Misconception Identification Of Buffer Solution Concept And Students' Learning Style

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Misconception Identification Of Buffer Solution Concept And Students' Learning Style

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Abstract: *The purpose of this study is to prevent misconception on the subject of buffer solution and students' learning style. The population of this research is class XI SAINS SMA Negeri 1 Samarinda. The sample of this research was chosen by using purposive sampling technique. The aouthor created a research tool that is a misconception detection instrument and learning power instrument that has been valid and tested. The valid instruments were used to obtain the research data. The data was collected in the form of raw data of students' answer and students' learning styles. The raw data was analyzed by using Excel program. The result of students' misconception categorization and students' learning style categorization was analyzed, and then the conclusion and suggestion were made. The result of the misconception evaluation based on Felder Silverman Learning Style Model (FSLSM) in the buffer solution from XI SAINS students of SMA Negeri I Samarinda obtained that students who have high misconception are 6.67% dominated by students who have strong active learning style, balance intuitive-sensing, balance visual-verbal, and balance global-sequential. Students who experience medium misconceptions are 70.00% dominated by students who have medium learning styles, medium sensing, balance verbal-visual, and balanvce global-sequential. Students with low misconceptions are 23.33% and dominated by students with balance active-reflective learning styles, medium sensing, medium visual and balance sequential-global.*

Keywords: *Misconception, Concept of Buffer Solution, Learning Style.*

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I. Introduction

Chemistry is one branch of science that studies objects, characteristics, structures, composition and changes caused by interaction with other objects or often called as chemical reactions. Chemistry is one of science that is very abstract and full of difficult concepts. According to the education level, chemistry began to be introduced to students in junior high school and studied more deeply at high school level. The chemistry that students study at the high school level is more complex than the chemistry that students learn at the junior level. The chemistry that students study at the high school level is more challenging for students because of many abstract chemical concepts that are difficult for every student to be understood. Understanding the concept of chemistry for students in the process of learning chemistry in the classroom is the beginning of students' problem understanding abstract chemical concepts in chemistry lesson.

Misconception is an interpretation of concepts in an unacceptable statement. The individual's interpretation of many concepts may vary. Someone's interpretation of a concept is called as conception. In common, students' conception with the chemists' conception is not exactly the same, because in general the conception of chemists is more complex and complicated and involves many relationships between one concept and other concepts. However, students' conception is the same with the chemists' simplified conception, so the students' conception may not be blamed. But if the student's conception is in complete opposition to the chemist's conception, then the student is said to have misconceptions. Misconception as an interpretation of concepts in a statement cannot be accepted by an expert [1].

There are five things that cause misconceptions: students, teachers, textbooks, context, and teaching methods [2]. Students are one of the factors that cause misconceptions. Misconceptions caused by students themselves can be caused by different learning styles of students in receiving information, processing and organizing information from teachers and other sources. Based on the study results [3] entitled "Identification of Students' Learning Styles that have Resistant Misconception on Chemical Concepts" says that the learning style of students affects students' misconceptions.

The relevant research [4-5] found that there was a significant influence between learning style and student misconception. Student misconceptions often arise because students only use intuitive or common sense

and do not use scientific thinking. The first solution that can be offered is identifying the students' learning style that experience resistant misconceptions on the chemistry concepts.

Buffer solution is materials consisting of concept definitions as well as calculations that make students feel difficult to solve problems from each question. So that if students can not understand the concept of buffer solution well, moreover if they use their learning style characteristic in understanding each concept of buffer solution, there will be a misconception in themselves that will reduce student learning outcomes. The study result [6] entitled "Misconception Analysis of High School Students on Chemical Learning for Materials of buffer solution" indicate that student misconception occurs in all concepts of buffer solution. Buffer solutions are classified as materials that are full of deep definition of concepts and there are chemical calculations that must be understood by each student to improve students' understanding of the buffer solution concept. Based on the above facts, then author made a study entitled Misconception Identification based on Students' Learning Style on Buffer Solution Material of Students in Class XI SAINS SMA Negeri 1 Samarinda 2016/2017.

The purpose of this research is to identify misconception on the subject of buffer solution and learning style of XI SAINS students of SMA Negeri 1 Samarinda. Students can know the tendency of self-learning styles so that students can learn more effectively and efficiently. Teachers recognize the learning styles of students so that teachers will apply the strategies that match the students' learning style in the learning process.

