

CHAPTER 4 RESULTS AND DISCUSSIONS

In this chapter presents the findings in the study from the analysis results about the students' perception of knowledge building-based environment and learning outcomes. From the findings, there are discussions section that discussed further and related the results to the relevant literature.

4.1 Student Perception of Knowledge Building-Based Learning Environment

The results of the first analysis of student perception of knowledge building based learning environment in the experimental and control group are shown in table 4. As the table is shown, firstly in the descriptive statistics result in the experimental group (n=10) there is some enhancement from the average score in all factors, from before = 3.18 become after = 3.43. The detailed score from each factor, two factors have an enhancement in average score. Working with idea (average score before = 3.06 and then after = 3.24) and fostering community (average score before = 3.3111 and then after = 3.54) enhanced but the average score of Assuming Agency decrease (average score before = 3.14 and then after = 3.04).

Then the descriptive statistics of the student in the control group (n=12) about knowledge building-based learning environment perception shown that there is some enhancement in average score all factors, from before = 3.13 become after = 3.44. Similar in the experimental group results, there were two factors that have enhancement in average score, they were Working with Idea (average score before = 3.06 and then after = 3.27) and Fostering Community (average score before = 3.30 and then after = 3.53) but the average score of Assuming Agency decrease (average score before = 3.30 and then after = 3.53).

Table 4. The Result of Student Knowledge Building Environment Perception with the Paired Sample T-Test

		Experimental Group (n=10)				Control Group (n=12)			
		Mean	SD	t	P	Mean	SD	t	p
Working with Ideas	Pretest	3.06	0.35	-2.05	0.07**	2.92	0.47	-2.51	0.03*
	Posttest	3.24	0.10			3.27	0.31		
Assuming Agency	Pretest	3.14	0.12	0.79	0.45**	3.14	0.32	0.82	0.43**
	Posttest	3.04	0.13			3.05	0.35		
Fostering Community	Pretest	3.31	0.14	-1.98	0.08**	3.30	0.40	-1.85	0.09**
	Posttest	3.54	0.14			3.53	0.43		
Total	Pretest	3.18	0.12	-2.27	0.05**	3.13	0.36	-2.81	0.02*
	Posttest	3.43	0.13			3.44	0.34		

*p<0.05 = significant

**p>0.05 = non-significant

The score of the p-value from pretest and the post-test of Experimental Group (n=10) Students Perception Knowledge Building-Based Environment is same as p-value 0.05 (p-result=p-value, 0.05=0.05), it means that there was no significant difference before and after the treatment assigned, because the p-result should less from 0.05, so it can be said that statistically significant. In the control group, we can see the p-value score less than 0.05 (p = 0.02 < 0.05). There is a statistically significant difference between the two conditions. So there was a different perception between before and after the KB-Based learning in the control group.

The student perception of Knowledge Building-Based Learning Environment results then conducted with ANCOVA to find out the difference between the students' perception of the two groups. As shown in table 5, the result from F value is 0.06, higher than 0.05 (F, p>0.05) it means that the result is not significant or there is no significant difference between experimental group and control group. So we can conclude that there are no differences between the two groups, so the knowledge building-based learning

environment in the experimental group is as good as in the control group. Further explanation about these findings will be discussed in the discussion section.

Table 5. The ANCOVA result of Student Knowledge Building Environment Perception

		Mean (adjusted)	Std. Error	F-value
Working with Ideas	Experimental Group (n=10)	3.24	0.32	0.32 (n.s.)
	Control Group (n=12)	3.27	0.31	
Assuming Agency	Experimental Group (n=10)	3.04	0.41	0.01 (n.s.)
	Control Group (n=12)	3.05	0.35	
Fostering Community	Experimental Group (n=10)	3.54	0.44	0.00 (n.s.)
	Control Group (n=12)	3.53	0.43	
Total	Experimental Group (n=10)	3.43	0.40	0.06 (n.s.)
	Control Group (n=12)	3.44	0.34	

4.2 Student Knowledge Building-Based Learning Outcomes

The student Knowledge Building-based learning outcomes analyze with qualitative analysis. Each group per week answer categorize in some theme. From the analysis, there are 11 categories that we found from the keyword of the results from all students' groups discussion. The analysis conducted would measure the student understanding about the topic and their knowledge improvement in Knowledge Building-Based Learning. The categories were listed in the table below:

Table 6. The Keyword Categories in the Learning Outcomes

Keyword Categories	
1	Benefit of GMF
2	Definition of GMF
3	Disadvantages of GMF
4	Ecological impact
5	GMF example
6	Health impact
7	Impact on animal
8	Impact on plant
9	National regulation of GMF
10	National regulation of GMF
11	Specifications of GMF

The result of the analysis in table 7 and Table 8 shows that in the first week, the experimental group gets 7 different categories in the outcomes of their results while the control group only 6 categories. However, in their learning outcomes results, the control group got 20 outcomes while the experimental group got 16 outcomes. Then in the second week, both group amount categories are 6 and some of the category different from the first week. It means that there was some knowledge improvement in the student discussion because there was some new category that appears different from the last week result. The result outcomes in the experimental group got a significantly different result in their discussion compare with the control group; there were 26 outcomes while the control group was 16 outcomes. So the experimental group got a better result than the control group in the second week.

