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Analysis of Concept Understanding in Material Colligative Properties of Solutions in View of the Tendency of Student Learning Styles at SMA N 1 Gunung Talang

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A B S T R A C T

Education is an important thing in achieving the goal of ability through the learning process in the classroom. Benchmarks for the success of the learning process are seen through students' understanding of concepts. The influencing factor in understanding the concept is learning style, because learning style influences the maximum a person absorbs information. This research is a descriptive research aimed at analyzing and describing (1) understanding of the concept of colligative properties of the solution, (2) learning styles of students, (3) understanding of the concept of colligative properties of solutions in terms of the tendency of students' learning styles. The subjects of this study were class XII MIPA 1 SMA N 1 Gunung Talang, which consisted of 35 people. The instruments used in this study were the Kolb model learning style questionnaire and open-ended questions. The results of the research data analysis show that (1) the learning style of students in class XII MIPA 1, the assimilation learning style is 51.4%, the divergent is 22.9%, the convergent is 17.1%, and the accommodation is 8.6%, (2) Students' understanding of the concept of colligative properties of solutions is in the partial understanding category (3) Understanding of concepts in colligative properties of solutions in terms of the tendency of students' learning styles for convergent, divergent, and accommodation learning styles is in the understand category, and assimilation learning styles are in the partially understood category.

1. Introduction

Education is a capital for human resources in the long term. As contained in the Law of the Republic of Indonesia Number 20 of 2003, regarding the National

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Education System which reads "National education functions to develop capabilities and form dignified national character and civilization in the context of educating the nation's life" (Nasional, 2003). By seeking to improve the quality of human resources through an educational activity it is hoped that it can increase the ability to educate the life of the nation. In the development of human life, education is an important thing. One of the efforts to achieve the goal of developing abilities in education is through the learning process in class.

According to the Law of the Republic of Indonesia Number 65 of 2013 concerning Process Standards for Elementary and Secondary Education, in article 1 which reads "Primary and Secondary Education Process Standards hereinafter referred to as Process Standards are criteria regarding the implementation of learning in primary and secondary education units to achieve graduate competence (RI, 2013). One of the efforts made in the implementation of learning is to achieve graduate competence by paying attention to the learning styles of students. The learning style of students is one that can determine the quality of the learning process, because learning styles affect cognitive (knowledge), affective, and physiological factors. This learning style is related to the fastest and best way for students to absorb, receive or manage information (Uno, 2006).

According to Abosalem (Fadilah, 2016) students' learning styles have a close relationship with students' understanding of concepts. Learning style is the way he reacts and uses the stimuli he receives in the teaching process. Learning style can also be interpreted as the way a person gets or processes information from the environment he gets and then processes that information. Kazu (2009) in his research stated that in order to provide the best way of learning for each individual, the learning style must be determined or known in advance by considering differences such as personality, perception, ability and intelligence. This is in line with Tanta's research (2010) which explains that learning styles significantly affect student learning outcomes in the Biology Education Study Program in General Biology courses.

According to Kolb (Nasution, 2013) there are four types of learning styles, namely: (1) Convergent, learning styles that prioritize thinking (abstract conceptualization/AC) and the information obtained is processed by practicing it (active experimentation/AE), (2) Divergent, learning styles learning someone who tends to involve himself in new experiences (concrete experience/CE) and reflects or thinks about his experiences from various aspects (reflection observation/RO), (3) Assimilation, learning styles that tend to like abstract concepts (abstract conceptualization/AC), as well as reflecting on experience from various aspects (reflection observation/RO), (4) Accommodation, learning styles with a tendency to be interested in concrete experience (CE), and active experimentation (active experimentation/AE). Some of the definitions above can be concluded that a person's learning outcomes are strongly influenced by the way they absorb information in learning, both directly in the classroom and outside the classroom.

Learning style is a consistent way of learning that is done by students in capturing information or stimuli, how to remember it, think, and work on problems. Not

everyone has the same learning style. Everyone has differences, but writers can categorize them. Learning styles are closely related to individual personalities and influence their educational history and development (Nasution, 2015). According to Uno (Uno, 2008) the ability of individuals to absorb and understand learning is definitely different, some are quick to understand, some are moderate and some are very slow. Therefore, each individual must take a different way of understanding any information obtained. According to Kolb (Kolb, 2011) learning style is a fixed psychological trait but a dynamic state that results from synergistic transactions between people and the environment.

