The Role of Visuospatial Representation to Improve Student's Conceptual Mastery based on Gender in Learning Human Urinary System

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ABSTRACT Study of this research investigates the role of visuospatial representation using Wimba model to improve student's conceptual mastery based on gender in learning Human Urinary System. The method used in this research was experimental research with matching pretest-posttest comparison group design. The sample was taken based on gender classes consisting of boys class (n=21) and girls class (n=9) in one of Bilingual School in Bandung. The quantitative data of this research was investigated through the objective test, while the supportive qualitative data gathered through *Likert-Scale*. The conceptual mastery of both classes measured based on Bloom's taxonomy cognitive domain through an objective test. Data processing was done by independent sample t-test. The result of this research shows that there are significant differences in conceptual mastery improvement between girl class and boy class by using visuospatial representation as a model. The research indicates that girl class is outperformed in conceptual mastery almost in each cognitive domain than boy class, and girl class also shows more positive responses toward learning using visuospatial representation than boy class.

Keywords Visuospatial Representation, Conceptual Mastery, The Human Urinary System

1. INTRODUCTION

Science education is one of the major that is essential for human being life. Thus the research on science education or science learning has become a vigorous-research in the research world. One of the important things which are important to be discussed is the conception of the student as a learner. Many research focuses on the learning of concept comprehension as well as student's misconception (Pratiwi, Rochintaniawati, & Agustin, 2018). The research on student's concept has been being approved as a key concern for science learning especially after Ausuble (1963) has developed the idea about the importance of prior knowledge to the learning of scientific knowledge.

Biology is one of the science branch studying about the process of a living thing and live. The study related to the system requires which is the correlation of anatomy with physiology, or structure with function whether in human or in another living thing. According to Ramadas (2009), structural and functional levels of organization provide a standard way of analyzing systems. Campbell, Reece, & Mitchell (2010) also declare that the structure and function are correlated to each other in biology system. On the other

hand, Thompson (2010) states that learning Biology will be easier to understand because the content is related to the organism and the living things. However, not all students like biology, some of them thought that Biology is hard to learn. They seem to be less interested in the science class. This might happen due to some factors in science teaching-learning strategy or the science concept itself which especially occur in junior high school students.

Student's cognitive load that overwhelm learner cognitive resources. The basis of this phenomenon is that learning will be hindered if the instruction materials overwhelm a learner cognitive resource (Chandler & Sweller, 1991). Moreover, it is due to the abstractness of the biology concept itself. The structure of the organ cannot be seen directly with the naked eye, thus the student needs some model to bridge their idea about that structure or organ. Student of approximately 7 until 11 years old which in Junior High school level still require a concrete operational stage according to Piaget's Cognitive Development theory, thus they still face difficulty to learn

the abstract concept (Santrock, 2008). Then, some complicated concepts really need a high order thinking ability to learn it. Such a complicated Human body mechanism in Biology subject, it really needs and requires high ability of thinking to digest the concept, for example, the mechanism of respiratory system, human circulatory system, and urinary system, which correlate both of physiology and anatomy function in Biology subject; structural and functional levels of organization provide a standard way of analysing systems (Ramadas, 2009).

Some research findings prove that visual representation, whether in 3 dimensions (3D) or 2 dimension form (3D), is capable to improve the student's conceptual mastery. Thompson (2010) found that visuospatial based learning help students enhance their understanding of plant tissue system and also ease student's mind to imagine the system when they learn. Perveen & Bhutta (2012) also found that visual representation functions as an effective tool to understand the difficult concept and functioning of the cell. However, visual representations give an illustration of invisible or abstract phenomena that cannot be observed or experienced directly (Buckley, 2000). This is why visualization is important in science learning. One of the important reasons is to help student bridge their mind from the abstract concept to be concrete, especially in Biology subject because there are lots of organs, tissues or cells which need to be visualized.