Table 7. The Amount of Keyword Categories

Week	Experimental Group		Control Group	
	Amount	Keyword Categories	Amount	Keyword Categories
1 st	7	Specification, Disadvantages, Health, Ecological, Example, Definition, Person	6	Definition, Health, Example, Benefit, Ecological, National Regulation
2 nd	6	Impact on Plant, Benefit, Health, Impact on Animal, Disadvantages, Ecological	6	Impact on Plant, Benefit, Disadvantages, Ecological, Health, Impact on Animal
3 rd	7	National Regulation, Disadvantages, Health, Impact on Animal, Impact on Plant, Example, Benefit	2	Example, National Regulation
4 th	6	Ecological, Disadvantages, Health, Impact on Plant, Impact on Animal, Benefit	5	Disadvantages, Health, Impact on Plant, Impact on Animal, Benefit
Total Amount of Categories	11	Specification, Disadvantages, Health, Ecological, Example, Definition, Person, Impact on Plant, Impact on Animal, Benefit, National Regulation	9	Definition, Example, Benefit, Health, Ecological, Impact on Animal, National Regulation, Disadvantages, Impact on Plant

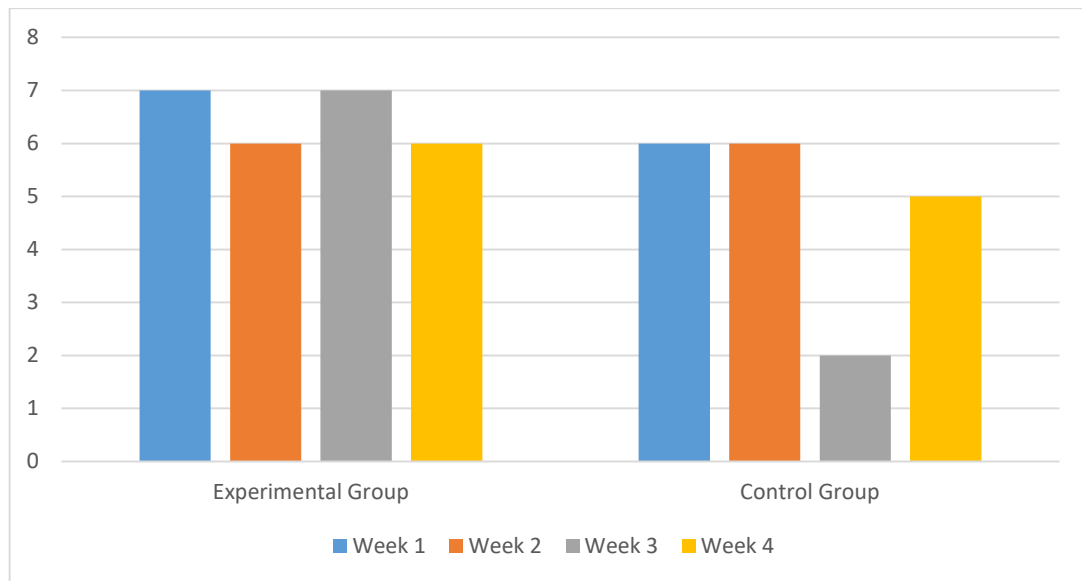


Figure 17. The Amount of Categories each Week between Experimental and Control Group

On the third week, we can see significant differences between the experimental and control group. The experimental group got the new keyword in their group discussion and more amount of keyword (6 categories) so as we can see that the knowledge construction better than in the control group (2 categories). For the results outcomes, the experimental group (20 outcomes) get higher results than the control group (15 outcomes). For the last week, students on both in the experimental and the control group discussion result outcomes were mostly concluded from their discussion in the past weeks (The experimental group 6 categories and the control group 5 categories) with the new addition of their knowledge about GMF. To see the result more clearly, we can see in figure 7 and figure 8 as the graph shows there is an enhancement in the experimental group result comparing with the control group. So from the analysis, we could see that from both of the group there was a knowledge improvement in the students, as among week they have advanced their understanding. The results outcomes also got almost similar result amounts between two groups, as the control group slightly higher (17 outcomes) than the experimental group (15 outcomes). Overall, the experimental group got better results outcomes from the control

group based on the result amounts in each week and also in the total result amounts. The total amounts from the experimental group of different keyword categories were 11 categories, and the outcomes amounts were 77 outcomes, while the control group was 9 categories, and learning outcomes were 68 outcomes. The knowledge improvement in the experimental group is better than the control group.

