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Analysis Difficulty of Mathematical Creative Thinking Ability Reviewed From Learning Styles Through Problem Based Learning

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ABSTRAK

This study aims to analysis and find out: (1) level the MCTA reviewed from learning styles through problem based learning; (2) difficulties experienced by students in solving the problem of MCTA reviewed from learning styles through problem based learning. This research is qualitative research. The subjects of this study were students of SMP Negeri 42 Medan class VIII-A which amounted to 35 students. The research instrument used tests of mathematical creative thinking ability, Kolb's learning style questionnaires, and interviews. The results of the study are as follows: (1) the level of MCTA for learning styles of accommodation 2 students (moderate), and 5 students (low); the level of MCTA for divergent learning styles 2 students (high), 4 students (moderate), and 7 students (low); the level of MCTA for assimilation learning styles 3 students (moderate), and 7 students (low); the level of MCTA for convergent learning styles 1 students (high), 2 students (moderate), and 2 students (low). (2) students with accommodation learning styles experience difficulties in aspects concepts, procedures and principles; students with divergent learning styles experience difficulties in aspects facts, concepts, procedures, and principles; students with assimilation learning styles experience difficulties in aspects facts, procedures, and principles; students with convergent learning styles experience difficulties in aspects facts, concepts, procedures and principles.

Keywords: Mathematical Creative Thinking Ablity, Kolb's Learning Style, Problem Based Learning

BACKGROUND

Progress of science and technology requires a person to master information and knowledge. Thus, it needs an ability to obtain, choose and process information. These abilities require critical, systematic, logical, and creative thinking. Therefore, an education program is needed that can develop the ability to think critical, systematic, logical, and creative. "One education program that can develop the ability to think critical, systematic, logical, and creative is mathematics"(Hasratuddin, 2014) (Pane, 2018).

Thus teaching mathematics at school is a priority in education. Mathematics will never be achieved if someone does not try to learn mathematics. According Purba (2017) that "one of

the goals to be achieved in the process of learning is mathematical creative thinking ability". In the field of education, creative thinking ability gets considerable attention. Because according Framework for Action (2016) that "education 2030 will ensure that all creativity is a strong foundation of knowledge, develop creative and critical thinking and collaborative skills and build curiosity, courage, resilience." And creative thinking is closely related with critical thinking which is a high level thinking ability in mathematics. "Thus it can encourage someone to always look at each problem creatively and try to solve problems with non-single solutions and generate new ideas"(Navarrete, 2013) (Nasution, 2017).

In Indonesia, students' mathematical creative thinking ability are quite concerned. As Munandar (2012) said that "Indonesian students achieved the lowest rank in the score of creativity in creative thinking tests followed by eight countries." More broadly Based on the results of the Trends In Mathematics and Sciences Study survey (TIMSS) in 2015, Indonesia ranked 36th out of 49 countries in the field of mathematics. Likewise, based on the results of the Program for Student Assessment (PISA) survey in 2015, Indonesia ranked 69th out of 76 countries. Facts in the field are also not in accordance with what is expected. The test results given to junior high school students show that mathematical creative thingking ability in students' is still low. Students can only answer soberly (provide one solution) so that from the aspect of indicators of fluency, flexibility, and novelty are still in the less category.

Many factors cause low mathematical creative thinking ability in students', including that caused by one's ability to understand and absorb lessons. According to Chatib (2016) that "there are students who are fast, moderate, and there are also students who are very slow. Therefore, they often have to take different ways to understand the same information or lesson". Learning styles are the key to developing performance in work, school and in interpersonal situations. In other words, information will be more quickly accepted by the brain if it is in accordance with the learning style possessed by a person (recipient of information). Because according to Cox (2013) & Zholgadri (2015) that "there is a significant relationship between academic achievement and learning style".

Another thing that is the reason for the low mathematical creative thinking ability in students', including the inaccuracy and lack of variety in the use of models used by teachers in class or perhaps due to mathematics learning as a monotonous and teacher centered learning. Besides learning mathematics in the classroom has not been meaningful and does not emphasize on students 'understanding, so that students' understanding of mathematical concepts is very weak. As stated by Sinaga (2007) that "reality shows that so far most teachers use conventional learning models and are dominated by teachers". As a result, students cannot develop their knowledge. This does not make students as learners, but only receives information that is required to memorize the information so that mathematial creative thinking ability in students' is low.

THEORETICAL FRAMEWORK

The creative thinking ability is closely related to critical thinking which is a high level thinking ability in mathematics, which can encourage a person to always look at each problem creatively and try to solve problems by thinking creatively. According to Nasution (2017) that "Creative thinking as a person's mental activity through internal factors is realized to get out of the comfort zone. Creative thinking is the potential of each individual. Creative thinking can be combined in response to problems to generate new ideas. Resolving problems with non-single solutions, can be said to be creative thinking if feasible, useful, and different from the previous product". According to Silver (1997) that "to identify and analyze the level of mathematical creativity is generally used three aspects of creativity that is fluency, flexibility, and novelty".

"Learning style is the most sensitive response in the brain as hard as it is to receive data or information and information providers and their environment and if we can understand our own learning style, then it is a big step towards increasing our learning strength and will get maximum results from our learning alone"(Chatib, 2016). Cox (2013), Zholgadri (2015), & Kolb's (2013) suggest that "Kolb's developed four learning styles that is accommodation, divergent, assimilation, and convergent.

