Kolb's Learning Styles and Educational Outcome:
Using Digital Mind Map as a Study Tool in Elementary English Class

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In learning a language, one critical aspect that affects the result is the learner's style. Because the style affects the learning result strongly, systemic analysis and understanding it are one of the features of being a teacher. For this study, in training vocabulary, besides learning just one word, we have used the Digital Mind Map, which applies all other relative vocabularies, to the learning. In addition to that, we rephrased the Kolb's survey to contrast sentiments, such as the interest, concern, and self-confidence, between using and not using the Digital Mind Map. Firstly, we divided the students into four groups (divergers, assimilators, convergers, and accommodators) with Kolb's learning style inventory. And we applied Digital Mind Map (http://www.mindm.com) which can be used as one of the tool to learn English vocabulary giving them the visual support. We have organized the essential vocabularies for elementary students into different units and reconstructed the English classes with applying Digital Mind Map constantly. After the each class, we measured the improvement of vocabulary and the satisfaction about the class. We concluded that the Digital Mind Map class is effective according to the paired t-test taken before and after the classes for all four groups. Also, even the students in both with mind mapping and without it, who did not have any difference in the ability of English, showed significant improvement in the group with mind mapping according to One-way ANOVA test and scheffe's post hoc tests. The most impressions told that the Digital Mind Map helped to rapidly find and memorize vocabularies, otherwise it was hard to connect with already known knowledge and using a tablet PC indulges out of the class. In this wise, the Digital Mind Map shows different effects on different learning styles, so that it is necessary to construct different teaching styles according to learner's style.

Keywords: learning style, digital mind map, learner's characteristic, English vocabulary

Introduction

Learner-centered education considering learner's characteristics and individual differences is major educational trend of these days. In case of English studying, the learning style of the student is the primary factor that determines the achievements and many educational scholars accept this and proceed their researches on it. In linguistic education, there are several learning styles, like continuous repetition (Oxford & Lavine, 1991). These learning styles are the factor that determines the size of achievement in the second language education. Kolb (1985) claimed that changing the method of teaching based on the majority's learning style is effective in recollecting the memory of the class. Additionally, he insist that if the learning style and class style matches, the achievement is qualifying, however, if those do not match, students tends to be bored and weary and even it even cause conflict between teacher and students (Oxford, 2001).

In learning English as a foreign Language, especially in beginning phase, the most important thing is vocabulary. Vocabulary is the base of communication in that language. Therefore, it is critical to try out various and different teaching style that cheers students to acquire vocabulary easily without negative emotion about it. In order to accomplish this, it is very effective to apply mind map system which helps to know relative vocabularies along with a base word. Also, it can help students to develop a motivate attitude. Digital Mind Map can show the meaning and relationship among foreign words using simple symbols which can help understanding meaning and grammar with visual support. Like this, the system with the technology of ICT can motivate the Digital Mind Map to spread widely. Digital Mind Map allows user to draw, fix, and save simply in addition to quick mind mapping which make user to learn vocabulary faster. Also, it can turn the mind map into the forms of PDF or picture files, so it can be used

widely. However, this system have confronted lack of usage due to the publicity and recognition problems (Cho, 2007). In the nowadays situation, the smart educational period, in the most schools, digital textbook and digital education is approaching to us rapidly, so, it will be essential to be ready for the digital era even in mind mapping system.

In this process, the research on the various styles of learning will allow us to learn foreign languages faster and deeper. For these reasons, this research will present how Digital Mind Map will effect on many students vocabulary skills. It will show the consideration of Digital Mind Map for the different learning styles.