One of the lessons learned by students in the learning process in high school is chemistry. Chemistry has complex and abstract concepts (Muchtar, 2012). One of the competency standards that must be possessed by students is conceptual understanding. In the learning process students are not only capable of knowledge but must be able to understand the concept of knowledge itself. The concept is a thought, an understanding, an idea, and something that is created in the mind (Sumaatmadja, 2005). Chemistry lessons are often considered boring learning for students because students do not see the connection between learning chemistry and life so that many students cannot apply the concept in everyday life.

Saifuddin Azwar (Azwar, 1987) stated that someone who understands means that he is able to explain, classify, abstract, predict, and differentiate. According to Anas Sudijono (Sudijono, 2011) understanding is a person's ability to understand and know something from various aspects. Widiasworo (Widiasworo, 2017) states that understanding is the ability to connect or associate information learned with a complete "picture" in the brain. Understanding is one aspect of the cognitive domain proposed by Bloom. According to Bloom in Wowo Sunaryo Kuswana (Kuswana, 2012) understanding the concept includes goals and actions or responses which are understanding of the literal message contained in communication to achieve it. Incorrect understanding of concepts results in the emergence of new concepts, sometimes students' understanding of concepts is not in accordance with explanations (Hairy, M. R., Kusmiyati, K., & Yamin, 2018).

The word concept comes from the Latin word "conceptus" which means "catch". The concept in KBBI means understanding various things by using reason for mental descriptions of objects, processes, or anything that exists outside of language (Dewi, S. Z., & Ibrahim, 2019). With an understanding of the concept students can develop any subject matter they get, therefore understanding the concept is a very important aspect in the learning process. Understanding of concepts with students has a very close relationship in interest and problem solving in learning. Conceptual understanding consists of two words, namely understanding and concept.

Based on the results of the author's interviews and observations with a class XII chemistry teacher at SMAN 1 Gunung Talang, the learning outcomes of students regarding the colligative properties of solutions are still relatively low from several classes. This is shown from the daily test scores of students. Students are still confused and have difficulty in answering the daily test questions given by

the teacher, when information is extracted about how the learning method is used by students they are confused to answer or even don't know with their own learning style.

Based on the statements and problems that have been explained, the researcher conducted a study with the aim of 'Analyzing Conceptual Understanding of Material Colligative Properties of Solutions in View of Student Learning Styles at SMAN 1 Gunung Talang'.

2. Methodology

This type of research is descriptive research. Descriptive research is research on phenomena that occur in the present. This descriptive research can be comparative in nature by comparing the similarities and differences of certain phenomena (Hariwijaya, 2015). According to Widodo (Widodo, 2017) descriptive research aims to describe or explain something as it is, so as to get a clear picture of the situation in the field as it is. The subjects in this study were class XII IPA students at SMA N 1 Gunung Talang Academic Year 2022/2023 consisting of six classes, namely XII MIPA 1, XII MIPA 2, XII MIPA 3, XII MIPA 4, XII MIPA 5, XII MIPA 6. Sampling in this study was carried out using purposive sampling technique. Sugiyono (Sugiyono, 2016) stated purposive sampling, namely a sampling technique based on certain considerations beforehand and in accordance with the research objectives. Due to research limitations, only one class was sampled in this study, namely class XII MIPA 1, which consisted of 35 people. The object in this study is the understanding of the concept of material colligative properties of the solution in terms of the learning styles of students. In this study using a research instrument, namely, the first questionnaire method is a number of written questions used to obtain information from respondents. With the questionnaire method, the data can be collected through the results of filling out the questionnaire so that the characteristics of the learning styles possessed by class XII students at SMAN 1 Gunung Talang are known. The second concept understanding test is a data collection technique in which the author gives a set of questions in the form of open questions to students.

3. Results and Discussion

1. Analysis of students' learning styles

Based on the results of research at SMA Negeri 1 Gunung Talang, learning style data were obtained from the Kolb model questionnaire, which consisted of 12 sets of statements that had been adapted to the learning characteristics of students. This questionnaire is given to classify learning styles according to David A. Kolb namely, convergent, divergent, assimilation, and accommodation.

From the distribution of students' answers, the total score of AC, CE, AE, and RO was obtained for each student. Then the AC score minus the CE score and the AE

score minus the RO score. The combination numbers obtained are then converted into learning style graphs, so the number of students for each learning style is known. From the data obtained the grouping of student learning styles, so that the percentage of students in each learning style category is obtained in Table 1.

Table 1. Data on the Percentage Distribution of Student Learning Styles

Learning Style	The number of students	Percentage
Assimilation	18	51,4 %
Divergent	8	22,9 %
Convergent	6	17,1%
Accommodation	3	8,6 %

Based on Table 1 above, it can be seen that the assimilation learning style is 18 people with a percentage of 51.4%, the divergent learning style is 8 people with a percentage of 22.9%, the convergent learning style is 6 people with a percentage of 17.1%, and the learning style of accommodation as many as 3 people with a percentage of 8.6%, this shows that most of the students at SMA N 1 Gunung Talang have an assimilation learning style.