In 2006, the National Research Council of Washington DC emphasized the importance of spatial ability in everyday life and science. However, spatial thinking is not included in the school curriculum. Integration and infusion of spatial thinking can help achieve the existing curricular objectives. This investigation is also conducted by Ramadas (2009). In his research, Visual and Spatial thinking is an integral part of doing and learning science. Gersmehl & Gersmehl (2007) found that the brain structure for visuospatial reasoning is optimum at a very early age, adult intervention can affect both use and representational ability. The visual-spatial ability can be sharpened through visuospatial activities such as, making a 3D model and using 3D computer-based (Huk, 2006).

According to *Peraturan Menteri Pendidikan Nasional Nomor 41 Tahun 2007* about the standard process of making lesson plan for an elementary and secondary school, teacher should consider about the difference of every student based on gender, ability level, sex, ethnics, learning style, level of intelligence, motivation, aptitude, and interest of students. Consequently, understanding the diversity of student has an important role in improving the quality of learning especially based on gender differences (Putri, Rusyati, & Rochintaniawati, 2018). In another hand, the visuospatial ability of female and male are different. This might be a factor affecting the result of learning outcomes in using visuospatial representation in both male and female class. Jones, Gardner, Taylor, Wiebe, & Forrester (2011) stated that there was a relationship between logical thinking and visuospatial ability. Male students are dominantly using their logical thinking than female (Ormrod, 2008). Hopefully, this research about visuospatial representation in based gender class is important to answer some problems above.

2. METHOD

The experimental method used in this study is quasi-experimental. This is due to many variables that cannot be controlled by the researcher. Based on Anderson & Arsenault (2005), the quasi-experimental control is only performed on one dominant variable, one of them is a method of learning. Researcher uses experimental research to test the effect of visuospatial representation towards student's conceptual mastery. The research carries out two experimental groups of 8th-grade students that are female class and male class.

The research design that is used in this research is two group pre-test and post-test design. It can be called as matching pre-test-post-test comparison group design without a control group. Both classes become experiment class by non-random taken a group.

The population of this research is all of the student's conceptual mastery that belongs to 8th-grade students. The sample is taken from two classes of the 8th grades. There are 8 A and 8 B for different based gender classes. 8 A is male class and 8 B is a male class, both of them are given the same treatment that is visual-spatial representation using wimba model which made of play dough.

A sampling is selected by purposive sampling technique according to Fraenkel, Wallen, & Hyun (1993). The consideration is because the researcher chooses sample based on the specific purpose which compares the cognitive achievement between female and male students, therefore researcher chooses a sample from based gender classes (Fraenkel, Wallen, & Hyun, 1993). Total samplings are 30 of 8th-grade students, with 8 female students and 21 male students.

The research instrument that used in this research encompasses several instruments that are, (1) Objective test is used as an evaluation to measure the conceptual mastery of students in the pre-test and post-test, (2) *Likert-scale* as questionnaire is proposed to the treated class, to get response about student's impression toward learning by visuospatial representation using play dough.

3. RESULT AND DISCUSSION

The research of learning implementation using visuospatial representation in the chapter of the human urinary system facilitates students' to have a new learning experience to improve their conceptual mastery in both female and male classes. The students are demanded to involve their imagination in learning through this media.

Most of the students in both female and male classes show an improvement in learning outcomes after learning through this media. The data which is elaborated from this research are consisted of: (1) pre-test and post-test score (2) 3D model's score which is made of play dough (3) *Likert-scale* score towards learning using visuospatial representation.

3.1 The Profile of Student's Pre-test and Post-test

A pre-test is given to students in order to assess the prior knowledge of both classes before they having treatment with a new concept. The improvement of student's conceptual mastery is determined by calculating the score of normalized gain (N-gain). Both prior knowledge and improvement of student concepts mastery are statistically tested using a hypothesis test. Based on pre-test analysis data from objective test items, it shows that both pre-test result average of boys' class and girls' class do not obtain significant differences (H_0 Accepted), means that both of classes have some prior knowledge. Average of pre-test score also includes in the lower standard category. That means all the average of both classes has a low score. On the other hand, the hypothesis test for an n-gain score of both classes are obtained significant different (H_0 Rejected, H_1 Retained), means that both of classes have different improvement of conceptual mastery. The girl class shows more outperformed result than a boy. Overall achievements of students are described in Table 1.

