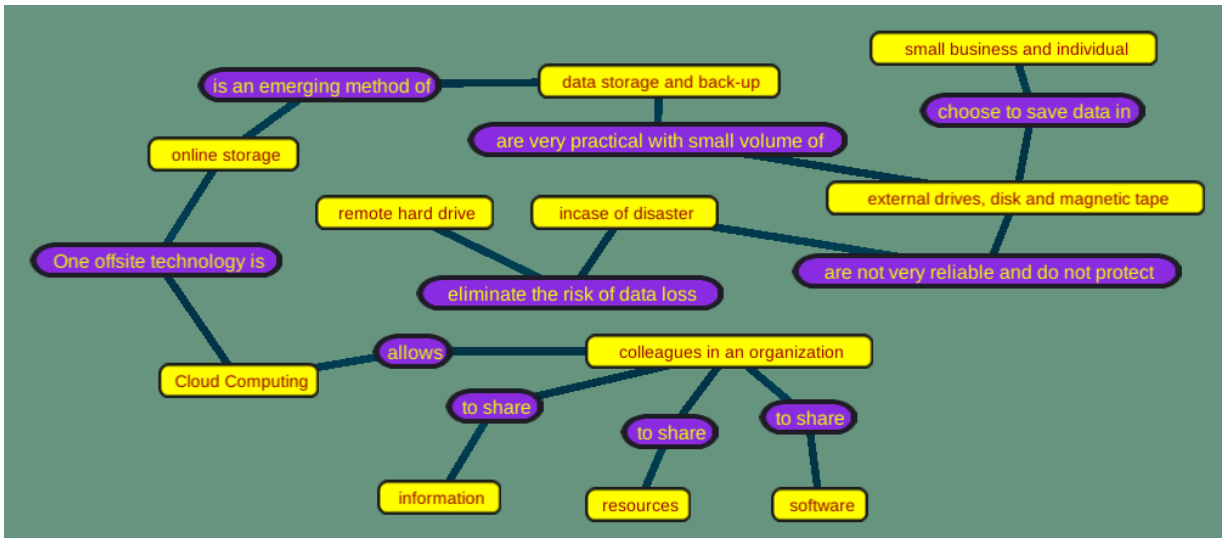

Figure 7 Example of Learner's map

2.6.3 KB-Analyzer

KB Analyzer is a tool to compare between the teacher and the student map. The comparison would be easier since they all are using the same component. The finding of misunderstanding proposition, un-constructed proposition, and same proposition is feasible to handle. The teacher can use the KB-Analyzer to provide an additional explanation. He can also use it to confront the different between the teacher and the

class understanding (see Figure 8) or the different between the student individually (see Figure 9).

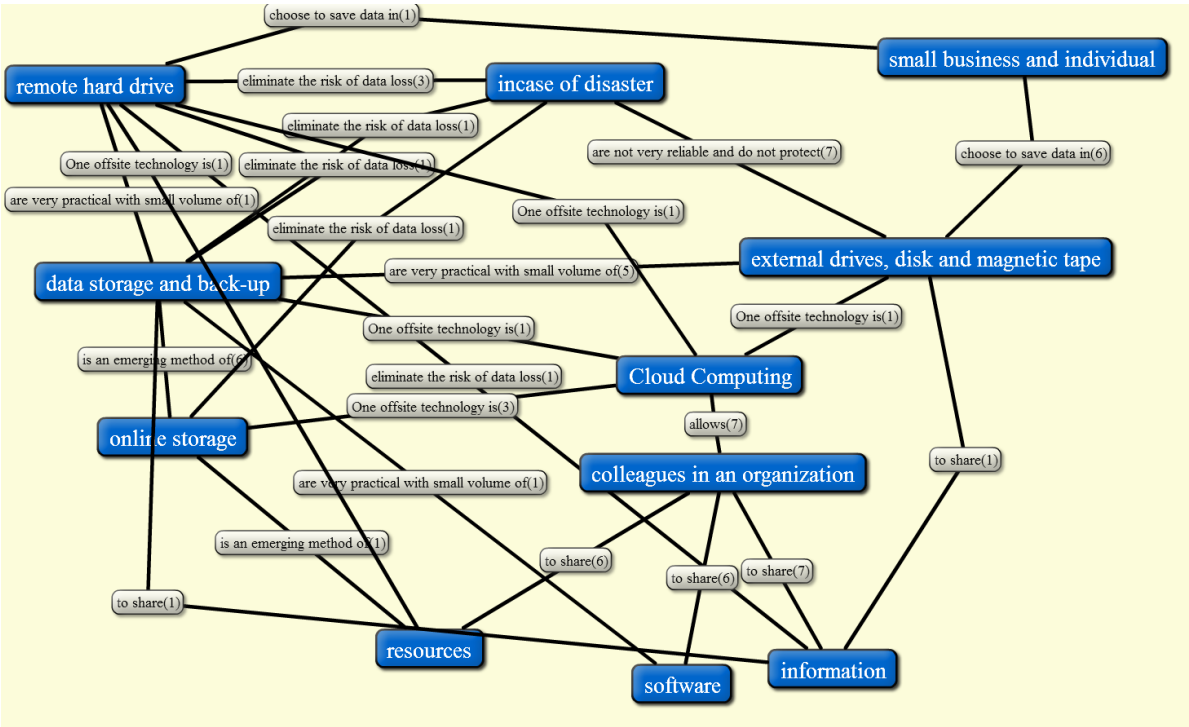

Figure 8. KB-analyzer to show the different between the teacher and the class understanding

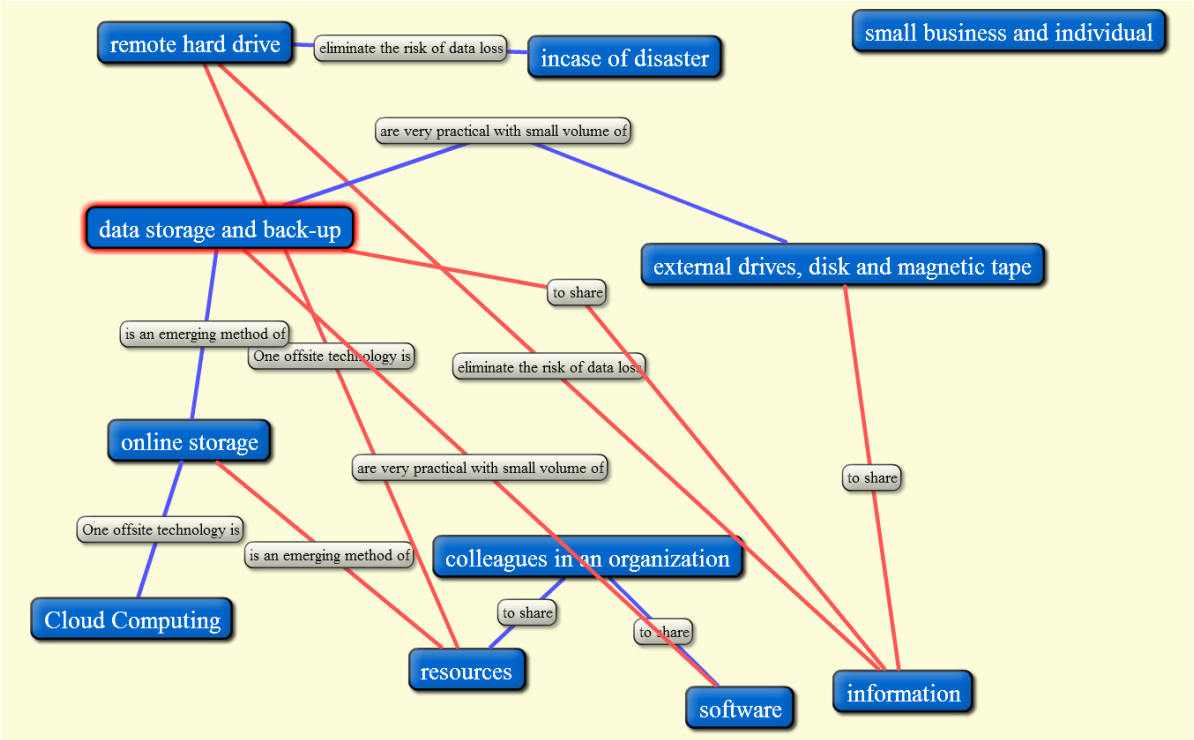

Figure 9. KB-analyzer to show the different between the teacher and the student understanding individually

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3 Analyzing the Reading Style of KB-map

In language learning contexts, reading comprehension is an important learning activity. In EFL reading comprehension learning, one of the frequent styles of reading is the sentence-by-sentence style, in which learners can understand the text as separate sentences only, not as a whole structure. This study focus on the structural understanding of test and map making process from the viewpoints of paragraph. The assumption in this study is that map making in KB mapping does not follow sentence order but focus sets of meanings formed by paragraphs. This study investigates the relation between map making process in KB and SB mapping and paragraph structure of text.

3.1 Introduction

Reading comprehension is an essential yet challenging task in language learning. Reading comprehension in English as foreign language (EFL) context is a particular case of reading comprehension; it is a complex, dynamic, multi-componential and multi-dimensional task in the learning process. It is a continuous process of multiple interactions between the readers' background knowledge in their Mother Language and the knowledge exposed to in the Target Language (here English). The reading comprehension of EFL is the same as the ML reading comprehension. However, it is slower and less successful than ML reading [49].

One of the prevailing styles of reading in EFL reading comprehension learning activities is the sentence-by-sentence style [47], in which learners can understand the text as separated sentences only, not as a whole structure. Less proficient readers seemed to monitor at word-level by using intra-sentential information while more proficient readers seemed to be able to use inter-sentential information and take a more holistic approach [50].

Concept mapping is one of the strategies used to support the reading comprehension, and it gives good effects on reading comprehension of EFL learners [51, 52]. It is a visual representation of knowledge, which can be employed as a learning strategy by learners to find the relationship between what they know and new information [53]. Many researchers have confirmed that EFL learners who used concept mapping gain great understanding in reading comprehension [54, 55, 51, 56]. Also, many studies have proved that the concept mapping or semantic mapping technique can improve the learners' reading comprehension because they could understand the text more efficiently through the concept map [57, 55, 48, 53].

Kit-build concept mapping (KB-mapping) method [18, 22] that is a kind of concept mapping method has the same efficiency as the original concept mapping (hereafter, Scratch-build concept mapping: SB-mapping) method for the comprehended information in a comprehension test just after reading. In addition to that, KB-mapping has better efficiency in recalling the understood information in the delayed comprehension test two weeks later than SB-mapping [49]. Map making of learners in SB-mapping is close to composing propositions sentence-by-sentence, which is not useful to comprehend the text in a full structural form. On the other hand, map-making in KB-mapping is not close to sentence-by-sentence, and this can be considered to be helpful for comprehending the text and for recalling it later [58]. In addition to that, readers with KB mapping tend to avoid reconstructing concept map following the order of sentences [59].

This study focuses on the relation between the structural understanding of text and map-making process from the viewpoints of paragraphs. One of the essential factors of reading comprehension is paragraph [60], and there are many strategies for reading comprehension with paragraphs [57, 61]. The assumption in this study is that map making in KB mapping does not follow sentence order but focus sets of meanings

formed by paragraphs. If this assumption is correct, KB mapping will contribute to facilitation of proficient reading in EFL. This study investigates the relation between map making process in KB and SB mapping and paragraph-structure of a text.

The composition of this paper is organized as follows. The next section gives an overview of KB-mapping, followed by the explanation of the difference of KB mapping from original concept map and relation between KB-mapping and EFL reading comprehension. Section 3 shows the setting and the method of the experiment in this study. Section 4 shows the result and make discussion on it. Finally, section 5 concludes this paper and shows some promises of future research.

3.2 Kit-Build Concept Map

"Kit-Build Concept Map" or "KB map" is an application that adopted the closed-end approach of the concept map. Concept map is a tool that was defined by Novak, and the definition is: Concept maps are graphical tools for organizing and representing knowledge. They include concepts that usually enclosed in circles or boxes of some type and relationships between concepts indicated by a connecting line linking two concepts. Words on the line, referred to as linking words or linking phrases, specify the relationship between the two concepts [48]. The framework of KB map has the following two characteristics, (A) concept map building task is divided into segmentation task and construction task, and then the segmentation task is replaced by recognition task of parts of a concept map that is "kit," and (B) a goal map should be prepared as an ideal map that a learner is required to build; the applicable targets of the KB map are restricted, and it needs several additional functions for the learning environment. Therefore, it is necessary to propose an adequate way to use KB map under these restrictions [18].

Figure 10 illustrates an example of a goal map. Teachers make goal maps as a representation of the structure of what they want learners to learn. Figure 11 shows an example of parts. It is called a kit. Although, in general, concept map building, learners are required to extract components from learning resources, in KB map building learners recognize the parts.