Table 8. The Amount of Result Categories and Learning Outcomes

Week	Experimental Group		Control Group	
	N Categories	N Outcomes	N Categories	N Outcomes
1 st	7	16	6	20
2 nd	6	26	6	16
3 rd	7	20	2	15
4 th	6	15	5	17
Total	11	77	9	68

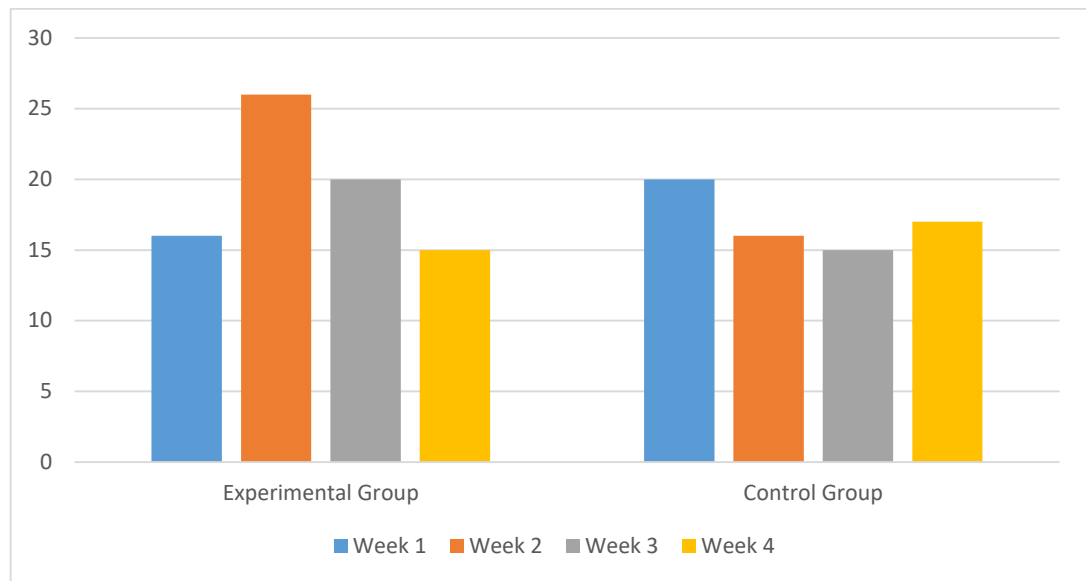


Figure 18. The Amount of Learning Outcomes Result in each Week between Experimental and Control Group

4.3 Discussions

From the findings, student perceptions of Knowledge Building-based learning environment in the experimental group are as good as in the control group because, from the ANCOVA analysis results, there is no significant difference ($F=0.06$). Based on the definition from Bereiter & Scardamalia (2003; 2006) the knowledge building is defined as a group activity where knowledge is intentionally developed and students collaboratively work to solve, discuss, and compare common problems and express their ideas. As we can see, the experimental group result is as good as the control group because both of the group's environment in the classroom is knowledge-building based learning. In the Knowledge Building environment, Students need to serve as knowledge workers, thinking and creating collaboratively, continually modifying and improving ideas as a class community and working towards more coherent explanations and ideas (Thagard, 1989) and this environment is suitable for both of the groups.

Possibilities that affected the result were as we know the participants are the elementary school students that need a teacher to guide them more than higher level school students. Based on Piaget (1936) theory of cognitive development, elementary students (children aged between 7-11 years old), they can only solve problems that apply to particular events or objects (Ginsburg & Oppen, 2002). Elementary students need more time to construct their knowledge in knowledge building-based learning environment, especially for the experimental group with self-directed learning with the Synchronous Discussion and Reflection System (SDRS) that have less teacher guidance than the control group.

In the learning outcomes, the experimental group got better results than the control group based on the result amounts in each week and also in the total result amounts. The experimental group total amounts of different keyword categories were 11 categories, and

the outcomes amounts were 77 outcomes while the control group were 9 categories, and learning outcomes were 68 outcomes. In the experimental group, we could say that the student effectively uses the platform for reflection in their discussion because the results outcomes in each week are better than the control group. These results are by the purpose of reflection in learning based from the Rodgers (2002) that is for students to make more meaning from one experience to the next experience with a deeper understanding of their relationship with and connection to other experiences and ideas.