The improvement of concept mastery can be analyzed by interpreting the increment of the score from pre-test. From the figure 1. it is seen clearly that the difference in the improvement of both classes is significantly different. Girl class is leading with the average of N-gain of 0.58 meanwhile boy class is only 0.37. However, averagely, both of classes are categorized in medium improvement. The

Table 1 The summary of student's statistical test of girl and boy classes

Component	Pretest		Posttest	
	Boys Class	**Girls Class**	**Boys Class**	**Girls Class**
N	21	9	21	9
Average	27.81	33.89	55.19	72.89
SD	13.467	10.764	9.273	12.002
Max score	60	53	73	86
Min Score	6	20	40	53
	Pretest		**N-gain**	
	Normality test (*Shapiro Wilk*)			
Sig.	0.076	0.418	0.288	0.384
Summary	Normal	Normal	Normal	Normal
	Homogeneity test (*Levene*)			
Sig.	0.677		0.146	
Summary	Homogenous		Homogenous	
	Hypothesis Test			
	Independent T-Test (*2-tailed*)			
Sig.	0.242		0.02	
Summary	H_0 Accepted		H_0 Rejected	

Figure 1 Comparison of N-gain in girl and boy classes

result of N-gain of each student in both class is shown in Table 2. Although both classes are equally categorized as a medium improvement, some girl students are categorized as a high improvement, meanwhile boy class has none. Only 33.3% of girl students who show the improvement which categorized in the high category. Most of the student in both girl and boy classes show the improvement in the medium category. About 55.5% of girl class and 80.95% of boy class include in this category. As the category of low improvement, there are, only 11.1% in girl class and 19.04% in boy class who are included in it. Based on the exposure above, it can be concluded that the improvement of the conceptual mastery in girl class is higher than boy class. Furthermore, the differences in understanding between the girl and boy class in each concept also can be seen in Table 3. and 4. The table gives the information

Table 2 The composition of n-gain interpretation

N-gain Interpretation	Category	Number of Students in Girl Class	Number of Students in Boy Class
$\langle g \rangle \geq 0{,}7$	High	3	0
$0{,}7 \ll g \rangle \geq 0{,}3$	Medium	5	17
$\langle g \rangle < 0{,}3$	Low	1	4

Table 3 Conceptual mastery in each concept before treatment

Concept	Conceptual mastery (%)	
	Girl Class	**Boy Class**
Components of the human urinary system	33.33	30.48
Kidney structures	25.93	23.80
Mechanism of urine formation	38.09	28.57

Table 4 Conceptual mastery in each concept after treatment

Concept	Conceptual mastery (%)	
	Girl Class	**Boy Class**
Components of the human urinary system	71.11	64.76
Kidney structures	70.37	34.92
Mechanism of urine formation	76.19	57.82

Table 5 The result of the student's test and project

Group	N	Pre-test	Post-test	N-gain	3D project Score
1g	3	30	66.6	0.5	86
2g	3	37.6	86.6	0.7	91
3g	3	32	66.6	0.5	77
1b	5	22.2	57.3	0.4	77
2b	6	27.92	51.96	0.3	72
3b	5	23	49.95	0.3	70
4b	5	39.2	63.98	0.4	82

about student conceptual mastery in each concept before and after treatment.

3.2 The Profile of Visuospatial Representation of Students

Wimba model is used to make a model or representation which can be in form 2 dimension or 3 dimensions. There are some ways to make a wimba model according to Tabrani (2009), but this study is focused on using modern way named as the extra close up way. The students have to make their own wimba model which is made of play dough as a project. The students should construct their own learning model and make it as learning model in the instruction process in order to help them to understand the concept of the human urinary system.