2. Analysis of students' answers on the concept understanding test

Based on the results of research at SMA Negeri 1 Gunung Talang, conceptual understanding data was obtained through an open-ended question test consisting of 10 questions consisting of students' understanding of the concept of lowering the vapor pressure of the solution, increasing the boiling point of the solution, lowering the freezing point of the solution, osmotic pressure of the solution and differences colligative properties of electrolyte and non-electrolyte solutions. This open-question test was given to 35 students in class XII MIPA 1 at Gunung Talang 1 Public High School in the 2022/2023 academic year. The test will be carried out on October 15, 2022.

The answers to this open-ended question test are grouped into five categories, namely, Understanding (P), Partial Understanding (PS), Partial Understanding with Misconceptions (PSM), Misconceptions (M), and Not Understanding (TP) (Calik, M & Ayas, 2005). For the understand category, if students answer correctly. If students answer with correct answers but are not complete, they are categorized as partially understood. Partly understand with misconceptions, if students answer with the correct concept but there are answers with the wrong concept. Whereas for the category of misconceptions when students answer with illogical and incorrect answers. If the student answers by repeating the question, the answer is irrelevant and unclear or does not answer, it is categorized as not understanding.

The distribution of answers to students' understanding of the concept through an open question test on the colligative properties of the solution can be seen in the picture.

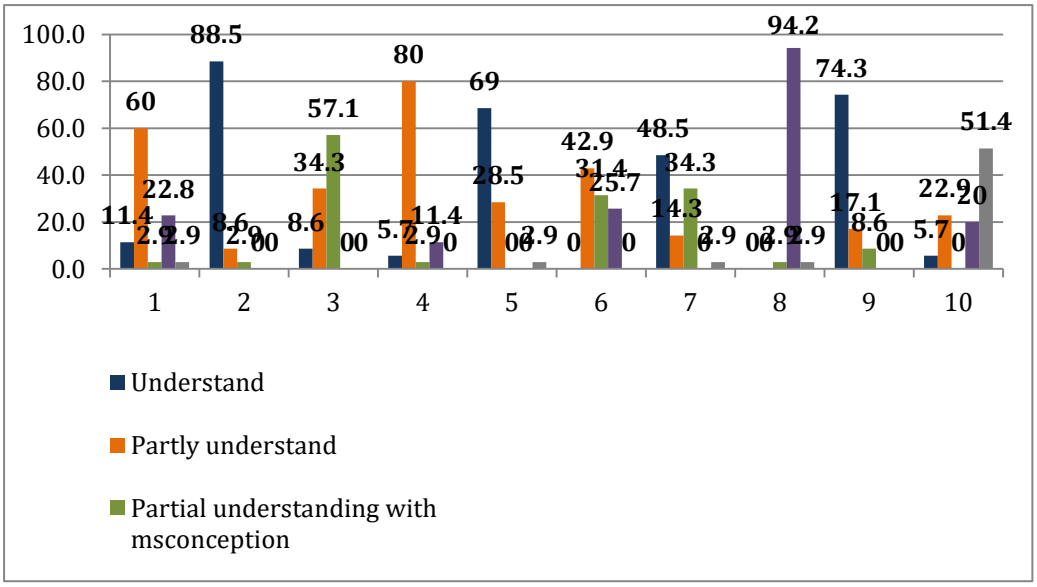

Figure 1. Graph of the distribution of understanding the concept of colligative properties of the solution

Information :
Problems No 1 and 2 The concept of lowering the vapor pressure of a solution
Question No. 3, 4, and 5 Concepts regarding the increase in the boiling point of a solution
Problems No. 6 and 7 The concept of lowering the freezing point of a solution
Problems No. 8 and 9 The concept of osmotic pressure of a solution
Problem No. 10 Concepts Concerning the differences in the colliagative properties of electrolyte and non-electrolyte solutions

a. Students' understanding of the concept for questions regarding the decrease in the vapor pressure of the solution

The distribution of students' open question tests can be seen in the appendix. From these data, the percentage of students' understanding of the concept is obtained in Figure 1.Figure 1 shows that students' understanding for question number 1 tends to be in the partially understood category by 60%, then question number 2 tends to be in the understand category by 88.5%.