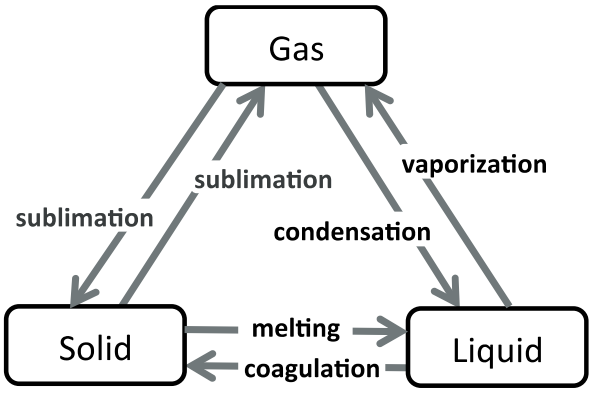


Figure 10. An example of Goal Map

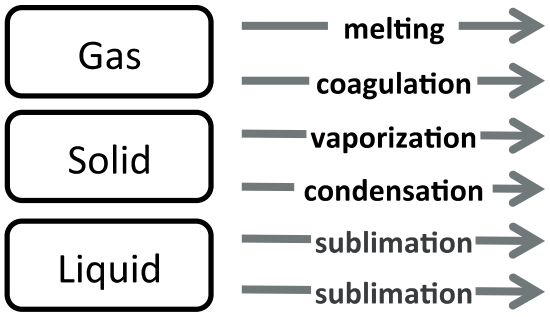


Figure 11. An Example of Kits

To do the required analysis, a new ability of KB-Map have been added. The ability is to record the learners' activity during the construction of map activity into a LOG data. The result of the LOG data will be calculated. The calculation result will be processed into a statistical analysis to visualize and support this research.

KB Map is an application to support learning. It adopted the Concept Map concept and extending it into a new kind of concept map. KB Map has three main phase 1) Goal map building, 2) Learner's map building, and 3) KB Analyzer. Goal Map building is a phase where instructor or teacher is constructing a Goal map. This created goal map then will be separated into separated Node and Link where learners will reconstruct them in phase 2. Learners Map is a phase where learners have to construct the provided link and node into a learner's map. Learners cannot create, update or delete node or link. They can only make a proposition of provided node and link. In phase 3, teacher or instructor can check learners map and analyze it by comparing between Goal map and learner's map.

In this research, we are using an English reading material and makes a Goal Map from it. Instructor or teacher should understand the main idea of the content and then he/ she should choose or use the words from the content or creating a new word that has the same meaning or purpose with the sentence. For example:

"Any substance may exist as solid, liquid or gas. If a solid is heated, it will melt to become a liquid. This change is called melting. If the liquid is then cooled, it will freeze to become a solid again. This change is called freezing. Similarly, if a liquid is heated, it will boil to become a gas. This change is called boiling……"

From the reading material, instructor or teacher construct a Goal map and separate it into Kits as shown in Figure 1.

3.3 Experimental Setting and Method

3.3.1 Procedure

This experiment involving eight Japanese undergraduate students who learn English as a foreign language. The student divided into two groups by the TOEIC reading score and they use Kit Build (KB) and Scratch Build (SB) by turn. We conduct six sessions

with a different material for each session. In each session we do several activities, they are:

- English Group discussion session
- Reading the material session with Dictionary and translator allowed
- Constructing KB Map and SB Map session with open reading material
- Test session with closed reading material, dictionary and translator
- Test explanation session

Before the experiment, learners took TOEIC score. Their score range was from 900 to 295, and the TOEIC Reading score variation was from 425 to140. The score variation determined the English competency level of the learners.

3.3.2 Materials

We used six intermediate level texts in information engineering. The texts had the same word count and so the same size and were taken from Wikipedia; we checked them for grammatical and semantical errors and for continuity since we selectively chose sentences. It already had the goal map verified by an English teacher. To support this research, the goal map has to be arranged into a hierarchy map without changing the proposition and others.

After that, we created the corresponding concept map (goal map) for every text, by using the Goal Map Editor. The goal map covered the main concepts and relations; also, all the goal maps had almost the same size and structure. We prepared comprehension tests, which were multiple choice tests with 10 questions of the same level of complexity. Around 80% of the comprehension questions could be answered by the goal map and the others could not. Again, we checked all of the materials to be sure they do not contain any errors.

3.3.3 Anagram Distance

Anagram Distance is used to measure the learner's construction style. The style that we're trying figure is the sentence by sentence style. This style determines that learners constructed their map according to the position of the reading material. If the distance result is low, then we can be sure that learners construct their map according to the position of text in the material. The goal map has the information of the text position for each proposition. Table 1 shows cases of calculation of anagram distance. Basically, anagram distance measures the difference between the order of proposition-making in concept mapping and the order of sentences related to the propositions in the text. If a learner makes propositions in the same order of a text, anagram distance is the minimum. Case 1 in Table 2 shows it. On the other hand, the orders are different anagram distance becomes high. In this study, we use this to measure whether a learner builds concept map sentence-by-sentence.

Table 2. examples of anagram distance

	Case 1		**Case**	
order	**proposition**	**distance**	**proposition**	**distance**
1	**1**	**0**	**3**	**2**
2	**2**	**0**	**1**	**1**
3	**3**	**0**	**4**	**2**
4	**4**	**0**	**5**	**1**
5	**5**	**0**	**2**	**3**
AD	**0**		**1.8**	

3.3.4 Paragraph remaining

Paragraph remaining (PR) is also used to measure the learner's construction style. This value measures how much a leaner makes propositions within the same paragraph continuously. This is calculated based on the concept map a learner made and the counting of staying the same paragraph if he or she is possible. For example, at the case 2 in Table 3, the learner entirely made two propositions related to the first paragraph and three propositions related to the second paragraph. He firstly made propositions associated with the second paragraph. Then, he had two options to create a proposition related first and second paragraph, that is, a possibility is 1 in the table. He made the paragraph related to the first paragraph that means he did not make propositions continuously in the same paragraph, so this is not counted. On the other hand, if made a proposition related to the second paragraph, it would be counted. PR is calculated as the division of the count by the possibility to formalizing among sessions.

Table 3. examples of paragraph remaining

	Case 1			**Case 2**		
step	**paragraph**	**possibility**	**actual**	**paragraph**	**possibility**	**actual**
1	**1**			**2**		
2	**1**	**1**	**1**	**1**	**1**	**0**
3	**2**	**0**	**0**	**2**	**1**	**0**
4	**2**	**1**	**1**	**2**	**1**	**1**
5	**2**	**1**	**1**	**1**	**0**	**0**
PR		**3**			**0.33**	

3.4 Experimental Result and Discussion

Table 4-6 show the result of the experiment. Here, anagram distance (AD) is normalized with the maximum value of each session to compare among sessions. The comparison between KB and SB, there is a significant difference only in anagram distance. Firstly, we focus on the significant difference in anagram distance. This result is the same as the previous study [59]. That means learners with KB tend to construct concept maps not according to the order of sentences in the text. As mentioned in Introduction, less proficient readers seemed to monitor at word-level by using intra-sentential information. That shows learners with KB has different characteristics from less skilled readers.

This result does not show that learners with KB construct concept maps like more proficient readers' reading comprehension. If just anagram distance is high also means the learners may randomly pick up sentences from the texts and make propositions. It is necessary to check whether that happens or not. We analyze the paragraph remaining (PR). It is not possible to say that the PR in KB and SB is different, however, PRs both in KB and SB is high, 0.7 - 0.8. This means learners make propositions in the same paragraph in the possibility of 70 – 80% if learners have options to make propositions from several paragraphs.

The combination of the result of AD and SR implies the different characteristics between KB and SB. SR is high in SB whereas both AD and SR are high in KB. This can be considered that learners with SB tend to construct concept map sentence-by-sentence, whereas learners with KB tend to create concept maps paragraph-by-paragraph and not follow the order of sentences in paragraphs so much.

Table 4. two-sided T-test result of test

Type	Mean (SD)	p-value
KB	**0.74 (0.19)**	**0.42**
SB	**0.68 (0.12)**	

Table 5. two-sided T-test result of AD

Type	Mean (SD)	p-value
KB	**0.47 (0.088)**	**0.049**
SB	**0.33 (0.15)**	

Table 6. two-sided T-test result of PR

Type	Mean (SD)	p-value
KB	**0.72 (0.14)**	**0.20**
SB	**0.81 (0.13)**	

3.5 Conclusion

This study analyzes the concept map building style in EFL reading comprehension as the comparison between KB and SB concept mapping. We conclude that reading style with KB mapping is different from less proficient readers. The reading style of less proficient readers is sentence-by-sentence where they only understand the word as a separate text only following the order of sentences. In the result of the investigation of this study, although PR is high in both of KB and SB, AD is higher in KB than SB. AD

indicates whether a reader make a concept map sentence by sentence or not. PR indicates whether a reader make a concept map following the paragraph structure or not. If a reader makes concept map completely sentence by sentence, AD is zero and PR is one. Based on these definition of AD and PR, we can interpret concept mapping with KB is not closer to sentence by sentence than concept mapping with SB. The readers have made concept maps not following the order of sentences but following paragraph structure when they have used KB, in contrast to that they follow both of the order and the structure when they have used SB.

The result shows paragraph remaining is not significantly different, but the anagram distance of the former is higher than the latter. Although both of reading pay attention to paragraphs as a unit of meaning, reading with SB mapping tends to follow sequence order of the text sentence-by-sentence while reading with KB mapping tends to organize the meaning of the text independently from the order of sentences.

In future work, firstly, it is necessary to investigate concept mapping style with much greater number of the subjects. Secondly, the next goal is to design an adaptive support environment for reading comprehension based on the considerations of this research and implementation of the monitoring function.

4 Source-connection support in KB-map for Reading Comprehension

Reading comprehension for English as a foreign language (EFL) students is crucial. Available information is mostly written in English, which becomes a problem for students from non-English-speaking countries. Such students should master English first in order to understand the information. This research offers a method to improve English reading with the help of the kit-build concept map as a graphical strategy and an additional function called source connection to facilitate EFL readers in reviewing their concept maps as the representation of their understanding. In this study, an English teacher in an Indonesian university practically used this system in the English class of second-year undergraduate students as EFL readers and tested the effectiveness of it. Results confirm that students who use the kit-build concept map with the source connection function show better performance in English reading compared with those who employ the traditional summarization method.

4.1 Introduction

Reading is one of the important activities to obtain knowledge or information. In other words, reading is one of the gateways of knowledge. It is an active and fluent process involving the readers and the reading materials in building meaning [1]. It is also noticed as an active task where readers are making selection from a range of words, derive from the text and the situational context that are constructing a model of meaning that reflects, more or less the same, the meaning designated by the writer [2]. Bowie [62] said that the ultimate goal of reading is understanding a continuous text. Word recognition becomes the foundation of reading, and all other processes are dependent on it [3].

Reading comprehension in English of native readers and English as a foreign language (EFL) readers is different. Understanding a reading material for EFL readers requires

more effort because they are more attached to texts or required to read the same texts more frequent than native readers [36, 37]. For some EFL readers, reading comprehension in English can be a challenging activity because they may understand each word separately, but when the words are combined into meaningful ideas, they often failed to understand the meaning as it should [35].

A popular strategy for reading comprehension is a graphical strategy. The underlying principle of graphical strategies is converting linear textual statements into a nonlinear graphic presentation [8]. The tree structure that appears after the construction has a similarity to the macrostructure of the text, and it is easy to retain and retrieve [9]. Graphical strategies made by the learners themselves can promote autonomous learning and enhance the depth of learning, but these will be time-consuming for training. This kind of task will also demand effort and can usually lead to a cognitive load and negative affect in learning outcomes [10]. To be able to construct it, learners must first determine importance concepts and make the relations between the concepts. Moreover, the whole structure will become summarized information in the shape of an information tree, which could be one of the reasons why graphical strategies are successful in reading comprehension.

Using an expert-generated map could help learners by presenting the macrostructure of the text in the form of graphic representation and could help save time and give a well-defined graphic organization that can serve as a preview of the reading material outline structure [8]. However, this kind of environment sometimes can put learners into passive learning where they cannot think creatively (because they cannot create their own map) and may eventually undermine their learning performance [63].

Kit-build concept mapping (KB-map) is an active learning method with expert-generated maps [22, 23, 18]. In the KB-map method, learners generate concept maps from the components of an expert-generated map instead of generation from scratch as

the original concept mapping method. This method has the same efficiency as the original method for comprehended information in a comprehension test taken just after reading [64]. The KB-map assessment method is automated, and its validity for evaluating the understanding of learners has been confirmed [65]. In addition to the one-on-one comparison, overlapping the learner maps as the representation of the aggregated understanding of learners is possible. Comparing the overlapped maps with the expert-generated map, the teacher can analyze the trend and errors of learner understandings in the class. The analysis is helpful for the teacher to provide feedback to the learners [66, 23].