Theoretical Background

Learning Styles and Educational Outcome

How students are engaged in classes is very different from one to another. One can understand fully by only listening to the instructions but some understand fully by touching and seeing with their own eyes. Some students focus on data, formula and facts, and some focus on charts, and pictures that can be visualized. In other words, we can simply observe that their method of learning is very diverse. Like theses, there are many other different and unique methods of how people learn and acquire data, and it is called learning style (Felder & Henriques, 1995). In this research of learning style, researchers have different opinions (Dunn, 1981; Grasha & Reichmann, 1974; Gregorc, 1984; Kolb, 1985). Within those opinions, Kolb (1985)'s experimental learning is most universally known. He thinks learning style is affected by how one was grown and what they experienced and divided into four categories such as divergers, assimilators, convergers and accommodators like Figure 1. Those separated categories of Kolb's experimental learning style build and deliver diverse knowledge and provide theoretical outline, so it affected much in learning style research (Choi, 2011).
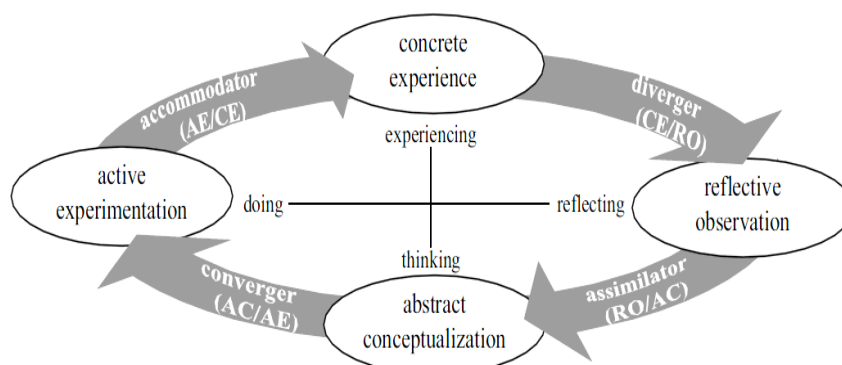

Figure 1. Kolb's experiential learning model. Adapted from: Kolb (1984)

When those learning style are in consideration, researches about positive class effects are like this. From the result of Carthey's research (1993) to investigate academic achievement following learning styles targeting 2nd grade students of Northeast Iowa Community College, it is said that through specific learning experiences, teaching strategy of additional practice and suggesting problem-solving need to be applied to Divergers. Besides, from investigating differences in interaction between learners and teachers and levels of achievement following learning styles in business training using WBT, the result showed that there were differences and distinctions between Divergers and Convergers, and Convergers were given higher scores than Divergers in levels of achievement. Cordell (1991) applied CAI programs which were designed differently, one as linear format and the other as branch format, and the result did not show any differences between each format. Kim and Park (1999) took one-way ANOVA in educational outcomes following each learning styles in studies using web boards, the result showed meaningful differences between Divergers and Convergers as Convergers has higher ability to self-regulation than Divergers. When examining such results, the relationship between academic achievement and learning styles has not been clearly clarified.

However, when we observe researches that pointed out erroneous parts of the previous researches, Hwang and Cho (2005) said previous learning style is mostly focused on linguistic elements and mathematical elements. Also, Silver, Strong and Perini (1997) criticized that previous researches are like squeezing students into a specific outline that was made already. That kind of a learning style is likely to

pass over influences and environment that affects studying. Garner (2000) criticized about discordance of Kolb's learning style and errors, and Spark (2006) reported that people's learning style is not fixed, but rather changes by growing.

When looking at those opposite researches, relationship of learning style and achievement is still not fully discovered. Therefore, there is a need of more researches of learning style and achievement.

English Class Using Digital Mind Map

A mind map is a diagram used to represent words, ideas, tasks, or other items linked to and arranged around a central key word or idea (Buzan, 1991). Mind maps are used to generate, visualize, structure, and classify ideas, and as an aid to studying and organizing information, solving problems, making decisions, and writing. The elements of a given mind map are arranged intuitively according to the importance of the concepts, and are classified into groupings, branches, or areas, with the goal of representing semantic or other connections between portions of information. Mind maps may also aid recall of existing memories.