II. Method Of Research

2.1 Conceptional Definition

1. Identification is the process of recognition, placing an object or individual in a class according to certain characteristics [7].
2. Learning Style is a combination of a person's way of absorbing information, then organizing information, processing that information to be meaningful [8].
3. Misconception is an interpretation of concepts in an unacceptable statement. Wilantara defines misconception as an interpretation of concepts in an unacceptable statement [1].

2.2 Operational Definition

1. Felder Silverman Learning Style Model (FSLSM) is a learning style that is grouped into four dimensions namely the processing dimension (active / reflective), perception (sensing / intuitive), input (visual / verbal) and understanding (squential / global). In order to determine the learning style of a student, the measurement used is the ILS Questionnaire.
2. Student misconception is the interpretation of concepts that is unacceptable because the concepts that students interpret are not in accordance with the concepts recognized by the experts.
3. Buffer solution is a solution that can maintain the pH of the system in its range even if acid or alkali is added, or it is diluted. The buffer solution is generally divided into two solutions, namely acid and base buffer solutions. Buffer solutions play a great role in helping to sustain the biochemical and physiological processes of living bodies and are used in chemical industrial processes to control a chemical reaction.

1.3 Research Time and Location

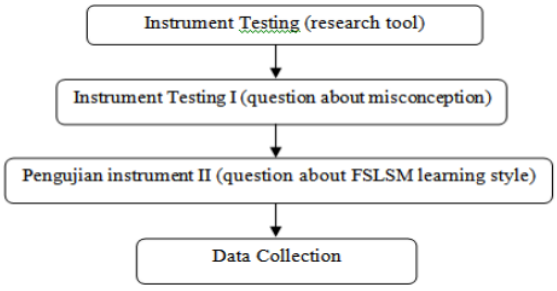
This research was conducted in July-August 2017 at SMAN 1 Samarinda.

1.4 Research Population and Sample

The population of this research is class XI SAINS SMA Negeri 1 Samarinda. The sample of this research is chosen based on purposive sampling technique.

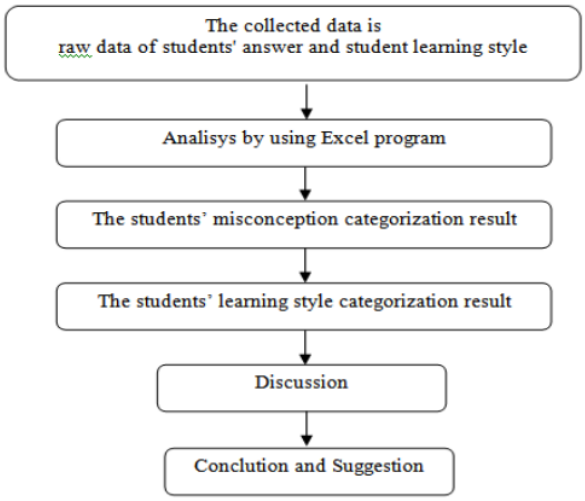
1.5 Research Design

1. Implementation Step



Picture 1. Research Design of Implementation Step Chart

2. Analysis Step



Picture 2. Research Design of Analysis Step Chart

1.6 Data Collection Technique

1. The question of misconception test use the type of threetier diagnostic test and was tested to all students, all the obtained students' answers were analyzed by using Microsoft Excel software to obtain the results of misconception in every student. The questions of misconception tests have been validated by a chemistry lecturer.
2. The questionnaire of students' lerning style was given to all students. The learning style questionnaire used the Felder Silverman Learning Style Model (FSLSM) that has been validated by Chemistry Lecturer.

1.7 Data Analysis Technique

1. Students' learning style technique

   The analysis of students' learning styles used the adopted instruments from Felder [9]. The answer results from tudents were processed by using microsoft excel spreadsheet where the device will analyze automatically to determine the student's learning style scale tends to be (1) sensing or intuitive, (2) visual or verbal, (3) active or reflective and (4) sequential or global in the form of numbers. The figures obtained from the four learning styles are two types of numbers that are positive and negative then the values are matched into Table 1 to find out what is the type of the student's learning style.