The experimental group students learn from their discussion recordings as the experience and got a better understanding and improvement in knowledge in the next activity after they reflect from the recordings because of the help of Synchronous Discussion and Reflection System (SDRS) platform. Reflection in knowledge building learning based on the Bereiter & Scardamalia (2014) is the same with term meta-talk that defined as “*discourse about progress and difficulties in the main knowledge-creating effort.*” From the excellent result in the experimental group we can see that the process of self and groups reflection in the knowledge building environment that applied Synchronous Discussion and Reflection System (SDRS) is that the students more involved in community discussions, can assess progress in the community and also find solutions if there are differences in opinions in the community. Students’ reflection plays a significant role in the students understanding and knowledge improvement in knowledge building learning.

The experimental group that given the Synchronous Discussion and Reflection System (SDRS) platform for self-directed learning comparing with the control class with teacher mostly directed the class, their result is almost similar in both of perception of knowledge building-based learning and group discussion learning outcomes. So in the big picture, the Knowledge Building-Based Learning using application of SDRS as a platform

for self-directed learning in discussion and reflection was equally effective with the discussion by the teacher guidance in the class.

To understand more about the cause of the results, we added some interview to 3 students in the experimental group regarding the use of the Synchronous Discussion and Reflection System (SDRS). The interview result as we can see in table 9. There was some useful information we got from the interview.

Table 9. Students Interview Result Regarding the Use of SDRS

Questions	Students	Answer
For the learning activities of genetically modified foods, how do you feel the advantages and disadvantages of using group collaboration and giving each group the means to find out the topics or content you want to know?	1	Advantage: <i>"I think this is a good way because I can try to find the problem, and go with everyone to find out the answer; you can also know where the problem is."</i> Disadvantages: No.
	2	<i>"I feel great because I can find the answer myself."</i> Advantages: <i>"This method is better than the previous information that everyone has the same or together to check the information."</i> Disadvantages: <i>"Some answers are not necessarily found, and sometimes there may not be a consensus, time will not be enough."</i>
	3	<i>"Good."</i> Advantages: <i>"You can work together and have different answers."</i> Disadvantages: <i>"When you want to integrate your answers, the opinions may be different, and it will take more time."</i>
In such a learning activity, how do you feel about the use of the discussion	1	Advantages: <i>"Let us know different software and know who is more interested in answering this topic when discussing."</i>

platform? What are the Advantages and Disadvantages?		Disadvantages: <i>"Sometimes, it will crash."</i>
		<i>"This way is excellent."</i>
	2	Advantage: <i>"Let us know that such software can be used. Moreover, they can combine the opinions of everyone. If you do not know, you can listen again."</i>
		Disadvantages: <i>"Sometimes it will crash, and then it will take more time."</i>
		<i>"Not bad."</i>
		Advantages: <i>"You can analyze and reflect on the status of the discussion."</i>
	3	Disadvantages: <i>"Sometimes the microphone will have no sound, and the recording will be stuck."</i>
		<i>"It is helpful for learning."</i>
On the whole, does this kind of learning activity help you to learn? What are the advantages and the disadvantages are? If you can have such learning activities, what do you think can be better?		Advantages:
		- <i>"You can find problems in different ways, search for information, and answers."</i>
		- <i>"You can get your information or ideas and generate answers."</i>
	1	Disadvantages: <i>"Sometimes there will be different opinions, there will be disputes, and it will take much time, so I think it will be better to have more time."</i>
		<i>"Yes. You can find the answer differently. It would be more fun if the platform could join an interactive game."</i>
	2	
		Yes.
		Advantages: <i>"Someone who does not understand can get answers from classmates, or have new information and messages."</i>
	3	Disadvantages: <i>"May quarrel because of</i>

different opinions or order of publication. We can pursue a better part: try to find different information or website information, but this time will not be enough. It would be better if we had more time for us.”

Overall the students feel positive about the usage of the Synchronous Discussion and Reflection System (SDRS) platform. The students said the platform is enjoyable to use individually and collaboratively, as they get new information about the topics. There were some suggestions from the student about the platform, like fix the crash in the system, need more time to adapt with the platform (the research conducted for 8 hours in 4 weeks) and add some game to make more interesting in learning. From the interview, we can conclude some essential issues for future study. The point we can learn from the interview is the elementary school students need more time to adapt using the platform in knowledge building-based learning to get better result both in their perception of the learning environment and their learning outcomes.