When we see the researches that were done in using mind map and class's positive effects, it is like this. Oh (1998) applied mind map into English skill in order to activate central thinking, and said if we use mind map into language skills, it is possible to organize thoughts without suppressing disorganized materials. Also, linking research to Kim (2005)'s who said it is possible to get a higher educational achievements because students use both sides of the brain. If mind map is used in language skills, students will naturally achieve language and get interest and confidence. It reported that if mind map was used and suggested in language skills, it is more efficient to get better learning style to students than book based learning style.

Bratt and McCracken (2007) emphasized on necessity modeling (tailoring) classes using Digital Mind Map as an educational method to help learners to have advanced thinking abilities such as logical thinking and problem solving abilities. In other words, Digital Mind Map as a tool based on computer making learners more clever is necessary to practically use in classes in order to help and promote learners' recognition process.

On the other hand, Jung, Park and Park (2004) claims that mind mapping is unusable for mathematics, since human-kind has lack of ability to relate different concepts and that the failure to draw the mind map will burden the students. Shim (2002) has reported that mind map is only effective in advanced classes in attitude and accomplishment. Baek (2011) pointed out that mind mapping have no effect on students before 9th grade because they don't have enough idea to follow the mind map.

Because there are such contradicting theories about mind mapping, both good and bad sides of Digital Mind Map must be considered. Language education with mind mapping can increase the constructional, initiative, contemplative sides of the education. And it motivates students to increase the participation in class and interest.

In this research, we have tested the fact that Digital Mind Map can have a positive effect on elementary education process.

Educational Implications: From Theory Practice

Research Questions

In this research, we have made following hypothesis to see how Digital Mind Map can affect the various groups of students.

H1: Digital Mind Map will cause positive effect on increasing vocabulary part.

H2: Depending on the learning styles, Digital Mind Map will have different effect on students.

Research Design and Methods

To test these hypotheses, we had experiment in two elementary schools in E-chen city of South Korea. We tested 100 fifth grade students and picked out 71 students who had definite learning style of their own. These students did not take any private classes out of school.

To divide them into divergers, assimilators, convergers, and accommodators, we performed Kolb (1985) learning style inventory. For this survey, we reformed the survey sheet based on Jeon (2001), Park

(1998), and Kweon (2001)'s research with three elementary school teachers and two educational technology specialists.

Before the class with Digital Mind Map, we tested the students' vocabulary ability with one-way ANOVA test. The vocabularies used on the survey has been tested in a exam of five listening, five reading, and ten writing questions with various topics after modifying with two elementary school teachers and two English language teaching specialists.
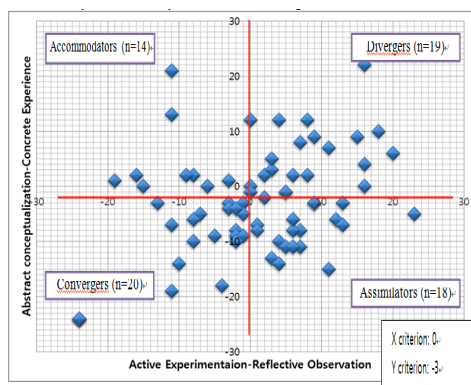

Figure 2. The distribution of the subject of study

As a study tool, we utilize Digital Mind Map to aid the students to study and memorize English vocabulary. Digital Mind Map, which is available at http://www.mindm.com, is a mind mapping and brainstorming software that can be used for capturing ideas, taking notes in a more visual interface, and organizing information graphically with some reference to mind-mapping.

In addition, Digital Mind Map allowed students to participate and be interested in class by sharing the results with other student online.

We trained the students to have no trouble to use the Digital Mind Map prior to the classes and we tested that the ICT skills of the testes are very fine and there is no effect on the result of the study by it. The supporting school had good ICT environment along with the fact that all students have their own tablet PC. Accordingly, all students have been educated in using the tablet PC and computer. Therefore, they had no problem using computer for Digital Mind Map.