The students are in a group during making visuospatial representation. There are three subtopics that should be made in the wimba model. There are human urinary system component, kidney structure, and urine formation mechanism. The project score of wimba model and the figure of it is presented in Figure 2 and Figure 3. The result shows that the improvement of the student's conceptual mastery is generally improved, but this research needs to see how is the correlation between the constructions of the 3D model with the conceptual mastery of the student. The

result of each group needs to be explored specifically in order to have a big idea of a correlation between them. The test result of each group is shown in Table 5.

The comparison between N-gain score and the project score will give any idea about the correlation between them. Based on Table 5, the higher score of the 3D model project the higher N-gain can be gained. The criteria for scoring the project are the planning, design, rightness of the concept, detail, and creativity. Thus, the higher score of the project means the less of misconception, the more detail, and well design. The correlation between the score of the project and n-gain of group score is proportional.

3.3 Student's Impression toward Learning using Visuospatial Representation

Student's impression of this learning strategy is obtained by questionnaire. This questionnaire consists of 20 question, 10 for positive questions and another 10 is negative questions. This questionnaire also consisted of three different indicators to the student's response toward learning using visuospatial representation in a biology lesson. Those three indicators are indicating interested in learning leisure in using Visual-spatial representation, response toward the usefulness of visual-spatial representation, and indicate students preference of learning strategy. This questionnaire is distributed to know whether students are interested in this learning strategy or not.

Girls have a higher value of approval level or agreement than boys. It can be seen from the value of the average score and the percentage value. For the first indicator which shown the students interested in learning using visuospatial representation is shown that girls class got 3.02 for the average score, meanwhile boy class is 2.87. The percentage of the positive response of girls class is also higher than boys although it is not really significant, which is 51.38% and boys only 46.38%. This means that girls are more interested in learning using visuospatial representation than boys.

Figure 2 Wimba model made by girl students'
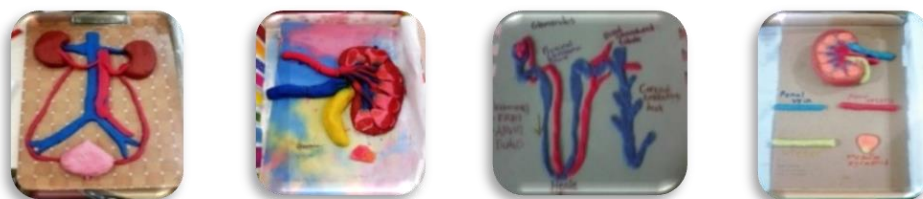
Figure 3 Wimba model made by boy students'

For the second indicator, the students show higher positive result than the first indicator, and the average score and positive response percentage of girl students are also leading, that is 3.8 and 79.16% meanwhile boy class is only 3.16 and 50%. This means that most girls student feel helpful when learning using visuospatial representation as their learning media. Only a half of boy students feel the same condition.

The result of pre-test gives an overview of students' prior knowledge. The results of pre-test in conceptual mastery for both of female and male classes are low. The score of both classes is averagely below 50% of the maximum score that is 100. From that fact, it could be assumed that both of classes are not learned yet about the concept of human urinary system, specifically about the kidney structure which obtains the lowest percentage of conceptual mastery before treatment conducted.

In this study, the student prior knowledge is averagely similar between female and male classes. This could be seen from the average of pre-test result, which only has a slightly different score that is 6.08 points (female class: 33.89 ± 10.467, male class: 27.81 ± 13.467). There is no significant different also in each conceptual mastery, both classes are only master around 23.80% until 38.09% in each concept of the human urinary system. It also strengthens by the hypothesis test which indicates there is no significant difference between the result of the pre-test for female and male classes (Sig: 0.242). This similarity of prior knowledge of both female and male classes give the advantage to avoid bias in research and also to know the impact of the treatment using visuospatial representation become clear.

Generally, both female and male classes are improving in each sub-concept. There are three sub-topics which learned by students in this study. The first sub-concept is the components of the human urinary system, the second subconcept is the kidney structure, and the third sub-concept is urine formation mechanism. Both female and male experience the improvement of conceptual mastery in the first sub-concept about 38-34 points, while for the second sub-concept female and male have significance different of improvement, for female around 45 points and male around 11 points, and for the third sub-topic female class improve better than male, that is 38 points and male 30 points. Overall, in those sub-topics, both female and male classes are improving differently.