In a classroom situation, the teacher can help the learners to review their understanding. However, teachers have a time limitation, and different types of reading comprehension problems exist. Teachers must encourage learners to solve problems by themselves. To promote the self-problem-solving activity, this research proposes a new function called source-connection in the kit-build concept map. It will facilitate learners to review their concept map, and hopefully, they will be able to find the errors in the proposition and fix them by themselves. Thus, this study aims to examine the effect of the KB-map with the source-connection function for EFL readers. The study hypothesizes that the KB-map with the source-connection function facilitates EFL readers to confirm the validity of the concept maps they have generated and obtain a better understanding of the reading materials than another method like summarization and just KB-map. To address it, the research question will be as follows: Can the kit-build concept map with the source connection groups overachieve immediate and delay test scores compared with the traditional summarization method and usual kit-build groups?

4.2 Literature Review

4.2.1 Reading Comprehension Strategies

In reading, novices and experts use their background knowledge, some existing cues in the text, and the situational contexts that are combined into a kind of a meaning model constructor of the text. Novice readers sometimes can act like experts when they are given a text and task where they have the appropriate knowledge. On the contrary, expert readers can become novices when they are exposed to ambiguous texts or new information. Accordingly, those two important characteristics of readers, namely, the knowledge that they have and the strategies that they use to foster and maintain understanding, play important roles in distinguishing between the old and new views of comprehension.

On the one hand, strategies emphasize reasoning, and reasoning and critical abilities can be used when constructing and reconstructing the expanding meaning of the text. On the other hand, skills tend to be related to a low level of learning and thinking. Moreover, the strategies and skills of readers are also different in terms of awareness. Strategies signify metacognitive awareness. Expert readers can reflect what they do while reading [67], and they have the awareness to judge and evaluate their understanding. This awareness tends to lead to regulation and repair. In the traditional skill curriculum, presumably, by doing a repeated practice and drill, readers would directly use the skills they have learned to everything they read. No room for neither intentionality nor consciousness will emerge in using these skills; in short, skills will be used automatically or unconsciously.

4.2.2 Comprehension Monitoring

Comprehension monitoring is an ongoing activity that evaluates and regulates the understanding of an individual from a written (or spoken) text [43, 67]. Furthermore, comprehension monitoring is defined as a metacognitive process affected by person,

strategy, and task variables [44]. This activity encourages students to become active during the process of understanding in reading the section [45]. Comprehension monitoring becomes one of the strategies used in reading comprehension because of its ability to enhance learning.

Moreover, comprehension monitoring consists of two parts of processes: (1) being aware of the quality and degree of the understanding of an individual and (2) knowing what to do and how to do it when one finds a comprehension failure. Expert readers are better than the novice ones when using the available resources like looking back to the text to solve the problem. Alessi, Anderson, and Goetz [46] claimed that the lack of knowledge in the consequence of deficits or losing information could be restored almost completely when using an induced look-back strategy on the part of college students. They also found that the monitor of a good reader not only occurs in comprehension monitoring but also becomes the key to restoring the lost comprehension. Monitoring takes a big role to differentiate between expert and novice readers.

4.2.3 Graphic Strategies

A graphic strategy is a common approach to be used in reading strategies. It can be used as a preview phase before reading, throughout the reading process, and at the phase after reading [13]. The whole text structure and the interrelations among concepts are shown in the graphic with a visual method that provides readers a clear and prime understanding of what is being read [14]. One of the graphic strategies is the concept map [15].

Concept mapping offers a graphic strategy that provides readers with new approaches to reading that are different from traditional [8] and also lets learners organize information through visual aids [16]. That kind of action can stimulate their metacognitive awareness [8]. However, concept mapping can also promote some

difficulties; they can be idiosyncratic in terms of design that they require some expertise to learn, and because of their complexity, they may not always assist memorability [17].

A previous study conducted by Liu et al. [16] on concept maps on EFL for college students involved one hundred ninety-two freshmen who were divided into two groups. Their experiment used nine articles from English magazines as the reading material, and they used the reading test provided by the magazines for evaluating the students. The reading test consists of 22 reading comprehension questions, and the test duration is 60 minutes. They also used a revised questionnaire from the questionnaire of Yang [68]. Their experiment was conducted for ten weeks; each class was allocated 2 hours a week. Before the experiment, each group was given a pre-reading test. They classified the students into good and poor readers on the basis of the test. The result confirmed that the concept mapping for the reading strategy was more effective than that for the traditional reading strategy to improve the reading comprehension of poor readers, and for good readers, the learning effect between the experimental and control groups was not always found. They concluded that concept mapping helps students analyze the structure of an article, especially for poor readers.

Chang et al. [8] conducted a study using a concept map with an expert-generated map. They also argued that using an expert-generated map might reduce teacher workload and help avoid student cognitive overload. In their study, the scaffolding group used the expert-generated map employed as a scaffolding instruction with spatial learning strategies. The structure of the expert-generated map was given to the learners as a kind of skeleton structure, but the text in some node was removed so the learners must fill the text by choosing the correct text from the provided list of words. The scaffolding was a teaching method that provides different degrees of assistance for a learner according to his/her progress. In the beginning, the learners were provided with a

complete expert map, so they could analyze the relationship between the map and the reading material. If their performance improved (the percentage of correct propositions increased compared with that in the previous map), then the expert-generated map would be given as an incomplete map and finally without a map at all (an empty canvas like the original concept map). Another use of the expert-generated map in their study was a map-correction approach. In this method, the learners were provided with 40% of the incorrect node interrelation of the expert-generated map according to the reading material. The learners were asked to correct the node contents without fixing the map structure. Chang et al. [8] included one hundred twenty-six fifth grade elementary school students. They divided the group randomly into four (scaffolding-map, map-correction, map-generated, and control groups): one control group, and three experimental groups. In the control group, students were asked to read and make a summary from the article provided for the experiments. Two out of three experimental groups used an expert-generated map. This experiment was conducted for seven weeks using reading comprehension and summarization test as covariates. The experiment result corroborated that the map-correction group was improved more than the map-generation and control groups. The map-generation map score was not so different from that of the control group. In contrast to the map-generation group, the map-correction group outperformed the control group in all tests. Chang et al. [8] also suggested that using scaffolding or map-correction strategies may be a potential approach in a concept map.

4.2.4 Kit-Build Concept Map

The KB-map method is a kind of concept mapping method. In terms of understanding measured by the comprehension test right after the reading process, the KB-map has been proven to have the same efficiency as a normal concept mapping method [69]. Moreover, the KB-map has prime efficiency in terms of recalling information in the text. The KB-map is a closed-end concept map. It means that the student cannot create

their concept and link since it is provided by the system from the dissembled expert map. This kind of approach may reduce teacher workload and learning complexity. However, sometimes, learners make an incorrect proposition because of their capabilities on processing texts, and it would be more difficult if they have some time limitation to complete all the processes (classroom situation). The closed-end approach can also be easily taken into the automatic diagnosis of the constructed map of the learners because it has the same component as the expert map. Therefore, finding a difference among them from the diagnosis result form will be feasible. Using the provided component, learners can construct a map limited by the component itself, unlike the concept maps where learners can freely create the component and the map by themselves.

Several main phases are available in the KB-map: the first phase is goal map building, the second phase is learner map building, and the third phase is a KB analyzer. Goal map building is a phase where the instructor or the teacher or the expert will construct the map from the information source or reading material, and this map will then be called a goal map. Thereafter, the goal map will be dissembled into parts or components consisting of nodes and links called kit. Learner map building is a phase where the learner will reconstruct the map from the provided node and link, and the constructed map by the learners will be called learners' map. In this reconstruction process, learners can only reconstruct a proposition into the map from the provided link and node, and they cannot create any new links or nodes. This process is different from the study conducted by Liu, Chen, and Chang [16] where students were not provided with anything; hence they needed to create their own node and link as the original concept of concept map. The process is also different from that conducted by Chang et al. [8, 10], where students from a scaffolding method group were provided with a complete expert-map structure with an empty text in some nodes and links; thus, the students needed to fill the text by choosing it from the list provided by the system. The KB

analyzer phase is where the teacher or the instructor or the expert will check the learners' map compared with the goal map. The analysis will automatically be provided by the system by using the exact matching method. The exact matching method compares each proposition on the goal map and learner's map (see Figure 12).

Alkhateeb et. al. [69] conducted a study by using the kit-build concept-map compared with the selective underlining strategy to support reading comprehension in EFL. The selective underlining strategy is where students organize what they have read by highlighting, underlining, or selecting the phrases, words, key concepts, and sentences that are important or central to understanding the reading. In this experiment, eight third grade Japanese students of Information Engineering Faculty were involved. Their Test of English for International Communication (TOEIC) score was between 430 and 625. The students were divided into two groups. They were divided equally on the basis of the aptitude pre-reading test. The experiment was conducted six times by using six different reading materials. The result was measured by using an immediate and delayed test and confirmed that the KB-map had a better effect on recalling the comprehended information two weeks after being used.

4.2.5 KB Map with Source Connection

To improve the process of learning during map construction, we have added the source connection function to the KB-map. This function aims to facilitate learners to make confirmation of their understanding in the form of learners' map with the reading material. It prompts learners to confirm each proposition by making a connection between a proposition and a specific sentence of the reading material. After the connection is made, the color of the proposition will be changed into black, and the selected text will also be changed into red (see Figure 13).