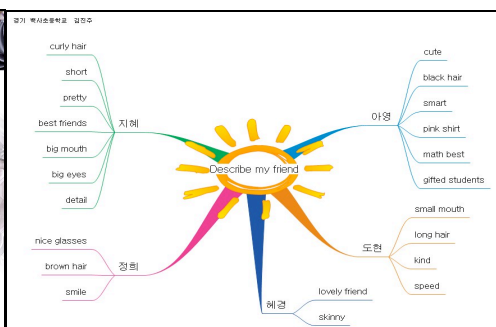*Figure 3*. Digital mind map software   *Figure 4*. Students' products

By analyzing English textbooks for fifth grade in elementary schools and teachers' guidebooks, operating plan for curriculum was established as in Table 1, and main vocabularies in each chapter were extracted. As in Table 2, occasional guiding plan in each chapter prepared and then, vocabulary teaching was accomplished. At each 6th occasion of the chapter, teaching was proceeded by using Digital MindMap, and their teaching was continued in the intervals such as extra time after school, in the morning studying time, and lunch time after school in order to constantly maintain vocabulary studies. Classes were proceeded as concertly establishing guidance plan of vocabulary teaching with Digtal MindMap as in Table 3. At each occasion per chapter, the meaning of new words was suggested, and

activities confirming part of comprehension were conducted. At 6th occasion, activities enhancing vocabulary were taken by groups.
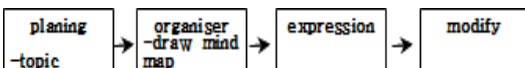
Table 1. *Curriculums Examples Using Digital Mind Map (Examples)*

Lesson	Mind map topic	Vocabulary	Lesson	Mind map topic	Vocabulary
1. How are you?	Greeting	about, angry, fine, cold, headache, home, love, tired, really, well, good, great	9. Whose boat is this?	possessive	mine, your, his, hers, boat, glue, sock, car, back
2. Do you have English class today?	Subject	art, English, math, music, science, physical education, social, Korean	10. Do you want some more?	food	ahead, chopsticks, fork, full, knife, more, some, try, use
3. It's under the table.	Stationery	ball, bookcase, box, scissors, pencil case, ruler, eraser, TV, under, desk, pen	11. What are you doing?	action	clean, kick, dance, sing, play, study
4. What a nice day!	Exclamation expression.	city, elephant, elevator, excuse, idea, over, picnic, rock, sky, tall, tower, wonderful	12. This is a bedroom.	rooms	living room, bedroom, bathroom, backyard, kitchen, storage, warehouse
5. Where is Gyeongbokgung?	Direction	right, left, corner, bank, church, hospital, just, middle, pardon, problem, straight, turn, way	13. Can you tell me about your family?	family	cousin, enjoy, favorite, fun, museum, park, river, telephone, yesterday, zoo
6. I get up at seven every day.	Life schedule	get up, wash my face, have breakfast, have lunch, have dinner, go to school, do my homework	14. Is peter there?	phone	free, speak, turtle, rest, ring, sea, dream, slowly, race, museum, deer
7. How's your sister?	Describe My friends	tall, big, hansome, small, ugly, pretty, ear, glasses, hair, long, short, singer, uncle	15. Can you join us?	spare time	everywhere, join, must, potato, together, windy
8. How about playing baseball?	Suggestion	busy, camping, lesson, paper, ready, shopping, sound, library, riding a bike	16. What did you do yesterday?	past tense	went, did, played, visited