The conceptual mastery in this study also analyzed from the cognitive domain refer to Bloom Taxonomy revised of the cognitive domain (Anderson & Arsenault, 2005). The cognitive domain which involves in this research are remembering (C1), understanding (C2), applying (C3), and analyzing (C4). Most of the high improvements are categorized in C3 and C4 cognitive domain, which is included to higher thinking ability. This result establishes that this visuospatial representation works well in higher order thinking level, especially C4 (Analyzing), correlate the

visual-spatial cognitive taxonomy according to Lazaer (2004). Making a model using clay or play dough is included to the second level of this cognitive taxonomy which is information analysis & processing in the visual illustrating abilities. Lazaer (2004) described that visual illustrating abilities are deal with creating a representation of one's learning and understanding using the media of the visual art. This what the student do when they are making wimba model. He described this process is involving the skills of visual representation and inner imagery to represent a relationship, dynamics, and the process of learning. Constructing and learning by using the wimba model factually improve the conceptual mastery in each cognitive domain, and better in the C3-C4 cognitive domain. C3 deals with applying concept meanwhile C4 deals with analyzing. This is in line with Lazaer (2004) that visual illustrating involving the ability of information analysis and processing. Thus, this learning model better improves in the higher level of the cognitive domain. It proved that the visuospatial representation support student to higher thinking ability as analyzing and applying.

Those phenomena show that visuospatial representation works in helping the student to improve their conceptual mastery. In line with this phenomenon Lu, Eliceiri, Squirrell, White, & Stewart (2008) have discovered through some research, that learning by developing visuospatial ability can improve learning outcomes, increase understanding structure and function at different scales of biology, and improve problem-solving abilities. Lu, Eliceiri, Squirrell, White & Stewart (2008) also find that microscopic materials study showed an increase when aided by visual and spatial models.

Besides, visuospatial representation also facilitates student to involve most of all their senses. The students do not only see the object but also be able to touch and feel how the structure of the object is. Huang, Puri, & Liu (2000) also state that the learning process which involves more senses inside will improve more achievement level. The more senses involved in the learning process, the more improvement gained by students.

Another factor which is involved in the role of visuospatial representation in improving student conceptual mastery is the involvement of imagination when students' learn. Visuospatial representation here facilitates students' imagination in the process of learning. Learning biology, especially in the topic of human body system is not that easy for students, because human body system study will correlate the structural its functional in the system, or usually it is known as anatomy and physiology. According to Ramadas (2009), structural and functional levels of organization provide a standard way of analyzing systems. In earlier research general system student conception of body system concepts, including structure and function, are used in understanding. This statement is also strengthened by Campbell, Reece, &

Mitchell (2010) that the structure and function are correlated to each other in biology system. Thompson (2010) proves in her research finding that learning Biology will be easier to understand if involving imagination, because the content is related to the organism and live process which involving the structural and functional system. One of the ways to facilitate imagination is by using a learning model, in this study is using the wimba model which adapted from Tabrani (2005).

In learning science, students need the imagination to support their logical thinking. Especially for Junior high school student. Junior High school students are still in a concrete operational stage which occur in seven to eleven years old according to Piaget's Cognitive Development theory (Santrock, 2008). This means that the student's need something to help them in order to understand the science concept itself (Prima, Putri, & Sudargo, 2017). The students also need the imagination to bridge their mind to an abstract concept. According to Tabrani (2005), imagine the process is a learning process, the thinking process, and creating a process to memorize. He described that in the process of thinking human involved three kinds of imagination, this process called creating process. The balance of three kind of imagination which appears, generally will determine the creation process, and specifically will determine the thinking quality, then the result of creation results from the integration of the external stimuli which gained through the perception-sensation with the internal stimuli which has owned before. The creation process is saved as a memory. Thus, the process of learning, thinking, creating, imagines, and forming memory is happening simultaneously. It supported by Thompson (2010), Imagination often has an important role in the invention process. The form that seems is an art, technique, science and a human life, and a visuospatial thinking strongly related to the image itself (Thompson, 2010). Hence, in this research the students learn using visuospatial representation as they learning model, to help them to imagine the concept. This is proved by the learning outcomes which presented in N-gain and its correlation with their 3D model as a project.