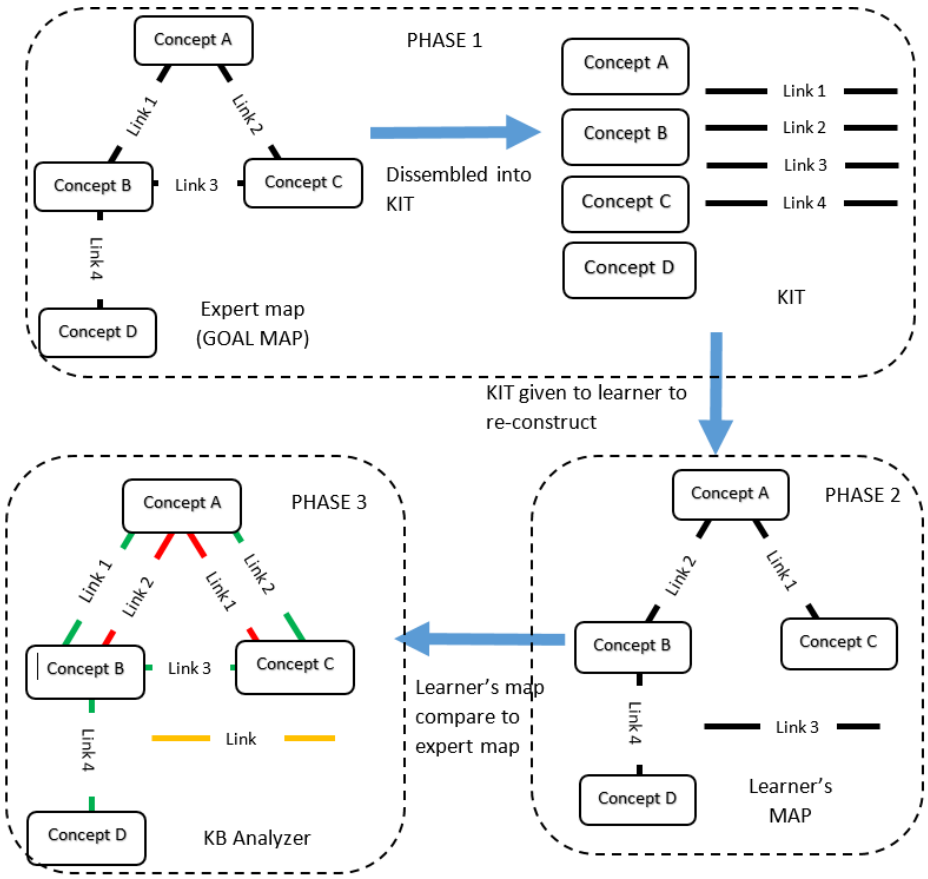


Figure 12. KB-map system lifecycle

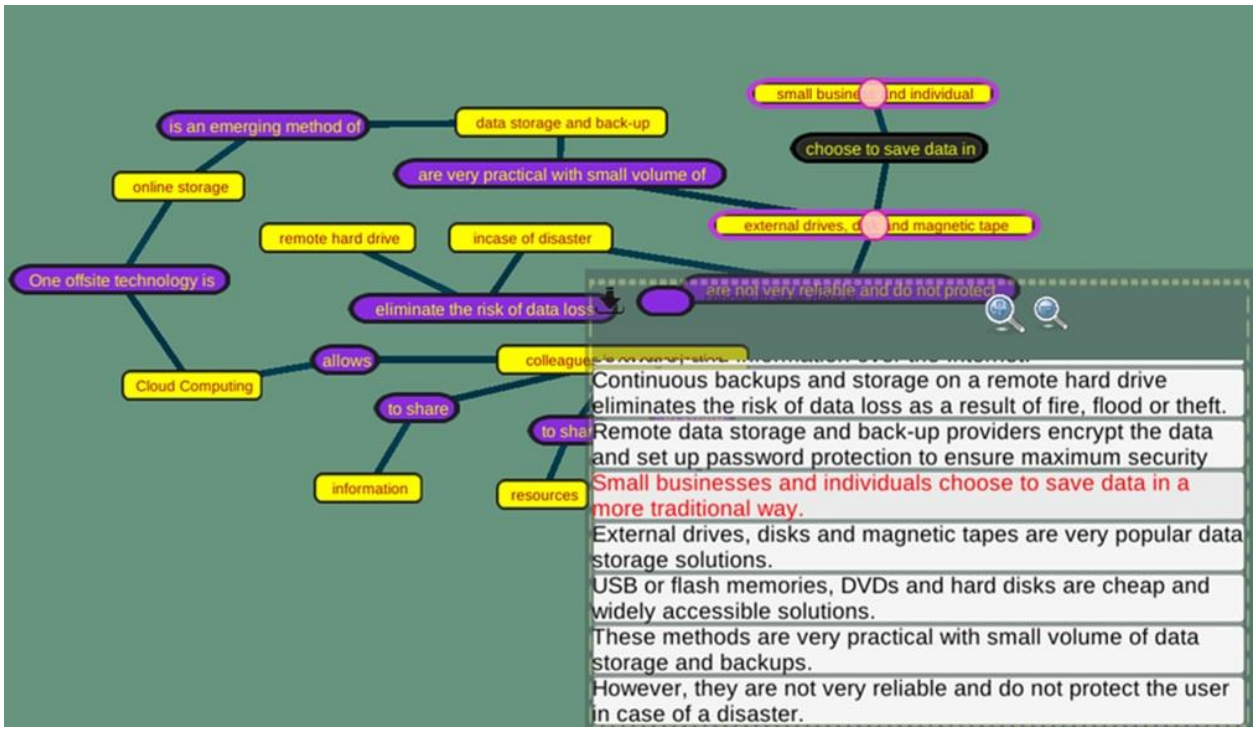


Figure 13. Example of kit-build with the source connection

4.3 Methods

4.3.1 Participants

In this research, 232 sophomore students of the Information Technology Department at State Polytechnic in Indonesia were involved. Their ages range from 19 to 22. Their first language is Bahasa Indonesia. They were divided into three groups: one control group and two experimental groups. To ensure that each group had the same level of reading comprehension, the reading comprehension pre-test was conducted before the experiment shown in Table 7. It was used as a basic guide to create the three groups. We also considered the students' age to check the equality among the groups. Several studies found that age differences in knowledge effect on various outcomes, specifically in term of memory performance. Studied by Morrow, Leirer, Alteri, and Fitzsimmons [70] found that age differences between pilots were eliminated on a task

that provided expert support but not on a task that offered less assistance. Other study also found that age differences between high- and low-knowledge groups were comparable [71]. Some evidence suggests that schematic or contextual information improves readability among older adults [72]. Analysis of covariance (ANCOVA) was used to divide the groups by using score as the main variable and age as the covariate (Table 8). The result confirmed that a negative weak correlation emerged between the age and the score; the younger the age, the better the pre-test score they obtained (see Figure 14), but there was no interaction between the group and the age. This result affirmed that all groups have the same level in reading comprehension.

Table 7. Mean of the pre-test score

Group	N	M	F	Avg. age	Mean	SD
Summarizing method (C)	78	58	20	19.98718	30.1667	11.6423
Kit-build (E1)	77	44	33	19.75325	30.5325	8.5480
Kit-build with source-connection (E2)	77	48	29	19.94805	30.0390	10.6418

Significant code: “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

Table 8. Analysis of covariance (ANCOVA) of pre-test scores

Source	SS	Df	F-ratio	p-Value
Age	287.4	1	2.7353	0.09954 .
Group	0.0	2	0.0001	0.99988
Age:group	139.0	2	0.6616	0.517029

Residuals	23743.4	226

Significant code: “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

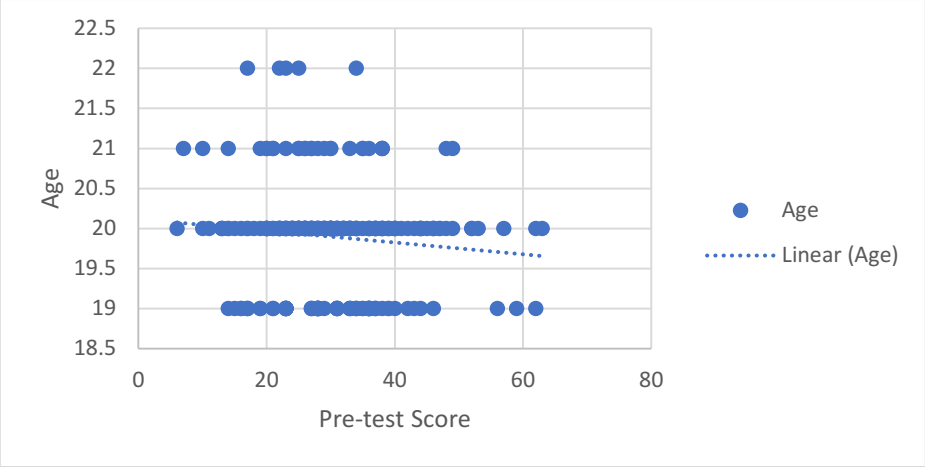


Figure 14. Correlation between age and pre-test score

4.3.2 Instruments

In this experiment, some of the reading materials were taken from the *English for Information Technology book by* Olejniczak, and the other was from the Teacher’s Handbook. The reading materials used were entitled *Data Storage, Channel of Communication,* and *Banana*. Moreover, the Flesch Grade Level formula was applied for each material, and the result is shown in Table 9

Table 9. Flesch Grade Level formula result for each material

Reading material	**Grade level**	**Reading level**	**Reader’s age**
Data Storage	10	Fairly difficult to read	14–15 years old (Ninth to Tenth

			graders)
Channel of Communication	11	Difficult to read	15–17 years old (Tenth to Eleventh graders)
Banana	12	Difficult to read	17–18 years old (Twelfth graders)

We also prepare the goal map and kits for each material, the goal map for each material. The goal map and kits will be presented below

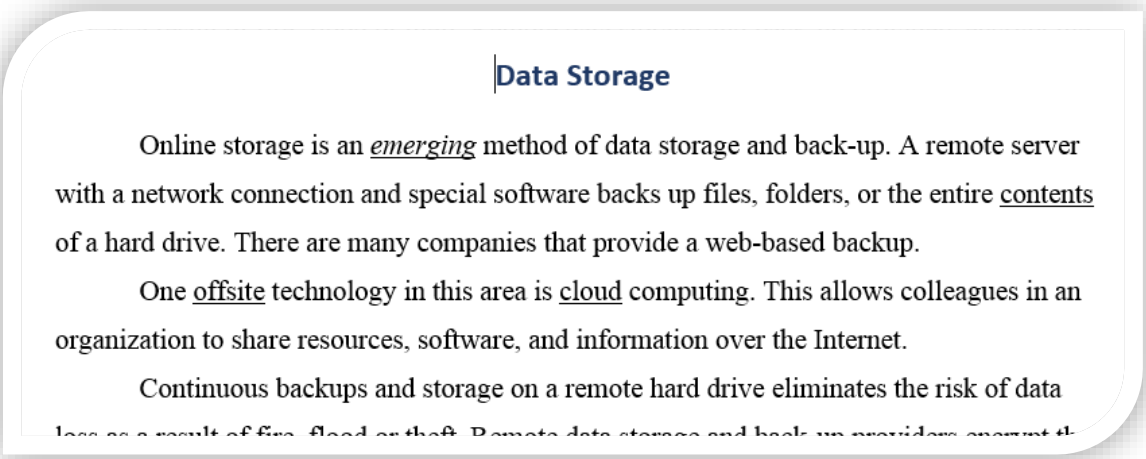
1. Data Storage

   Data storage based on *Flesch Grade Level formula* is the easiest among other. The material consists of 370 words in total. Because we used this material as the beginning of the experiment, we are highlighting some important point in the material (see Figure 15). The goal map consists of 10 propositions (see Figure 16). The kits consist of 11 concepts and 10 links (see Figure 17). Figure 18 show the example of Data storage test.
2. Channel of Communication

   Channel of Communication based on *Flesch Grade Level formula* is stand in the middle among other. The material consists of 456 words in total. we used this material as the second sessions of the experiment, we are not highlighting the important point in the material (see Figure 19). The goal map consists of 11 propositions (see Figure 20). The kits consist of 12 concepts and 11 links (see Figure 21). Figure 22 show the example of Channel of Communication test.
3. Banana

   Banana based on *Flesch Grade Level formula* is the hardest among other, but the topic of this material is a common topic unlike other which is more specific

with the computer science major. The material consists of 320 words in total. we used this material as the third or final sessions of the experiment, we are not highlighting the important point in the material (see Figure 23). The goal map consists of 11 propositions (see Figure 24). The kits consist of 12 concepts and 11 links (see Figure 25). Figure 26 show the example of Bananas test.



Data Storage

Online storage is an *emerging* method of data storage and back-up. A remote server with a network connection and special software backs up files, folders, or the entire contents of a hard drive. There are many companies that provide a web-based backup.

One offsite technology in this area is cloud computing. This allows colleagues in an organization to share resources, software, and information over the Internet.

Continuous backups and storage on a remote hard drive eliminates the risk of data

Figure 15. Parts of Data Storage Reading Material

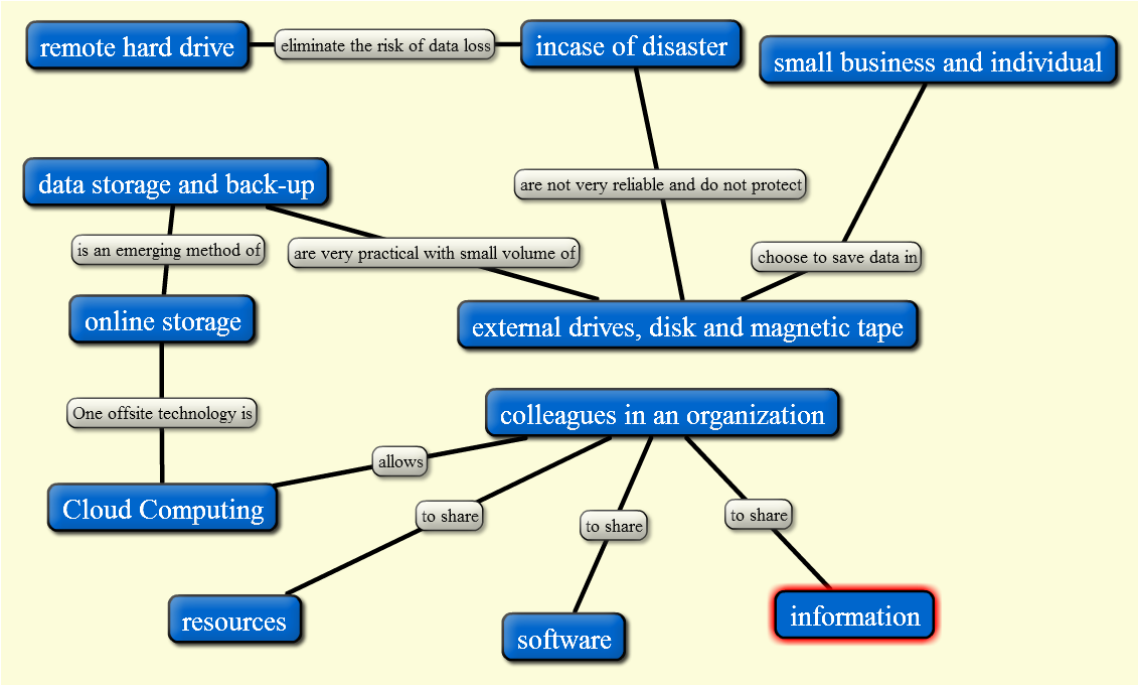


Figure 16. Goal map of Data Storage

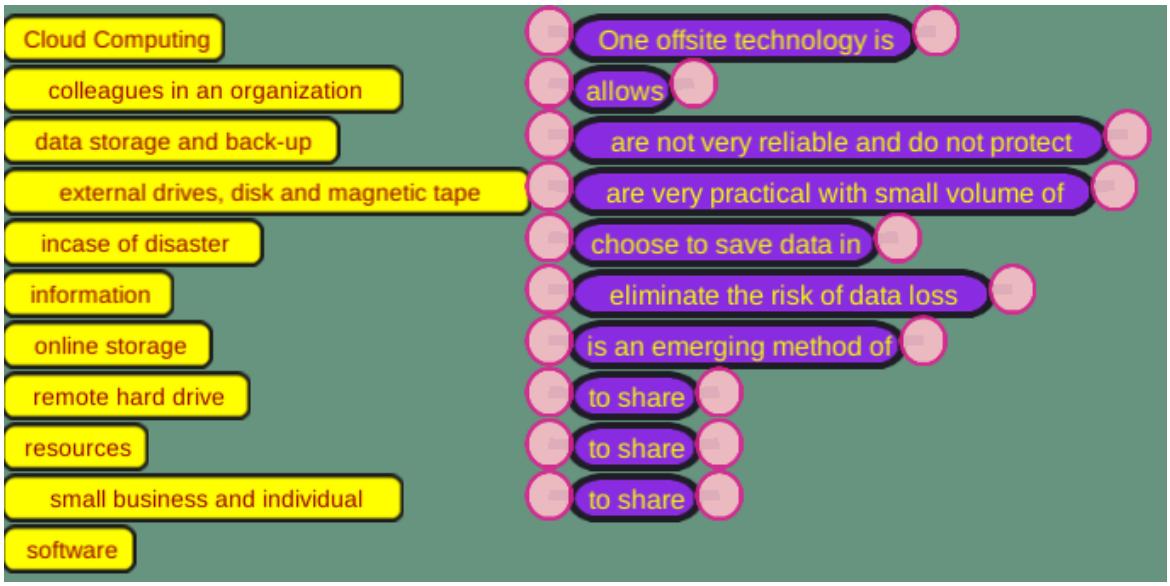


Figure 17. Kits of Data Storage

Data Storage

1. What is the function of online storage? (Related)
   - **a. a method of data storage and back-up.**
   - b. a method of data storage.
   - c. a method of data back-up.
   - d. a method of data.