Table 2. *Process of Digital Mind Map English Class (Examples)*

period	Contents	Activities	Vocabulary	mindmap strategy
1	• Look and Listen • Listen and Repeat • Let's Practice 1	• Listen and watch CD-ROM • Listen and Repeat • Slam Game	short long big tall small handsome ugly beautiful good great nice color black white brown blue eyes nose mouth ears hair glasses	Voca brainstorming Image brainstorming
2	• Listen and Speak • Look and speak • Let's Sing • Let's Practice 2	• Listen and watch CD-ROM • Listen and Repeat • Sing along: She's Tall • Finish the Features Game		Topic Vaca learning
3	• Listen and Read • Let's Read • Let's Practice 3	• Read the words describing the body parts. • Domino Game		Find topic word. Mind map through word root
4	• Let's Write • Read and Write • Listen and Write • Let's Practice 4	• Write the words involving the body parts • Make a Funny Picture Activity		Similar ward through key word Life scheduling mind map
5	• Story Time • Activity 1 • Activity 2	• Listen story and understand • Solve the Listening and Speaking task • Solve the Reading and Writing task		Analysis of listening story
6	• Let's Review • Project	• Review and Consolidate the Unit. • Digital mind map		Reminding strategy

Table 3. *Lesson plan of Digital Mind Map English Class (examples)*

Subject	English	Grade	5th	Textbook	90-91	
Unit	7. How's your sister?			Teaching Style	Co-teaching	
Vocabulary	tall, nose, mouth, face, big, small, short, long, hair, ears, handsome, pretty			Period		6/6
Objectives	·Students should be able to use the expressions they've learned by doing an activity. ·Students should be able to apply what they learned to real situation through the review.					

Steps		contents	Teaching-Learning Activities	
Introduction	Project meet	▫Greeting ▫Motivation ▫Review	‣Ask and answer about their feeling, weather and day and date. ‣Guess who? about principle. ‣Check what they learned last class.	Discussion and Feedback
	Project planning	▫Statement of the objectives	‣Statement of the objectives ·Students should be able to use the expressions they've learned by doing an activity. ·Students should be able to apply what they learned to real situation throug the review.	
		▫Guide of today's activities	‣Guide of today's activities Activity Ⅰ Card game Activity Ⅱ Making UCC Activity Ⅲ Whispering game Activity Ⅳ Digital mind map	
Development	Explore	▫Card game	‣ A teacher describe 3 different people. Students grab picture cards from "yellow work box"	
	Sharing	▫Making UCC	‣ Students open their TPC. They're going to make ucc using "window movie maker". Each group has theme. ‣ The teacher give you 5 minute for each group. ‣ Do your own work then discuss your work with other group members. Later presenter, from each group, is goint to present their work. So you need to select one person. One leader from your work.	
	Sharing2	▫Whispering game	‣Mr. Kim, I-ju, Bum-su and I are going to whisper to the first person of each group. Each person need to whisper to the next person until last person get all information. The last person in each group must draw what they have heard on the blackboard. If you draw the picture conectly, you can win. Each group has all same information.	
	Solve the task	▫Digital mind map	‣Work Digital mind map ‣Save Digital mind map->Share with friends 	
Consolidation	Follow up	▫Guide	‣Guide the next lesson. ‣Fare well	

Results

Hypothesis Testing Result

This research was conducted in order to examine differences in vocabulary per learning styles in English classes with Digital Mind Map being used as a study aid. The results from each hypothesis are as follows.

H1: Digital Mind Map will cause positive effect on increasing vocabulary part.

To see the improvement of English vocabulary using Digital Mind Map, we performed Paired t-test shown in table 4 and the result showed 0.001 of overall improvement was appeared. Digital Mind Map increased the test scores in all groups of students. This result tells that it helps students to acknowledge meanings and relationship among vocabularies just like the research of Bratt and McCracken (2007).

Table 4. *The Change of the Learning Style's English Vocabulary Ability*

Group	N	Before	After	Mean Difference	Standard Deviation	t value
Divergers	19	12.84	17.79	4.95	5.57	**3.87 *****
Assimilators	18	9.20	12.30	3.10	2.67	**5.19 *****
Convergers	20	10.11	15.56	5.44	3.15	**7.34 *****
Accommodators	14	9.36	12.86	3.50	2.53	**5.17 *****
Total	71	10.44	14.70	4.27	3.81	**9.44 *****

*** p<.001

H2: Depending on the learning styles, Digital Mind Map will have different effect on students.