Imagination process is strongly related with the visuospatial ability of someone. Visuospatial ability is known as the ability of someone to understand the concept through visual-spatial representation when learning or doing the task (Prima, Putri, & Rustaman, 2018). Thus, higher imagination will also require higher visuospatial ability.

Due to that statement, it can be predicted that the student who makes a better wimba model will also have a better improvement too. When they make their own 3D model, they will involve their visuospatial ability. The highest score of the project is owned by the group 2g who makes the project of kidney structure. The considerations why this project is got the best score among other project are because they making the kidney structure detail, the information of the structure is complete, there is no misconception, the proportion of the structure is proportional, and the last is from the color choices in the model is near to the initial picture which provided in the student handout. The students who get the best score for their project also get a highest N-gain score. The member of this group got the highest score among another student, that is 86.6 on average, and also the highest N-gain among other that is 0.77. On the other hand, the lowest score of the project also got the lowest average score of post-test and N-gain. This is owned by the students of male class that is group 3b. Their project got to score 70, and the score of their post-test is 49.9 on average with N-gain 0.34. This is the lowest score among other students.

As described above, that evidence proves that the group who make the best model project, also get the best n-gain score. The best wimba model will require the best visuospatial ability also. It can be stated that when student constructs and learn with their wimba model, they use their visuospatial ability optimally. It is in line with the finding of Huk (2006) who found that 3D modeling only capable to improve the cognitive achievement to a student who has the high visuospatial ability, but it does not give any impact to a student with low visuospatial ability.

This study also proves that visuospatial representation has a role to improve student conceptual mastery in learning the human urinary concept. It is seen from the result of N-gain which shown there is an improvement after learning using this visuospatial representation, although the improvement is not really high. Both female and male classes are averagely categorized as a medium improvement. However, females' class improvement is higher than male class. It is known from the number of students which categorize in each category. The female class has 33.3% students' which included too high improvement category, while male class has none. Thus, generally despite both of classes categorized as a medium improvement, but the quality of female improvement is better.

The difference of the improvement between female and male class after treatment using visuospatial representation is not only by interpreted by N-gain, determined by the improvement in each concept, and interpreted by the improvement in each cognitive domain but also by the Hypothesis test. After the t-test is conducted, the result shows that H_0 is rejected, it means H_1 is retained. Hence, this t-test strengthens that the result of the post-test between female and male is different. This proves that male and female are different in improving their learning outcome through this learning model. However, most of the theory-based gender states that visuospatial ability is more outperformed by males meanwhile verbal ability is outperformed by women (Maitland, 2009). This phenomenon is also strengthened by Benbow & Stanley

(1983) and Geary (1996), in cognitive abilities between men and women have usually been reported that higher verbal abilities favoring women, and higher spatial abilities, favoring men and the last is higher arithmetical abilities, also favoring men. However, differences in calculation abilities have at times been interpreted as a result of men's superior spatial abilities (Benbow & Stanley, 1983; Geary, 1996).

This phenomenon is explained by Gurian & Ballew (2003), he argues that the differences between males and females exist because of differences in their brain. Both male and female use their brains but their lobes in different compositions. Males tend to use the left hemisphere of his brain. The left hemisphere of the brain develops in a male over female. The left brain controls logical thinking, abstract things, setting numerical, and analytical thinking (Chuang, 2008). Meanwhile, based on Halpern & Wright (1996) females do better in the language, arts, reading comprehension, and written and oral communication, whereas males more excel slightly in mathematics and mathematical reasoning. This is causing why male students have better visuospatial ability generally.