2. What is being backed up by a remote server? (not Related)
   - a. folders, or the entire contents of a hard drive.
   - b. files, or the entire contents of a hard drive.
   - c. files, folders, or the entire contents of a software.
   - **d. files, folders, or the entire contents of a hard drive.**

3. What is cloud computing? (related)
   - **a. offsite technology to share resources, software, and information over the Internet.**
   - b. offsite technology for resources, software, and information over the Internet.
   - c. technology to share resources, software, and information over the Internet.
   - d. sharing resources, software, and information over the Internet.

4 Why is backing up our data regularly important? (Related)

Figure 18. Example of Data Storage Test

Channels of Communication

What are telecommunications?

Telecommunications refers to the transmission of signals over a distance for the purpose of communication. Information is transmitted by devices such as the telephone, radio, television, satellite, or computer networks. Examples could be two people speaking on their mobile phone, a sales department sending a fax to a client, or even someone reading the teletext pages on TV.

But in the modern world, telecommunication mainly means transferring information across the Internet, via modem, phone lines or wireless networks.

Because of telecommunications, people can now work at home and communicate with their

Figure 19. Part of Channel of Communication Reading Material

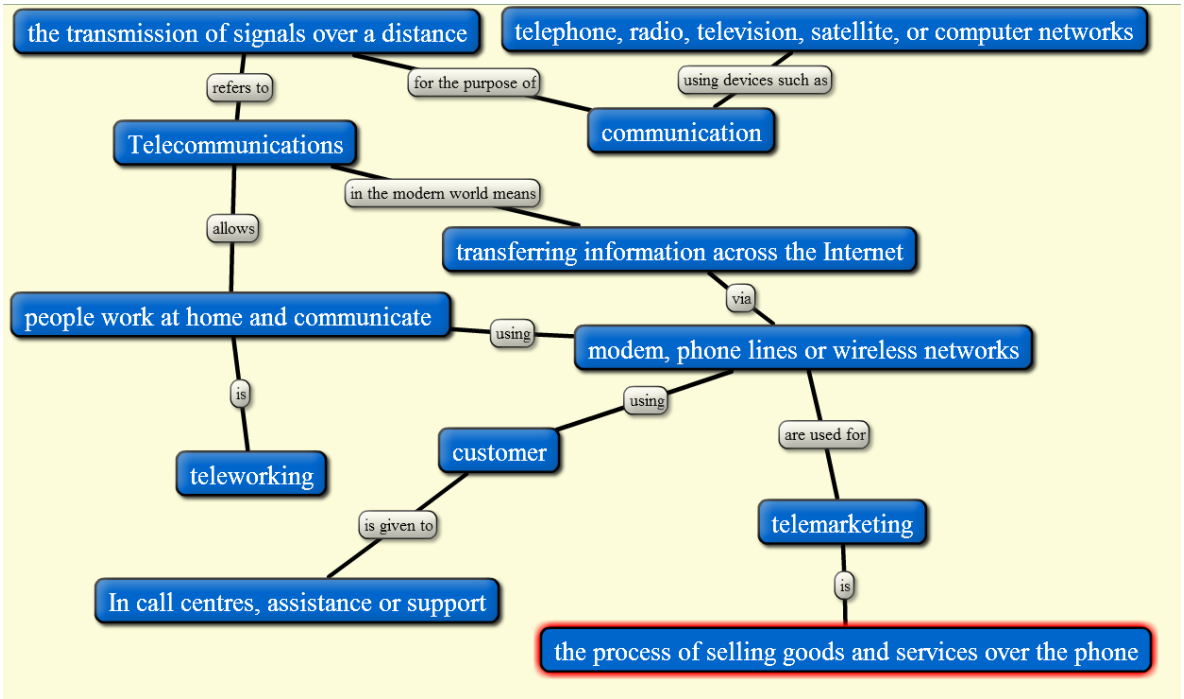


Figure 20. Goal map of Channel of Communication

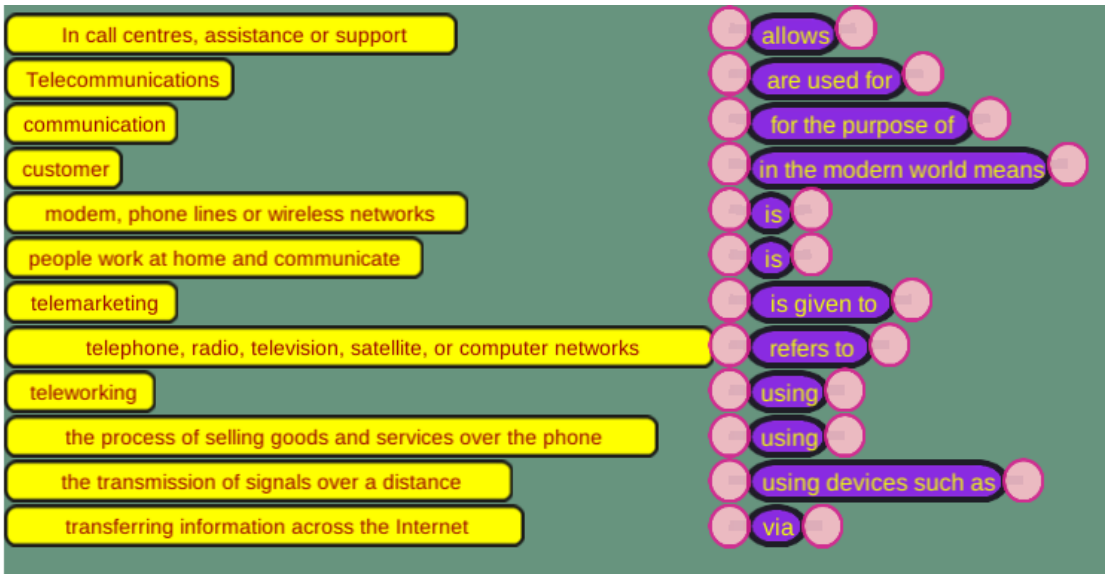


Figure 21. Kits of Channel of Communication

How is information transferred?

- a. Information is sent over the radio signal
- b. Information will be launched through the radio wave
- c. information is transmitted by devices such as telephone, radio and etc.
- d. Information is launched by the transmitter for telecommunication

What is teleworking?

- a. is to communicate people to others by computer and telephone
- b. is a communication around people with its devices
- c. is a connection among peers and telecommunication tools
- d. is a work could eventually be performed outside

What has been predicted about the current work?

- a. Internet connecting each others.
- b. Transferring information will be easier.
- c. All work could possibly be performed outside the workplace.

Figure 22. Example of Channel of Communication Test

BANANAS

Bananas originated in Malaysia as early as 2000 BC, but first banana plantations were established in China around 200 AC. In the early 1500s, the Portuguese and Spanish introduced bananas to the Caribbean and Americas. The United fruit Company, formed in 1899, was responsible for the commercialization of Latin American bananas and controlled most of the trade in tropical fruit into the mid-twentieth century. Nowadays, bananas are trades as a commodity. With the aid of refrigerated transport, bananas have conquered the world.

In fact, the banana plant, Musa acuminate, is the world's largest perennial herb. Cultivation is best suited to tropical and subtropical areas with ample water, rich soil, and good drainage. Because bananas have been cultivated to become seedless, commercially grown bananas are propagated trough division, a process of

Figure 23. Parts of Bananas Reading Material

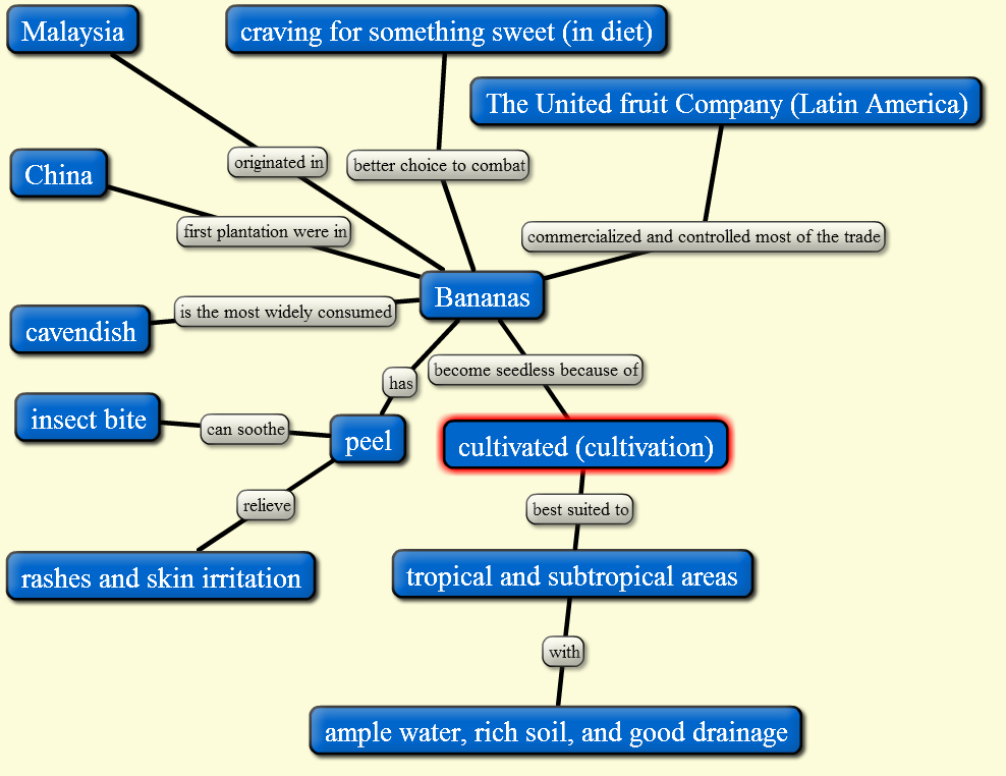


Figure 24. Goal Map of Bananas

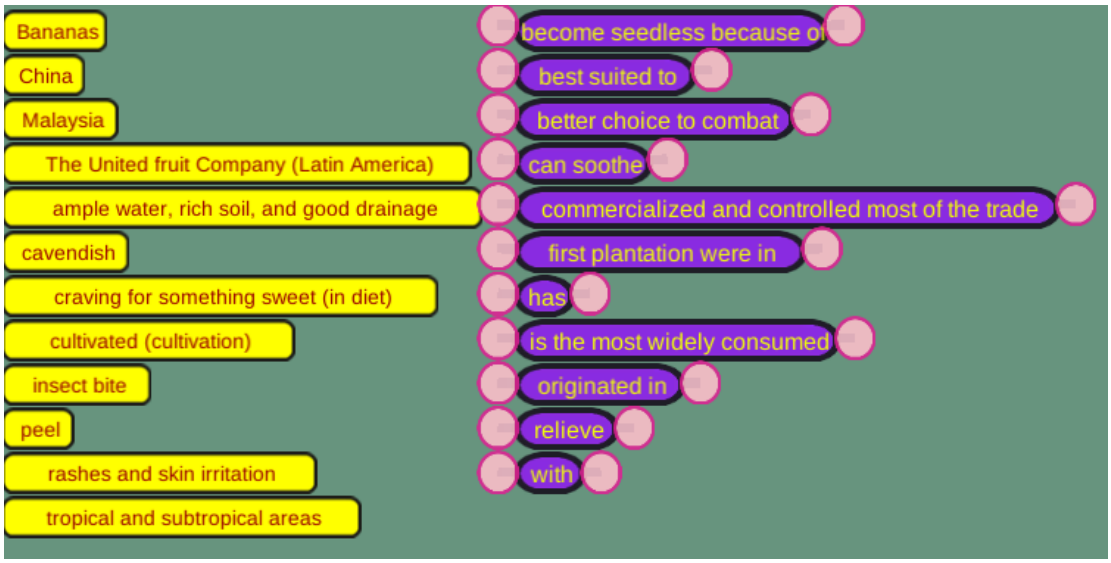


Figure 25. Kits of Bananas

1. Bananas were first grown in _____.
   A. China.
   B. Malaysia.
   C. Spain
   D. Portugal.

2. Bananas were commercialized by _____
   A. Portuguese and Spanish explorers.
   B. Chinese fruit growers.
   C. The United fruit Company.
   D. Caribbean people.