Table 1. The Example of Learning Style Type Analysis from Felder Silverman Learning Style Model (FSLSM)

No	Manual Score	Level	Learning Style			
1	11a – 0b = 11a	Strong	*Sensing*	*Visual*	*Active*	*Sequential*
2	10a – 1b = 9a		*Sensing*	*Visual*	*Active*	*Sequential*
3	9a – 2b = 7a	Medium	*Sensing*	*Visual*	*Active*	*Sequential*
4	8a – 3b = 5a		*Sensing*	*Visual*	*Active*	*Sequential*
5	7a – 4b = 3a	Balance	*Sensing*	*Visual*	*Active*	*Sequential*
6	6a – 5b = 1a		*Sensing*	*Visual*	*Active*	*Sequential*
7	5a – 6b = 1b		*Intuitive*	*Verbal*	*Reflektive*	*Global*
8	4a – 7b = 3b		*Intuitive*	*Verbal*	*Reflektive*	*Global*
9	3a – 8b = 5b	Medium	*Intuitive*	*Verbal*	*Reflektive*	*Global*
10	2a – 9b = 7b		*Intuitive*	*Verbal*	*Reflektive*	*Global*
11	1a – 10b = 9b	Strong	*Intuitive*	*Verbal*	*Reflektive*	*Global*
12	0a – 11b = 11b		*Intuitive*	*Verbal*	*Reflektive*	*Global*

(Source [10])

The learning style of the students can be categorized into three, they are:

a. If the student's scores are on a scale of -3, -1, 1, and 3 then both learning styles tend to be balance.
b. If the student's scores are on a scale of -7, -5, 5, and 7 then it tends to be in that learning style but not so strong (medium). These students will tend to be easier in learning according to that learning style.

c. If the student'ss scores are on the scale of -11, -9, 9 and 11 then it tends to be in that learning style is very dominant / strong. These students will have difficulty when the learning is not appropriate with their learning style.

2. Analysis of students' misconception

The analysis of students' misconception used three tier misconception detector analysis (Three Tier Diagnostic Test). This three tier type misconception detector provides the question of multiple choice and the reason as many as the answer choices are available as well as the level of confidence whether or not the student chooses an answer from the provided option. The criteria for grouping student conceptions are based on the threetier diagnostic test according to [11]. After the misconception of students is known then the students who experience misconception are grouped according to their level misconception that are high misconception, medium misconception and low misconception.

III. Result and discussion

3.1 Research Result

The research was conducted at SMAN 1 Samarindasiswa in class XI SAINS 2. The research was conducted from 8th of August to 21st of September 2017. The results of the research were data analysis consisting of:

1. The percentage of students' misconception based on the misconception level.
2. The result of students' learning style analysis based on the Felder Silverman Learning Style Model (FSLSM).
3. The analysis result of students' learning style who experienced misconceptions based on the Felder Silverman Learning Style Model (FSLSM) in each misconception level.

The results of the first data analysis is the percentage of students' degree of understanding. The result of this analysis is used to know the misconception experienced by students of SMAN 1 Samarinda that was 50, 17%. The results of the next data analysis is the percentage of misconceptions of students in SMA Negeri I Samarinda. The results are shown in table 2 below.

Table 2. Percentage of Students's Misconception in SMA Negeri 1 Samarinda

No	Misconception Level	Percentage
1	High	6.67%
2	Medium	70.00%
3	Low	23.33%
Total		100%

(Source: Research result, 2017)

After the students' misconception had been identified then the next step is identifying the students' learning styles who have misconception. The results of the students' learning style analysis in SMA Negeri I Samarinda are in Table 3.

Table 3. Percentage of Students' Lerning Style in SMAN 1 Samarinda

Learning Style Dimention	Learning Style	Number of Students		Learning Style Dimention	Learning Style	Number of Students	
		∑	%			∑	%
Processing Dimention	*Strong Active*	10	33.33%	Input Dimention	*Strong Visual*	1	3.33%
	Medium Active	12	40.00%		*Meedium Visual*	5	16.67%
	Balance Active-Reflektive	8	26.67%		*Balance Visual-Verbal*	17	56.67%
	Medium Reflektive	0	0.00%		*Medium Verbal*	7	23.33%
	Strong Reflektif	0	0.00%		*Strong Verbal*	0	0.00%
Total		**30**	100.00%		**Total**	**30**	100.00%
Perception Dimention	*Strong Sensing*	2	6.67%	Understanding Dimention	*Strong Sequential*	0	0.00%
	Medium Sensing	17	56.67%		*Medium Sequential*	4	13.33%
	Balance Sensing-Intuitive	11	36.67%		*Balance Sequential-Global*	17	56.67%
	Medium Intuitive	0	0.00%		*Medium Global*	6	20.00%
	Strong Intuitive	0	0.00%		*Strong Global*	3	10.00%
Total		**30**	100.00%		**Total**	30	100.00%

(Source: Research Result, 2017)

The next data analysis result is the percentage of students' learning styles who experienced misconception based on the misconception level. The learning style of students in SMAN 1 Samarinda who have high misconception are shown in Table 4.