Figure 1 shows that for the "understand" category in question number 1 it is lower than question number 2, meaning that for understanding the concept of the vapor pressure of the solution students understand more about the calculation of the vapor pressure of the solution than the concept of the vapor pressure of the solution.

b. Students' understanding of the concept for questions regarding the increase in the boiling point of the solution.

The open question test regarding the increase in the boiling point of the solution is found in question numbers 3, 4 and 5. Based on Figure 1 it shows that in the open question test for question number 3 students answered tend to be in the partial understanding category with a misconception of 57.1%. Furthermore, question number 4 students answered questions tended to be in the partially understood category by 80%. In question number 5, the students' answers tend to be in the understanding category of 68.6%.

In Figure 1 it can be seen that the percentage gain of students' conceptual understanding for the open-ended questions test questions numbers 3, 4, and 5. Figure 1 shows that the open-ended questions in the "understand" category of questions numbers 3 and 5 are lower than question numbers 5, This means that students understand more about the concept of calculating the boiling point elevation of a solution than the concept of increasing the boiling point of a solution.

c. Students' understanding of concepts for questions about lowering the freezing point of solutions.

Questions about understanding the concept of lowering the freezing point of a solution are found in questions number 6 and 7. Figure 1 shows an open question test on question number 6, students answered tend to be in the partial understanding category of 42.9%. Furthermore, for the open-ended question test on question number 7, students answered a tendency to understand the category of 48.5%.

Based on Figure 1, the open question test on questions number 6 and 7, for the "understand" category students better understand the concept of calculating the freezing point depression of a solution than the concept of freezing point depression.

d. Students' understanding of concepts for questions about the osmotic pressure of a solution.

Open question test on questions number 8 and 9, regarding the osmotic pressure of the solution. Figure 1 shows an open question test on question number 8 students answered tending to the misconception category of 94.2%. Furthermore, question number 9 students tend to answer in the understanding category of 74.3%, followed by partial understanding of 17.1%.

Based on Figure 1 it shows that question number 8 is lower than question number 9 for the "understand" category, meaning that students understand more about calculating the osmotic pressure of a solution than the concept of osmotic pressure.

e. Students' understanding of concepts for questions about differences in the colligative properties of electrolyte and non-electrolyte solutions.

Open question test on question number 10 regarding the comparison of the boiling points of electrolyte and non-electrolyte solutions. Based on the test, data on the percentage of students' answers was obtained by category. Figure 1 shows that in the test question number 10 students answered tend to be in the category of not understanding at 51.4%.

3. Description of students' understanding of concepts in terms of learning style tendencies

Based on the results of the answers from the open-ended question test and questionnaire, grouping is carried out based on the learning style of each student. Thus, it can be seen that the understanding of the concept in terms of the tendency of students' learning styles. The data from the grouping results calculated the number of students for each category of conceptual understanding in each learning style, then the data was processed so that the percentage of students in each category of conceptual understanding was obtained for each convergent, divergent, assimilation, and accommodation learning style as shown in Table 2.

Table 2. Average Percentage of Conceptual Understanding for Each Learning Style.

Concept understanding category	**The average percentage of students in each learning style**			
	Convergent	**Divergent**	**Assimilation**	**Accommodation**
Understand	**31,67**	**30,75**	30	**40**
Partly understand	**31,67**	25	**34,99**	16,67
Partial understanding with msconception	13,33	16,25	13,89	10
Misconception	15	18,75	17,22	30
Do not understand	8,33	8,75	5	3,33

In Table 2 it can be seen that students' understanding of the colligative nature of the material in each learning style tends to understand. In the concept of lowering the boiling point of students with convergent and accommodation learning styles tend to be in the understanding category. In the concept of increasing the boiling point, students with assimilation and convergent learning styles tend to be in the partial understanding category. In the concept of lowering the freezing point of students with convergent and assimilation learning styles tend to be in the partially understood category. In the concept of osmotic pressure students with the four learning styles tend to be in the category of misconceptions and understanding. In the concept of differences in colligative properties of electrolyte and non-electrolyte solutions, students with the four learning styles tend to be in the category of not understanding.

4. Conclusion

Based on the research that has been done, it can be concluded that the learning styles of students in class XII MIPA 1 SMA N 1 Gunung Talang are dominant in assimilation learning styles, followed by divergent learning styles, then convergent, and finally accommodation. Students' understanding of the concept of colligative properties of the solution is in the partial understanding category, while for the concept of calculation it is in the understand category. The students' understanding of the concept of class XII MIPA 1 SMA N 1 Gunung Talang regarding the material colligative properties of solutions in terms of learning style tendencies. Convergent, divergent, and accommodation learning styles are in the understand category, while the assimilation learning style is in the partial understanding category.

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