3. The most popular variety of banana is the _____
   A. Cavendish.
   B. Devonshire.
   C. Costa Rican.
   D. William Cavendish

4. The banana peel can be used to cure _____

Figure 26. Example of Bananas Test

4.3.3 Procedures

These experiments lasted 40 minutes per week for each session for each group. During the experiment, the learners did not receive any feedback from the teacher. They had to understand the reading materials by themselves. The complete sections in one session for each group are described in Figure 27. In the second section of the experiment session, we are allowing students from all groups to open the reading material and allowing them to use a dictionary to help them understand words they did not know. However, during the test section, all the materials and dictionaries were closed.

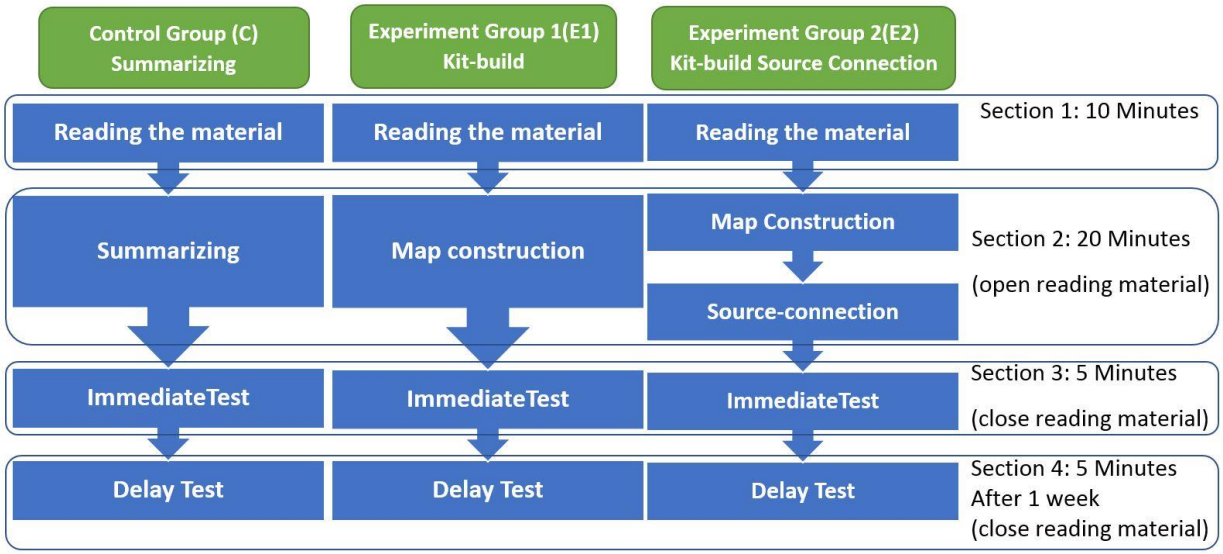


Figure 27. Session allocation for each group

4.3.4 Analysis tools

The ANCOVA analysis was used in this experiment to ensure that the age of the students did not affect the experiment result. The pre-test score was used as the basic guideline to create each group. We wanted to ensure that each group had the same level of reading comprehension. The immediate and delay tests were conducted as the values

to measure the comprehension level of the students in each session. Both tests were used as the indicators of treatment among the groups. Lastly, Holm's sequentially rejective Bonferroni procedure was used as the post HOC analysis to rank up the groups.

4.4 Results and Discussion

4.4.1 Results

These sections were divided into three parts. Each part will show the analysis result for each material. Next is the discussion of the hypotheses that we have exposed earlier.

4.4.2 Material 1 Analysis

The test results for Material 1 were shown in Figure 28 and calculated in several steps. First, the mean analysis was conducted for each group for each test shown in Table 10.

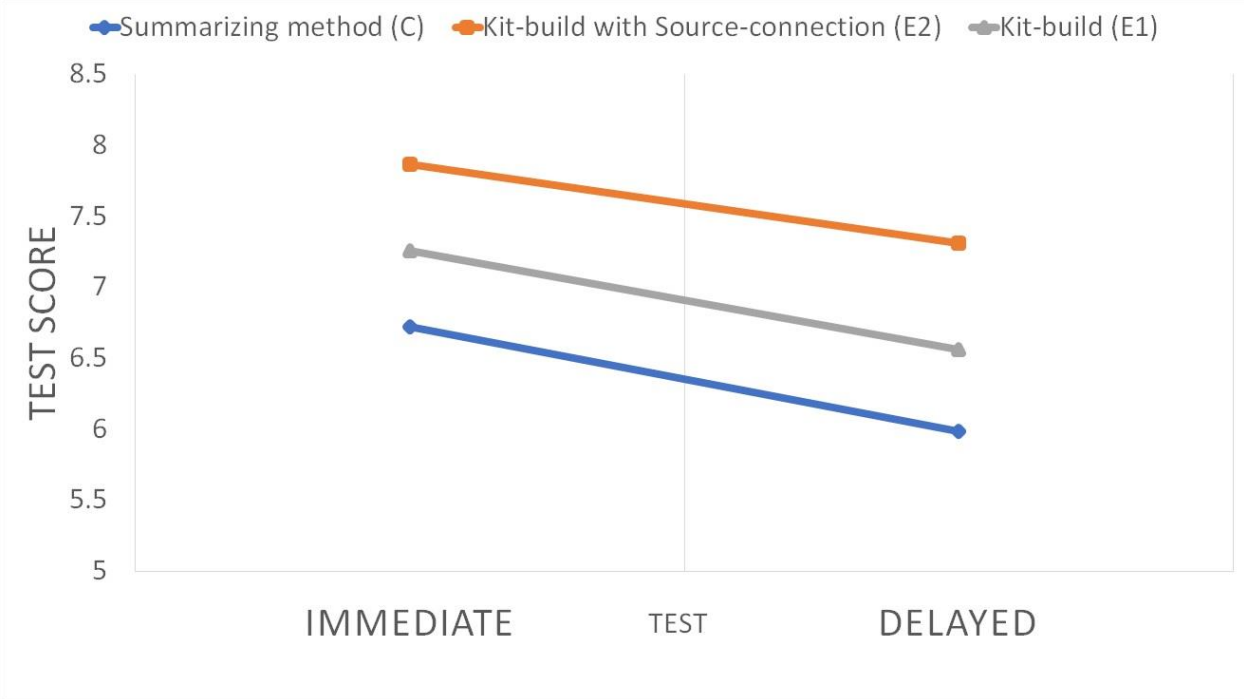


Figure 28. Graphical test result comparison between groups for Material 1

Table 10. Mean of the immediate and delay tests of Material 1 in all groups

Group	N	Mean immediate	Mean delay	SD immediate	SD delay
Summarizing method (C)	78	6.7308	6.0000	1.9585	2.1861
Kit-build (E1)	77	7.2468	6.5844	1.5145	1.6650
Kit-build with source-connection (E2)	77	7.8701	7.3117	1.2392	1.6484

Second, the ANCOVA was conducted to all groups by combining the immediate and delay tests as the variables named group, age and Pre-test as the covariates. Because the data was unbalanced the type II SS was used as the dependent measurement. The result in Table 11 showed that no interaction emerged between the group and the age but there was ($p < 0.5$) interaction between group score and Pre-test, to investigate the result we are conducting a separate ANOVA analysis between immediate and delayed test to explain regarding this result. The result in Table 12 indicates that the Pre-test is effective factors for Immediate test (see Figure 29) and age can be ignored and the result in Table 13 indicates that immediate test and Pre-test are affective factors for Delayed Test and we can ignore the age. Moreover, the age of the students in this session did not affect the scores of the learners, and significant differences ($p < .001$) emerged among the groups.

Table 11. Analysis of covariance (ANCOVA) type II SS result for Material 1

Source	SS	Df	F-ratio	p-Value
Pre-test	198.811	1	75.6051	< 0.001 ***

Age	0.185	1	0.0702	0.791
Group	117.841	2	22.4066	< 0.001 ***
Pre-test : Age	0.338	1	0.1285	0.720
Pre-test : Group	20.043	2	3.8111	0.023 *
Age: Group	16.284	2	3.0964	0.046 *
Pre-test : Age : Group	0.517	2	0.0983	0.906
Residuals	1188.578	452		

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

Table 12. Analysis of Variance (ANOVA) type II result for Immediate test and Pre-test

Source	**SS**	**Df**	**F-ratio**	**p-Value**
Group	50.10	2	10.9877	< 0.001 ***
Age	0.45	1	0.1986	0.6563
Pre-test	66.38	1	29.1169	< 0.001 ***
Residuals	517.51	227		

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

Table 13. Analysis of Variance (ANOVA) type II result for Immediate Test, Delayed test and Pre-test

Source	**SS**	**Df**	**F-ratio**	**p-Value**
Group	14.77	2	3.5156	0.3137 *
Age	0.02	1	0.0076	0.93046

Immediate Test	176.37	1	83.94.61	< 0.001 ***
Pre-test	40.03	1	19.0510	< 0.001 ***
Residuals	474.82	226		

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

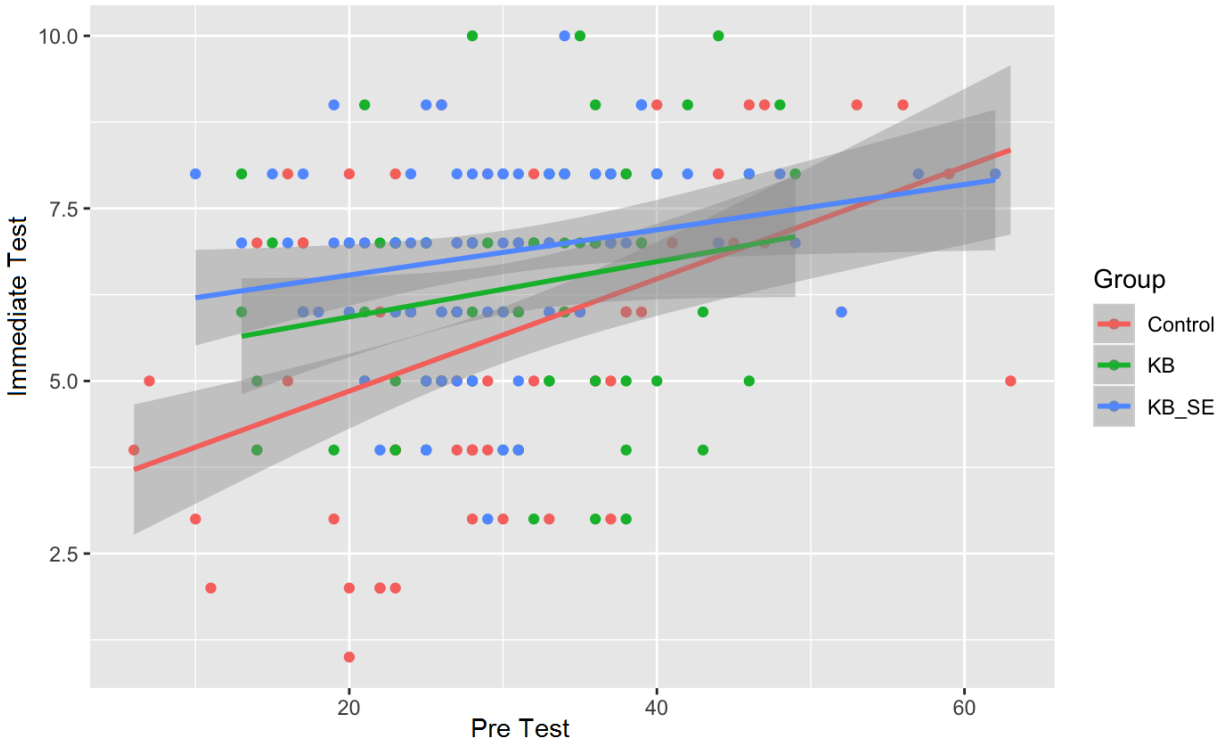


Figure 29. Correlation between immediate Test and Pre-test

However, the main effects of the treatments were observed for each group. Therefore, Holm’s sequentially rejective Bonferroni procedure was applied by combining the mean of the immediate and delay test results for each group (Table 14), and the alpha level used was 0.05.

Table 15 shows the results.