Table 4. Percentage of Students' Learning Style in SMAN 1 Samarinda Who Ecperienced High Misconception

Learning Style Dimention	Learning Style	Number of Students		Learning Style Dimention	Learning Style	Number of Students	
		∑	%			∑	%
Processing Dimention	*Strong Active*	2	100.00%	Input Dimention	*Strong Visual*	0	0.00%
	Medium Active	0	0.00%		*Medium Visual*	0	0.00%
	Balance Active-Reflektive	0	0.00%		*Balance Visual-Verbal*	2	100%
	Medium Reflektive	0	0.00%		*Medium Verbal*	0	0.00%
	Strong Reflektif	0	0.00%		*Strong Verbal*	0	0.00%
Total		**2**	100.00%	**Total**		**2**	100%
Perception Dimention	*Strong Sensing*	0	0.00%	Understanding Dimention	*Strong Sequential*	0	0.00%
	Medium Sensing	1	50.00%		*Medium Sequential*	0	0.00%
	Balance Sensing-Intuitive	1	50.00%		*Balance Sequential-Global*	2	100%
	Medium Intuitive	0	0.00%		*Medium Global*	0	0.00%
	Strong Intuitive	0	0.00%		*Strong Global*	0	0.00%
Total		**2**	100%	**Total**		2	100%

The next data analysis results is the percentage of students' learning styles of students who experienced misconception based on the misconception level. The students' learning style in SMA Negeri 1 Samarinda who experience medium misconception are shown in Table 5.

Table 5. Percentage of Students' Learning Style in SMANegeri I Samarinda Who Experienced Medium Misconception

Learning Style Dimention	Learning Style	Number of Students		Learning Style Dimention	Learning Style	Number of Students	
		∑	%			∑	%
Processing Dimention	*Strong Active*	7	33.33%	Input Dimention	*Strong Visual*	1	4.76%
	Medium Active	10	47.62%		*Medium Visual*	5	23.81%
	Balance Active-Reflektive	4	19.05%		*Balance Visual-Verbal*	12	57.14%
	Medium Reflektive	0	0.00%		*Medium Verbal*	3	14.29%
	Strong Reflektif	0	0.00%		*Strong Verbal*	0	0.00%
Total		**Total**	100.00%			**Total**	**Total**
Perception Dimention	*Strong Sensing*	2	9.52%	Understanding Dimention	*Strong Sequential*	0	0.00%
	Medium Sensing	10	47.62%		*Medium Sequential*	3	14.29%
	Balance Sensing-Intuitive	9	42.86%		*Balance Sequential-Global*	13	61.90%
	Medium Intuitive	0	0.00%		*Medium Global*	3	14.29%
	Strong Intuitive	0	0.00%		*Strong Global*	2	9.52%
Total		21	100.00%			**Total**	21

The next data analysis results is the percentage of students' learning styles of students who experienced misconception based on the misconception level. The students' learning style in SMA Negeri 1 Samarinda who experience low misconception are shown in Table 6.

Table 6. Percentage of Students' Learning Style in SMANegeri I Samarinda Who Experienced Low Misconception

Learning Style Dimention	Learning Style	Number of Students		Learning Style Dimention	Learning Style	Number of Students	
		∑	%			∑	%
Processing Dimention	*Strong Active*	1	14.29%	Input Dimention	*Strong Visual*	0	0.00%
	Medium Active	2	28.57%		*Medium Visual*	6	85.71%
	Balance Active-Reflektive	4	57.14%		*Balance Visual-Verbal*	1	14.29%
	Medium Reflektive	0	0.00%		*Medium Verbal*	0	0.00%
	Strong Reflektif	0	0.00%		*Strong Verbal*	0	0.00%
Total		**Total**	100%	**Total**			
Perception Dimention	*Strong Sensing*	0	0.00%	Understanding Dimention	*Strong Sequential*	0	0.00%
	Medium Sensing	6	85.71%		*Medium Sequential*	0	0.00%
	Balance Sensing-Intuitive	1	14.29%		*Balance Sequential-Global*	3	42.86%
	Medium Intuitive	0	0.00%		*Medium Global*	3	42.86%