In order to find out any differences occurred by learning style differences through the English class with Digital Mind Map being used as a study aid, one-way ANOVA was conducted, and the result showed significant differences in 0.5 level per types of learning styles as in Table 4. To investigate on differences according to learning styles, posteriori-tests of Sheffe was taken, there were significant average differences between Divergers and Convergers. However between Accommodators and Assimilators, there were statistically no significant differences while showing average differences comparing to others.

Table 5. *Learning Style After Gap of English Vocabulary Ability*

Group	N	Mean	SD	F-value	p	post hoc
Divergers	19	17.79	4.837			
Assimilators	18	15.56	5.216			**Divergers**
Convergers	20	12.30	5.459	4.519	.006**	**>**
Accommodators	14	12.86	4.928			**Convergers**
Total	71	14.70	5.507			

**p<.01

Significant differences in grades between Divergers and Convergers have something in common with the research outcome of Carthey (1993) which says Divergers' learning styles show higher academic achievement in the class providing detailed learning experience than Convergers'. In other words, tailoring teaching methods needs to be proceed considering learning styles due to differences in academic achievement according to learning styles in the English class with Digital Mind Map being used as a study aid. Since Divergers prefer detailed experiences and have excellent introspective observation skills, they are exceptional learners in comparison to other groups. Besides since they enjoy detailed situation being provided, investigation and search within such situation and have tendency to look at the situation with various angles of views (Kolb, 1984), it can be said that they are familiar with expressing creative thoughts and effectively achieved the outcome in the English class with a study aid of Digital Mind Map where situational appropriate ideas or vocabulary are provided and learned.

Satisfaction Survey

For investigation more in depth, survey on posterior-satisfaction was conducted. It asked to freely comment on their opinion in vocabulary learning with Digital Mind Map, and their responds were like Figure 8. There were many positive responds that learning vocabulary in each chapter through Digital Mind Map was helpful to be familiar themselves with new words and finally to expand their vocabulary skills. They also said that they drew up the Mind Map by free association for the words they do not know and completely understood them with looking up dictionaries. As a result, they stated positive opinions that using Digital Mind Map was much faster and easier to look up words and to memorize them rather than looking up standard English dictionaries. Besides, they presented impressions like Figure 6 and 7 from extracting students opinions after taking vocabulary classes with Digital Mind Map being used as a study aid.
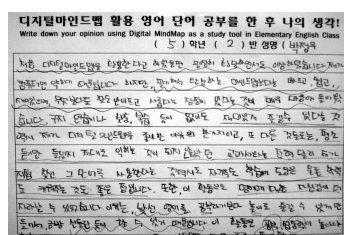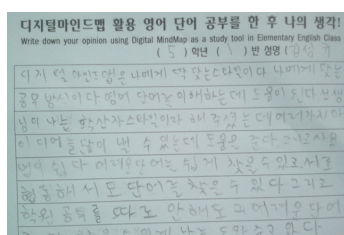

Figure 6. Student A's opinion
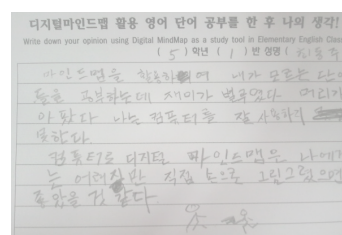

Figure 7. Student B's opinion

Figure 8. Student C's opinion

"First, when I heard about using the Digital Mind Map, it was nonsensical and odd. It was faster, more interesting than the hand-writing mind map and mostly, it did not tire my arm... Also, it was good to find the words for myself in addition to the English textbook. It definitely increased my confidence by its amusement in English which was unfamiliar to me. I highly recommend Digital Mind Map."