Table 14. The combined mean for Material 1

Group	n	Mean	S.D.
C	156	6.3654	2.1010
E2	154	7.5909	1.4802
E1	154	6.9156	1.6207

Table 15. Holm's sequentially rejective Bonferroni procedure results for Material 1

Pair	Diff	t-Value	df	P	
C–E2	- 1.2255	4.9591	229	< 0.001	C < E2 ***
E1–E2	- 0.6753	2.7240	229	0.0139	C < E1*
C–E1	- 0.5502	2.2264	229	0.0270	C < E1*

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

4.4.3 Material 2 Analysis

The test results for Material 2 were shown in Figure 30 and also calculated in several steps. First, we conducted a mean analysis for each group for each test in

Table 16

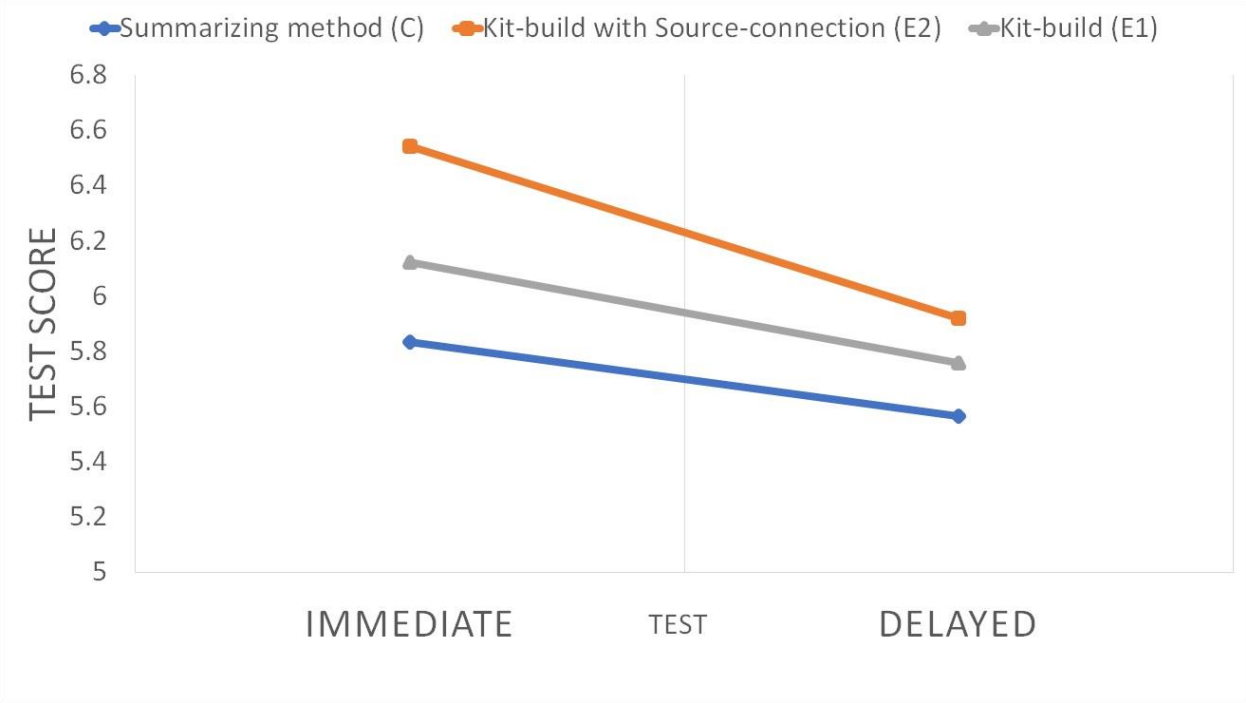


Figure 30. Graphical test result comparison between groups for Material 2

Table 16. Mean of the immediate and delay tests of Material 2 in all groups

Group	N	Mean immediate	Mean delay	SD immediate	SD delay
Summarizing method (C)	78	5.807692	5.564103	1.644019	1.592105
Kit-build (E1)	77	6.116883	5.779221	1.235165	1.429238
Kit-build with source-connection (E2)	77	6.545455	5.922078	1.153318	1.285202

Second, ANCOVA was conducted to all groups of immediate and delay tests, and given that the data was unbalanced, the type II SS was used as the dependent measurement. The result also suggested that

no interaction emerged between the group and the age and between the group and Pre-test that could affect the score. However, to ensure it, we also conducting the ANOVA analysis to support the result. The result in Table 18 indicates that only the Group is the effective factors for immediate Test and the result in

Table 19 indicates that only immediate test is the effective factor for the delayed test. Moreover, the age of the students in this session did not affect the scores of the learners but there is a significant difference ($p < .01$) of scores existed among the groups (Table 17).

Table 17. Analysis of covariance (ANCOVA) type II SS results for Material 2

Source	SS	Df	F-ratio	p-Value
Pre-test	14.40743	1	7.299	0.007 **
Age	0.00112	1	5.68e-4	0.981
Group	23.75992	2	6.019	0.003 **
Pre-test : Age	0.91293	1	0.463	0.497
Pre-test : Group	6.10558	2	1.547	0.214
Age: Group	8.93523	2	2.263	0.105
Pre-test : Age : Group	0.51871	2	0.131	0.877
Residuals	1188.578	452		

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

Table 18. Analysis of Variance (ANOVA) type II result for Immediate test and Pre-test

Source	SS	Df	F-ratio	p-Value

Group	21.17	2	5.7242	0.003756 **
Age	1.28	1	0.6910	0.406711
Pre-test	3.60	1	1.9451	0.164475
Residuals	419.75	227		

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

Table 19. Analysis of Variance (ANOVA) type II result for Immediate Test, Delayed test and Pre-test

Source	**SS**	**Df**	**F-ratio**	**p-Value**
Group	0.911	2	0.3459	0.70799
Age	2.793	1	2.1200	0.14677
Immediate Test	166.024	1	126.0261	< 0.001 ***
Pre-test	5.022	1	3.8124	0.05211 .
Residuals	297.728	226		

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

However, the main effects of the treatments were observed for each group. Thus, Holm’s sequentially rejective Bonferroni procedure was applied by combining the mean of the immediate and delay test results for each group in Table 20, and the alpha level used is 0.05. Table 21 exhibits the results.

Table 20. The combined mean for Material 2

Group	**n**	**Mean**	**S.D.**

C	156	5.6859	1.6177
E2	154	6.2338	1.2566
E1	154	5.9481	1.3421

Table 21. Holm's sequentially rejective Bonferroni procedure results for Material 2

Pair	Diff	t-Value	Df	p	
C–E2	- 0.5479	2.7195	229	0.0070	C < E2 **
E2–E1	- 0.2857	1.4137	229	0.1588	E2 = E1
C–E1	- 0.2622	1.3013	229	0.1945	C = E1

Significant code : "***" .001, "**" .01, "*" .05, "." .1, " " 1

4.4.4 Material 3 Analysis

The test results for Material 3 were shown in Figure 31 and calculated in several steps. First, we conducted a mean analysis for each group for each test in Table 22.

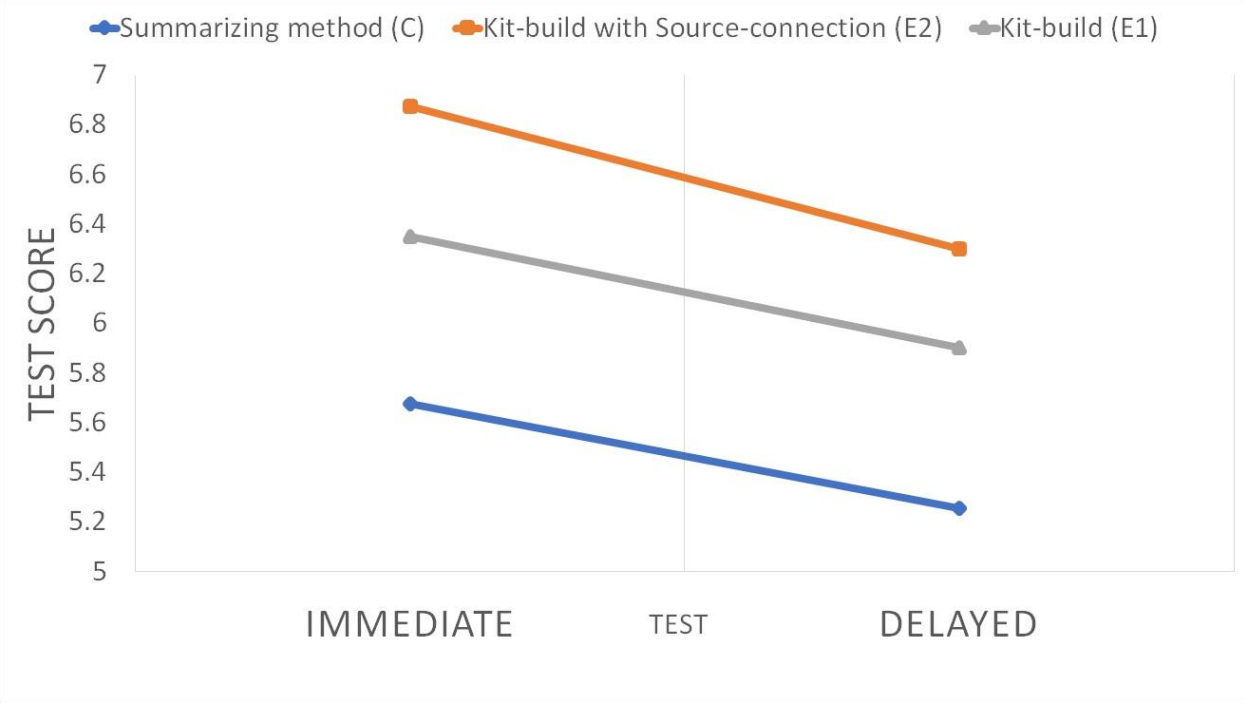


Figure 31. Graphical test result comparison between groups for Material 3

Table 22. Mean of the immediate and delay tests of Material 3 in all groups

Group	**N**	**Mean immediate**	**Mean delay**	**SD immediate**	**SD delay**
Summarizing method (C)	78	5.679487	5.269231	2.028969	2.166289
Kit-build (E1)	77	6.350649	5.922078	1.636478	1.826459
Kit-build with Source-connection (E2)	77	6.870130	6.298701	1.417472	1.953842

Second, ANCOVA was conducted to all groups of the immediate and delay tests, and

given that the data was unbalanced, the type II SS was used as the dependent measurement. The result suggested that there was no interaction that emerged between age and groups that effecting the score in Table 23. The ANOVA analysis was also conducted to investigate more regarding the result. Table 24 indicate that only group and Pre-test are effective factors for the immediate test (see the correlation in Figure 32) and Table 25 indicates that only immediate test and Pre-test are effective factors for the delayed test.

Table 23. Analysis of covariance (ANCOVA) type II SS results for Material 3

Source	SS	Df	F-ratio	p-Value
Pre-test	181.62	1	59.542	< 0.001 ***
Age	4.87	1	1.598	0.207
Group	97.39	2	15.954	< 0.001 ***
Pre-test : Age	5.07	1	1.663	0.198
Pre-test : Group	16.93	2	2.775	0.063 .
Age: Group	2.24	2	0.367	0.693
Pre-test : Age : Group	5.32	2	0.872	0.419
Residuals	1188.578	452		

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

Table 24. Analysis of Variance (ANOVA) type II result for Immediate test and Pre-test

Source	SS	Df	F-ratio	p-Value
Group	54.10	2	10.2856	< 0.001 ***
Age	2.04	1	0.7751	0.3796
Pre-test	70.67	1	26.8719	< 0.001 ***
Residuals	596.99	227		

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

Table 25. Analysis of Variance (ANOVA) type II result for Immediate Test, Delayed test and Pre-test

Source	SS	Df	F-ratio	p-Value
Group	1.18	2	0.2787	0.757031
Age	1.05	1	0.4983	0.480988
Immediate Test	306.00	1	144.9775	< 0.001 ***
Pre-test	18.48	1	8.7566	0.003413 **
Residuals	474.82	226		