Contrary, the results of the male students are not better than females, despite visuospatial abilities of male better than female (Chuang, 2008). This can happen because of several factors. One of the factors is learning motivation. In this study, the females students seem to have higher motivation in learning through this model. So that, the result shows the female class is leading whether in the post-test result as well as in their score of the 3D model project. This happens due to the high-learning motivation of the female students.

According to Ormrod (2008) in terms of learning motivation, female students are more concerned about doing well in school. They tend to work harder but take the fewer risk. This is in line with Higgins (1991) who also states that female student has more motivation to make their parents proud and happy by learning achievement, meanwhile male student not except they really like the subject.

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information of the project is incomplete, and even they do not collect the project on time. The higher conceptual mastery improvement obtained. Because the involving of imagination and vision-spatial ability also happen when they are making the model besides their learning through this model. And when the students make a wimba model better, it means the model become more representative to the learning object. It will help students to avoid misconception and construct a deeper analysis when learning using that wimba model. Contradictory, if the representation model is not good, it may cause a misconception and shallow analysis. Less motivation for learning cause the visuospatial ability does not work optimally.

Another factor is their different learning style between female and male. According to Kolb (1984) women tended to prefer concrete learning styles, whereas men are more likely to opt for abstract conceptualization modes of learning. Gelwick (1985) assumes more women appeared on the concrete end meanwhile more men on the abstract end. If it correlated with the role of the 3D model or visuospatial representation here is to help or bridge the conception from the abstract to the concrete one, by using this 3D model the learning process becomes more concrete. Hence the female class will be more interested in learning, and they have greater achievement because of female student tend to prefer a concrete learning style, it means the female student prefer to learn use this media to male students. And most of the female students are like biology than male students, it stated by Bätz, Wittler, & Wilde (2010) that most female students are higher interested in Biology than the male student.

The *Likert-scale* used in this study gives a general perspective that generally, most of the female student response positive toward this learning strategy, which means they all generally feel comfort, enjoy, helpful, and prefer this learning strategy than the conventional one. Only around half of male students give the positive response toward this learning strategy.

This preference also gives any impact to the learning outcomes. Female students which show more positive impression toward this learning model result a higher improvement than a male who less interested in this learning model. The preference and feeling of joy might increase the learning motivation. So that it gives any big impact on learning outcomes, this is in line with what Ormrod (2008) stated in his book about the female motivation in learning.

The female class gives more positive response than male students in all of the category, there is the leaning leisure when using visuospatial representation, feeling helpful while learning using visuospatial representation, and the preference of student to learning using visuospatial representation compare to conventional learning strategy. This positive response of female class is given a positive

impact on the achievement of female class. the female class who give more positive response toward visuospatial learning model gain more achievement than male students who do not really respond positively toward this learning model.

4. CONCLUSION

Visuospatial representation has a role in improving students' conceptual mastery of the human urinary system through the involvement of imagination and visuospatial ability. Human urinary system concept requires an imagination to be learned, while the imagination process requires visuospatial ability. Visuospatial representation facilitates the students to involve their visuospatial ability to create their imagination when learning. Those of process help improve the conceptual mastery of students.

The result of conceptual mastery improvement from both of based gender class is a significant difference. It stated so because of the comparison of the n-gain score and Hypothesis test from both classes. Then-gain comparison of both classes show that both of classes are significantly different, the female class has higher improvement than male class. In line with the n-gain comparison, the hypothesis test result also shows that there are also significant differences result between females and male classes (Sig = 0.002) with a significance level (α) = 0.05. The significant difference of conceptual mastery improvement of both based gender classes also represented in each cognitive level. The result shows that female students are more outperformed in C1, C3, and C4 problems. Meanwhile, male students only outperformed in the C2 problem. From all of the difference in the result, it can be stated that female students result in higher improvement than male.

Generally, the response of students towards visuospatial representation as their learning model shows positive response in all indicators; learning leisure, the usefulness of media, and preference of learning strategy. Specifically, female students show a greater positive response than male. It means that females students are more prefer using visuospatial representation as their learning model than male students.

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