Learning Style Dimention	Learning Style	Number of Students		Learning Style Dimention	Learning Style	Number of Students	
		∑	%			∑	%
	Strong Intuitive	0	0.00%		*Strong Global*	1	14.29%
Total		7	100%	**Total**		**7**	100%

IV. Discussion

This study aims to identify misconceptions experienced by students based on the learning styles on the subject of buffer solution from students in XI SAINS SMA Negeri I Samarinda in the academic year 2016/2017. The study was conducted from 8th of August to 21st of September 2016.

To find out the students' misconceptions and learning styles, all students were tested by giving three-tier diasnogtis test questions and Felder Silverman Learning Style Model (FSLSM) learning style questionnaires. The three-tier diasnogtis test was used to detect misconceptions experienced by students and was in the form of multiple choice with the reason and level of confidence of each question that must be answered by the students. In addition, the three tier diagnostic test question was made from the material of buffer solution consisted of 20 items that represent all the concepts that exist in the material of buffer solution. The learning style questionnaire was a questionnaire of the Felder Silverman Learning Style Model (FSLSM) that was adopted from the original text and was used to identify students' learning style for those who experience misconceptions. The learning style questionnaire consisted of 44 items that represent each dimension of learning style that are processing dimention, erception dimention, input dimension and understanding dimension. After the students were tested, the result of misconception identificationstudents' eearning style was analyzed by using Microsoft Excel 2013 application so that tha data analysis result will be obtained in the form of students' learning style, students' misconception and the learning style of students with misconception.

The type of students' learning style that was analyzed in this study is the Felder Silverman Learning Style Model (FSLSM). In this learning style, students have 4 dimensions of learning style, namely the processing dimension (active-reflektive), the perception dimension (sensing-intuitive), the input dimension (visual-verbal), understanding dimension (sequential-global). In order to know the learning styles of students, students are given a questionnaire of learning style that consisted of 44 items that represent each learning style dimension. Items number 1-11 are about learning styles for processing dimensions, number 12-22 are about learning styles for the perceptual dimension, number 23-33 are about learning styles for input dimensions and number 34-44 is a matter of learning style for the understanding dimension. The questions were adopted directly from the original text in the English then was translated and adopted in order to be in accordance with the criteria of learning style dimensions. Student learning style of class XI SAINS 2 SMAN 1 in processing dimension had the same tendency that is moderate active. In the perception dimension, they had a tendency of medium sesing learning style. In the input dimension, they had a tendency of balanced visual verbal learning style. In the understanding dimension, they had the tendency of a balance global sequential learning style.

Students who had a tendency to active learning style were a student with moderate learning style preference. This means that the students' learning styles of students were between the strong active learning style and balance active-reflective [12] Active learning style tends to understand information by practicing and learning in groups. [13] Active learning style tends to learn while doing something actively to try things. In the case of learning chemistry like a practicum that is conducted in thelaboratory, students who have an active learning style will be easier to understand the lesson because learning method with practice is supportive for active learning style.

Students who have a tendency of balance active-reflective balanced were students with low learning style preferences for both active and reflective learning styles. This means that it requires both learning styles. [12] Active learning style tends to understand information by practicing activities and group learning while reflective learning style tends to learn by thinking of several things at once and practicing on their own. [13] Students who have an active learning style tend to learn while doing something actively to try various things, often have different ideas with others. While reflective learning style tends to be introspective in a process that is thinking about various things before trying it. At the time of understanding the material in the classroom, students who have a balance active-reflective learning style will be a little hindered in understanding the lesson if the lesson should be done by practicum in the laboratory, because the practical method will greatly help students who have strong active learning style by the way students play an active role in his group. Students who have a balance active-reflective learning style will also be hampered in understanding materials if in the practicum they are placed with those who have strong reflective learning style because the students also need friends who have an active learning style to be able to be balance.