Significant code : “***” .001, “**” .01, “*” .05, “.” .1, “ “ 1

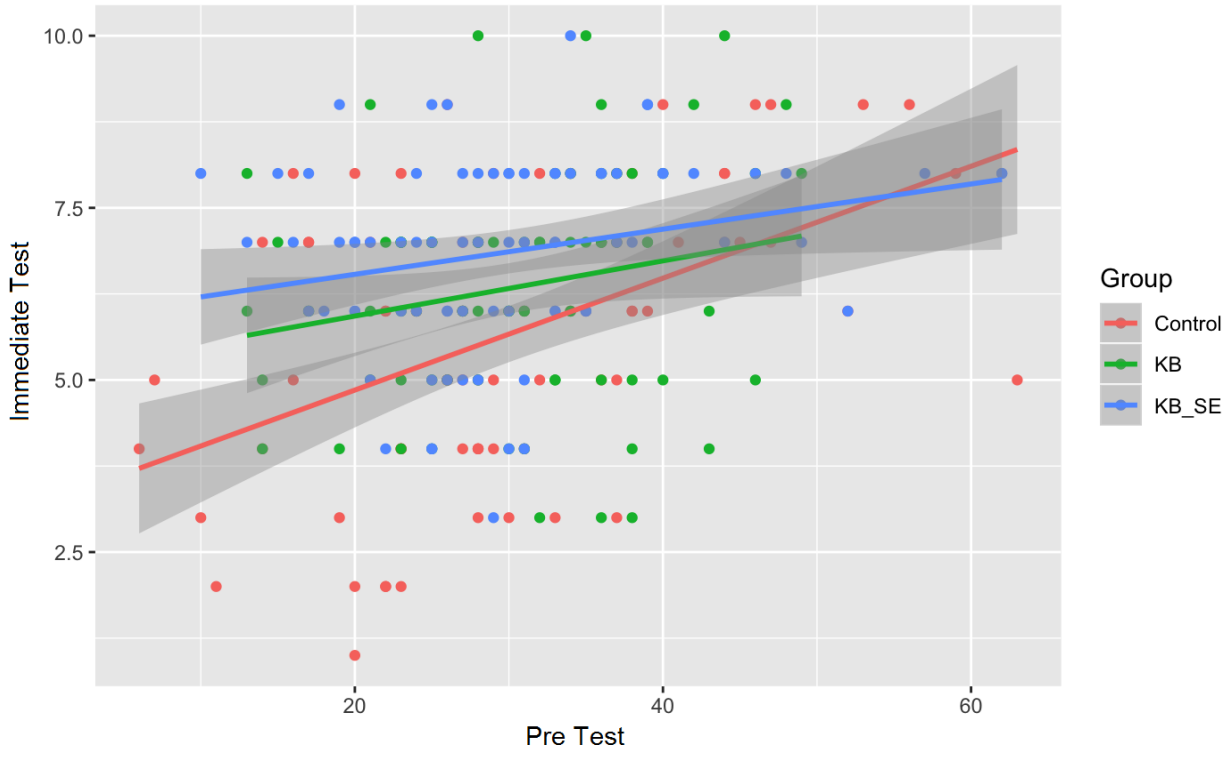


Figure 32 Correlation between immediate Test and Pre-test

However, the main effects of the treatments were observed for each group; hence, Holm's sequentially rejective Bonferroni procedure was implemented by combining the mean of the immediate and delay test results for each group shown in Table 26, and the alpha level used is 0.05. Table 27 shows the results.

Table 26. The combined mean for Material 3

Group	n	Mean	S.D.
C	156	5.4744	2.1021
E2	154	6.5844	1.7253
E1	154	6.1364	1.7417

Table 27. Holm's sequentially rejective Bonferroni procedure result for Material 3

Pair	Diff	t-value	df	p	
C–E2	- 1.1101	4.0812	229	< 0.001	C < E2 ***
C–E1	- 0.6620	2.4339	229	0.0157	C < E1 *
E2–E1	- 0.4481	1.6420	229	0.1020	E2 = E1

Significant code : "***" .001, "**" .01, "*" .05, "." .1, " " 1

4.4.5 Discussion

Most of the facts that we found in the experiment results were in line with our hypothesis. In the first session, the E2 score result was higher among all groups, followed by E1 in the second rank that has a higher score compared with C ($p < .05$) but has a lower score compared with E2 ($p < .05$), and C has the lowest score among all the groups. In the second session, E2 was higher than C ($p < .05$) and had the same score with E1 ($p > .05$), and E1 had the same score with C ($p > .05$). This situation happens because no significant differences emerged between E2 and E1 and between E1 and C, but significant differences existed between E2 and C. In the third session, E2 and E1 had overachieved C, and no significant different between E1 and E2. The answer to the research question would be E2 overachieved C in all the materials, but it overachieved E1 once, only twice were equal. We can confirm that age is not a factor in all the sessions and in two sessions (session 1 and 3) the Pre-test becoming the factor to get a better score in both immediate and delayed test. Learners with a better Pre-test score would get a better score in both immediate and delayed test. In addition to that, the use of KB-map with the source connection makes a difference in both immediate

and delayed test from the summarizing method. This shows that kit-build with the source connection was better way from the summarizing method in this experiment.

Figure 33 shows the learners' way of learning by using the usual KB-map as a graphical strategy. The figure exhibits that the area is divided into two layers. A non-physical layer represents the mind of learners, which cannot be seen, and the physical layer represents the outside world, which can be seen and interacted with. When learners read and comprehend the reading material, the information or knowledge is shaped into some kind of model in their mind or mental model, which can be called an understanding. After reading, they are asked to represent their understanding in a graphical map so that learners can directly see their understanding through the map. This activity aims at making learners realize or see their understanding. This research attempts to improve the learning process by assisting learners to fix their misunderstanding. This additional function is to encourage learners to make a reflection by making a connection between the reading material (the main source of information) and the proposition (understanding of learners in a graphical shape). Figure 34 shows that the additional function aims to urge learners to comprehend the reading material with their understanding of the mental model directly. In short, learners can make confirmation of their understanding of the reading material, repair their misunderstanding, and read the material one more time.

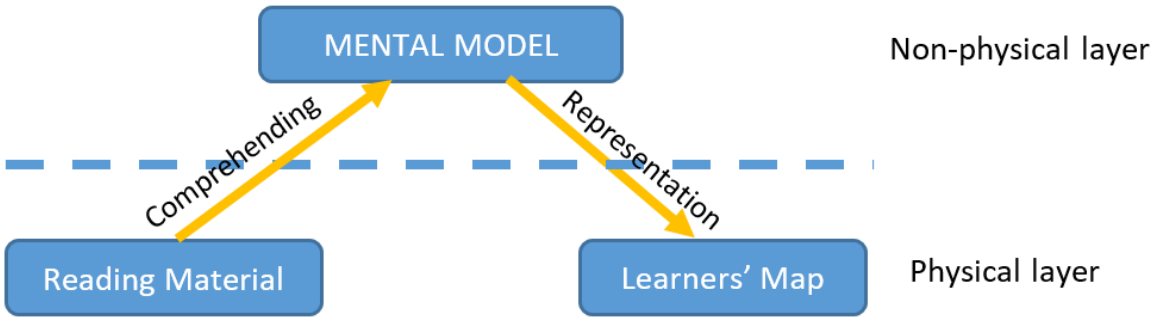


Figure 33. Learner's thinking in usual KB-map

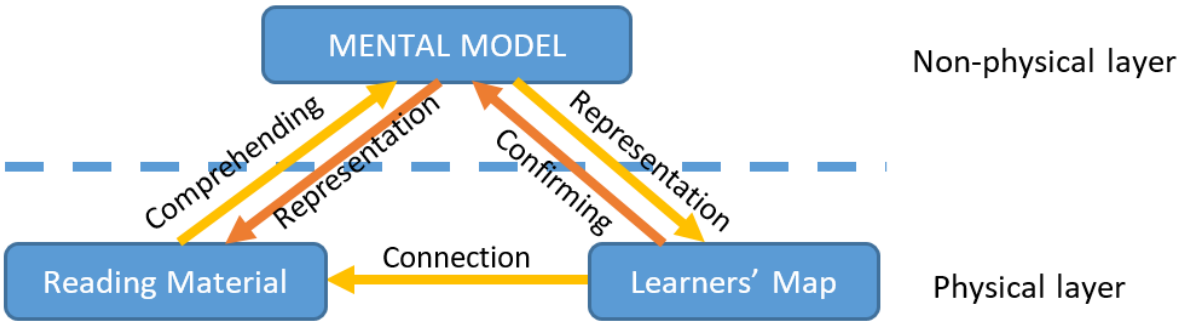


Figure 34. Learners thinking in KB-map with source connection

One of the failures that occur in graphical strategies is learners fail to make a correct proposition. This situation happens because they fail to understand the reading material. For the reduction of the understanding failure, the source-connection function was added to a graphical strategy, and this function aims to encourage learners to repair their misunderstanding. It intends to encourage learners to make confirmation by connecting the constructed proposition with the reading material. According to the fact found, adding the source-connection function to the kit-build concept map could better increase the learning activity in reading comprehension compared with the summarization method and also slightly better compared with the usual kit-build.

4.5 Conclusion and Future Works

Reading in English is a difficult task for EFL readers. Graphic strategies and comprehension monitoring are famous effective reading strategies. Some good readers use these strategies to understand the reading material, unlike the novice ones who are more passive. By promoting these actions, readers can act like good readers where they can confirm their understanding with the help of the system. This study proposes to add the source connection function to the KB-map method to facilitate learners to make a connection between concept maps and the reading materials for inducing comprehension monitoring. The result of the practical use of the KB-map with source connection shows that learners with the function achieve better performance than the ones with the traditional summarization method.

All the group in the second section of the session (summarizing for C Group, map construction for E1 group, map construction and map connection for E2 group) have the same opportunity to access the reading material, However, only the E2 group can confirm or clarify the proposition with the reading material. Most of the good readers using this kind of monitoring by themselves, unlike the novice ones who are more passive. Prompting learners to make a connection to the reading material shows a promising result when combined with the usual KB-map. Confirming their understanding of the reading material offers a new way to improve the kit-build concept map.

This study was conducted for 3 weeks with only 40 minutes in each session, In a general class situation, we cannot say that the abilities of learners are improved. We can only say that during this study, we are able to identify some positive learning effects, and this study offers a new point of view in the learning process of reading comprehension for EFL.

A deeper analysis of the learning process in the KB-map with source connection should

be conducted in the future. This study measures not the process of understanding but the result by questions about the content. Checking whether the proposal can change the comprehension process of EFL readers is also crucial to prove the hypothesis of this study. The analysis of operations in map-construction and map-connection and answers to the immediate and delay tests contributes to the revelation of the comprehension process of EFL readers with the KB-map with source-connection.

5 Conclusion

In this dissertation, we can confirm that KB-Map user are avoiding the sentence-by-sentence reading style of EFL reading comprehension unlike the normal Concept Map user. We can confirm the finding that being found by Alkhateeb [59] and added a new definition for the KB-map user reading style. The KB-map users are not bound with the sequence appearance order of sentence in the material but more bound with the paragraph structure of the text. It means that the KB-map is encourage the learners to have do the same style as the proficient readers.

We also successfully made an improvement in KB-map to help readers understanding the reading material in Reading Comprehension for EFL better by adding a new function called source-connection. The function proven to be more effective compare to the summarization method. The KB-map with source connection group are over achieve all the test compare to the summarization group. And there are also an indication that KB-map could improve the poor reader better than the summarization. Further research need to conduct to strengthen this indication.

We have conducted two experiments and published the finding that we found. The first experiment was conducted in six sessions within two months involving eight Japanese students divided into two groups based on their TOEIC reading score to have the same group. The result of this experiment was that we could explain the KB-map user characteristic clearer and we need to support KB-map user differently with the concept-map user. The KB-map users are not bound with the sequence appearance order of sentence in the material but more bound with the paragraph completion. They tend to construct the proposition that coming from the same paragraph than move to another paragraph without following the sentence appearance order. The second experiment was conducted in three sessions within four weeks involving 232 Indonesian students that were divided into three groups based on their reading pre-test score to have a

balanced group. The purpose of this experiment was to enhance the support of KB-map in Reading Comprehension for EFL students by adding a function called source-connection. The source connection function aims to increase the students' awareness of their understanding by facilitating them to confront their understanding with the reading material. By doing such activity, we tend to facilitate student to make a self-reflection to confirm their understanding with the source by themselves. The result of this experiment was not as expected but acceptable. Statistically, groups with the source connection function were overachieved the traditional method in all sessions, but only one out of three overachieved the KB-map only groups. Even in number, they are higher, but statistically, there was no difference. Moreover, for the KB-map only group, they succeed in overachieving the traditional group in two out of three sessions.

5.1 Limitation of Experiments

The first experiment has a lack of participants, where it only consists of eight participants However, we try to experiment as close as the real class by using six material for each day in seven weeks and adopting the class like environment where there are other numbers of activity besides the experiment activity. And for the second experiment, we have many participants from a real class situation. The experiment was close to the real environment, but we cannot say it represents the real class since there are some limitations in the experiment. The number of the test used is smaller than the real class situation, the reading material used is not as much as the real class situation. And the lack of interaction of the Teacher-student was not present since we are limiting the involvement of the teacher in the experiment.

Given the limitation makes this study focused to achieving the specific goal and able to give a clear image and input in order to be implemented in a real class situation. The

experiment also opens many new ideas to improve the use of KB-map for future research.

5.2 Future Works

For further research, we are planning to use the KB-map in Indonesia especially in State Polytechnic of Malang. The teachers that involved in the previous experiment were impressed and asking for using KB-map for their daily teaching. KB-map were proven to be an effective tool to improve the students understanding and the teacher are able to explain better since it can show the different between them. Another future work is we are aiming to investigate the student behavioral deeper by using the data that we found to analyzed the student understanding by visualizing the pattern they have made when using the system. We can try to investigate and gather the information regarding the reason behind their decision, try to simulate their steps and makes a prediction based on their previous activity.

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