"Digital Mind Map is perfect fit for me. It helps me to understand each words. My teacher has been telling me that I have many ideas; Digital Mind Map helps me to express these ideas. It is easy to use. It motivates to cooperate to find and draw mind map. It also helps me for school work without private education."

"It was hard for me to connect words using mind map. I am not handy with computers, so it was hard to use Digital Mind Map. I prefer hand-writing mind map."

On the other hand, like figure 8 some students insisted that it is such a burden to use Digital Mind Map in class. From this situation that Digital Mind Map is hard to use, we can conclude that some has hard time to adapt the new device. We must consider these people who cannot find the usefulness of this device easily.

Conclusion and Discussion

Vocabulary Acquisition in an elementary school's English class is required basically for communication and learner-directed learning. To improve vocabulary skills dependent on learners' preference and style is an important factor to develop communication skills. Accordingly, tailored teaching methods are needed to be used in English learning class in order that learners acquire vocabulary more easily and have positive experience of learning English. Also, for the excellence and effectiveness of education, understanding about the learners is the priority with a consideration of learners' characteristics and their individual gap.

A tailored teaching method considered learners' learning style and characteristics affects both teachers and learners in a positive way. So it can provide learners in the beginning level of English learning with interest and experience of achievement. Especially, having English class in EFL, learners in the beginning level of English could recognize that vocabulary acquisition is needed basically for communication and their self-directed learning. They could also recognize that the tailored learning method which is conformed to their self-directed learning is important. With these recognition, difference of the level in English vocabulary skills was analyzed according to their learning styles of learners in the English class with Digital Mind Map being used as a study aid.

There are several following conclusions about using Digital Mind Map in class:

First, there are positive effect on improvement of English vocabulary by using Digital Mind Map. This result is also shown by Bratt and McCrackens (2007)' study. Using Digital Mind Map in various classes can motivate the students and help them in the process of understanding. Also, Choi (2007) research tells that Digital Mind Map can be used easily for studying vocabulary and gives a chance to share the thoughts and ideas online with other friends. As a conclusion, we can carefully result that this device can improve and delicate students' initiativeness.

Secondly, significant differences among groups in English vocabulary skills were found per their learning styles in English learning class with Digital Mind Map. In other words, as Sim (2001)'s study results, a certain groups who gain more effectiveness in English learning class with Digital Mind Map were showed. In this research, English vocabulary skills of Divergers who have various ideas and prefer intuitive learning acquisition were found to be meaningfully improved more than those of the Convergers whose vocabulary skills are logical and who prefer convergent thought. With this result, tailored class should be designed with the consideration of the facts that learning achievement is dependent upon the learning style in English learning class with Digital Mind Map. In other words, provision of various kinds of learning vocabulary skills and their activating ways should be made. Accordingly, the characteristics in a specific learning group should be considered and reflected when a English learning class with Digital Mind Map is planned.

Third, from the final survey, a lot of students said that they have found out new vocabularies. Additionally, they said it was very easy to search for words and it was beneficial to share thoughts. This concludes Digital Mind Map definitely has a positive effect on linguistic learning. On the other hand, researches of Jung (2004) and others shows opinions of hardness to find the connect among vocabularies. For this reason, we can conclude there are people who cannot adopt the new process easily. We must consider these students no fall behind.

As a conclusion, adaptive learners could be predicted and considered in a English class with Digital Mind Map as a study aid and tailored teaching methods in a learning class which consider their characteristics should be designed in order to enhance their effectiveness.

When learning English vocabulary, it is very significant to think outside of the idea that it is boring. And also it is significant to develop learning method with interesting and easy approaches for vocabulary. More importantly, follow up researches regarding not only aspects of learning styles of learners but also other learners' aspects (cognitive and psychological) need to be considered in the future research project on the English class with Digital Mind Map being used as a study aid.

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