Students who have moderate learning style are students with a preference for sensing. This means that the learning style of students are between the learning styles of strong sensing and balance sensing-intuitive and these students only tend to the sensing learning style only. [12] The sensing learning style tends to study concrete, practical, pleasurable material with detailed details and problem solving by using predefined methods. [13] The

sensinh learning style tends to acquire incoming information through the senses, pay attention to detail and dislike abstract concepts. At the time of classroom learning, a teacher who teaches students with a sensing learning style is advised to exp the material in a brief, concise, and clear way because with those methods of deliverin e teacher can help students who have a moderate learning style to understand the subject matter.

Students who have a balanced sensing-intuitive learning style were students with low learning style preferences for both sensing and intuitive learning style. This means that students need both styles to understand the subject matter. [12] The learning style of sensing tends to learn concrete, practical, pleasurable material with detailed details and problem solving by using predetermined methods whereas intuitive learning styles tend to learn abstract, more innovative and creative materials, enjoy global explanations and use challenge. [13] The learning style of sensing tends to support incoming information through the senses whereas intuitive learning style tends to support information that results from internal (memory, conjecture or interpretation). In the process of learning in the classroom students who have a balanced sensing-intuitive learning style will be helpful to understand the lesson if the teacher explains the subject matter in detail and global because by that kind of way, teachers will help the students' perceptions that have balance sensing-intuitive learning style in understanding the lesson.

Studen who have a balance visual-verbal learning style were students wi low learning style preferences for both visual and verbal learning styles. This means that students still need both visual and verbal learning styles to understand the concepts in the subject matter. [8] In general, visual style people absorb information with a strong visual strategy with visual images and expressions. [12] Visual learning style tends to learn with visual images such as pictures, videos, flowcharts, diagrams and so on. Verbal learning style tends to learn with verbal, oral or written words. Therefore, students who have a balance visual-verbal learning style have a balanced tendency between the two. At the time of classroom learning, students who have a balance visual-verbal learning style will have difficulty in understanding the lesson if teachers, textbooks and other learning resources are more inclined to one of those two learning styles. For example, teacher teaches by using lecture method without providing visual explanation, student wisth balance visual-verbal learning style will be difficult to follow and understand the lessons. This will be the same for students with verbal learning style. However, if teachers teach in balance between oral explanation and explanation of visual images in a learning then students who have balance visual-verbal learning style will be helpful in understanding the lesson.

Students with a balance global sequential learning style were students with low learning style preferences for both sequential and globa earning styles. This means students need both learning styles to understand a subject matter. [12] Students with sequential learning style tend to learn in a linear fashion and explore the material sequentially while sequential learning styles absorb information and gain material to understand in the form of interconnected small pieces. Students with global learning style tend to learn randomly, and explore the material in a non-sequential fashion. [13] Students with global learning style absorb information and gain understandings in the form of unrelated fragments and reach understandings through large holistic leaps. Therefore, students who have a balance sequential-global learning style have a balance tendency between the two. At the time of classroom learning, if the teacher gives a task to make scientific paper, students who have a balance sequential-global learning style will be difficult if they are in a group with students who have strong global learning style. Because in one group, students will be easy to complete their scientific papers if they have the same learning style or gathered with friends who have strong and medium sequential learning styles. Therefore, they can be more well considered in completing the task of scientific papers, because students who tend to be strong and medium sequential have understood the material in a structured and systematic.

V. Conclusion

Based n the research results and data analysis, it can be concluded that the identification of misconception based on Felder Silverman Learning Style Model (FSLSM) on the subject of buffer solution for students in XI SAINS SMA Negeri I Samarinda that students who have high misconception were 6.67% and dominated by students with strong learning style, balance intuitive sensing, balanced visual-verbal, and balance sequential-global. Students who experience medium misconception were 70.00% and dominated by students with medium learning styles, medium sensing, balance visual-verbal, and balance sequential-global. Students who experience low misconception were 23.33% and dominated by students w balance active-reflective learning style, medium sensing, medium visual and balance sequential-glo . Based on the results of the research, the researcher gives the suggestion that a teacher should be able to know the domin students' learning style in the class that is being taught through the identification of student learning style based on the Felder Silverman earning Style Model (FSLSM) by using ILS Questionnaire. Therefore, teacher can adjust the learning method with the students' learning styles in each dominant learning style dimention in the class so that students will be directed in understanding the concepts in a subject matter.

Acknowledgements

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