Problem based learning is a learning model that uses problems as a starting point for learning. Problems that can be used as a means of learning are problems that meet the context of real world that is familiar with the daily lives of students. Nasution (2017) & Syahputra (2017) suggested that "problem based learning is learning that uses real world problems as a context for students to learn creative thinking and problem solving skills, as well as to acquire knowledge and concepts that are essential from subject matter". "Implementation of problem based learning models that is (1) problem orientation: at this stage the teacher explains the purpose of learning and motivating students, (2) arranging students to learn, (3) leading student investigations per individual or group, (4) developing and present work results, (5) analyze and evaluate the problem solving process "(Nasution, 2017), (Surya, 2017).

Mathematical Creative Thinking Ability (MCTA)

Munandar (2012) that "mathematical creative thinking ability is a combination of logical thinking and divergent thinking based on intuition in awareness that concerns flexibility, fluency and attention to novelty. The three components to assess creative thinking in mathematics review different things and stand alone, so that students or individuals with different abilities and backgrounds will have different abilities according to the level of ability or influence of the environment. Navarrete (2013) that "creative thinking process is proposed as a central skill needed in education to prepare all students".

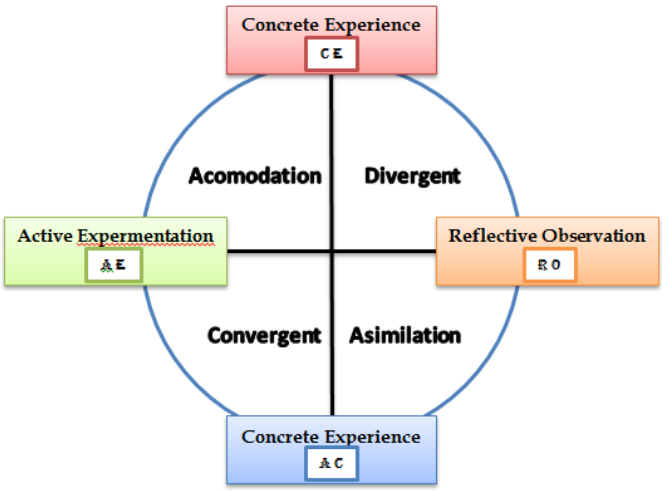
According to Silver (1997) that "to identify and analyze the level of mathematical creativity is generally used three aspects of creativity that is fluency, flexibility, and novelty". "Fluency is characterized by the ability to solve problems in various ways or suggestions in doing various things and always think of more than one answer. Flexibility is characterized by the ability to solve problems by looking at different points of view and being able to change the approach to getting a solution from a problem. And novelty is characterized by the ability to be able to give birth to new and unique ideas, or to be able to solve problems in their own way or different from those previously learned "(Silver, 1997), (Munandar, 2012), (Nasution, 2017) & (Pane, 2018) .

Kolb's Learning Style

Banjarnahor (2017) argues that "learning styles are one of the important variables and are related to the way students understand lessons in school, especially mathematics. Each student's learning style is different from each other". "Kolb's developed four learning styles that is accommodation, divergent, assimilation, and convergent" Cox (2013), Zholgadri (2015), & Kolb's (2013). Kolb's in his book The Kolb Learning Style Inventory 4.0. (2013) suggested that "learning styles describe a unique way of spiraling through the learning cycle based on their preference for four different ways of learning namely concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). Kolb's has developed learning theory which is a useful model for recognizing learning styles, this is called Kolb's learning cycle". Kolb's learning cycle is shown in Figure 1. For grouping learning styles that is (Kolb's, 2013):

1. If the score AC reduced by the score CE is positive, and the score AE reduced by the score RO is positive, then appropriate learning style is accommodation learning style.

2. If the score AC reduced by the score CE is positive, and the score AE reduced by the score RO is negative, then appropriate learning style is divergent learning style.
3. If the score AC reduced by the score CE is negative, and the score AE reduced by the score RO is negative, then appropriate learning style is the assimilation learning style.
4. If the score AC reduced by the score CE is negative, and the score AE reduced by the score RO is positive, then appropriate learning style is convergent learning style.



Gambar 1 Kolb's Learning Cycle

Research aim

The Objectives of this study was to investigate:

1. How is the level MCTA of students' reviewed from learning styles through problem based learning ?
2. How are the difficulties experienced by students in solving the problem of MCTA reviewed from learning styles through of problem based learning?

RESEARCH METHOD

This research is a qualitative research. According to Moleong (2017) "qualitative research is research that intends to understand the phenomenon of what is experienced by the subject of research, for example behavior, perception, motivation, actions, etc. holistically and by means of descriptions in the form of words and languages, in a special natural context and by utilizing various natural methods".

This research was conducted in SMP Negeri 42 Medan. The population of this study was all students' of SMP Negeri 42 Medan. Subjects in this study were class VIII A amounting to 35 students'. The subject of the interview was chosen based on Kolb's learning style and an error in the indicator of MCTA. The instrument used in this study consists of three types. The first is a test instrument used to measure students' MCTA. The type of test is an essay test consisting of four items. The score for each test item of MCTA is 25. The total score of all four items is 100. Classification of students' level of MCTA are presented in Table 1.

Tabel 1 Level MCTA of Students'

Level MCTA	Criteria
$0 \leq$ MCTA < 65	Low
$65 \leq$ MCTA < 80	Moderate
$80 \leq$ MCTA ≤ 100	High

Note : Highest Total Score = 100

Second is a questionnaire for grouping student learning styles. The type of questionnaire is Kolb's learning style questionnaire consisting of forty items. Each of the CE, RO, AC, and AE consists of 10 items and the highest scores are CE, RO, AC, and AE respectively 40. And the last is as triangulation and in depth analysis of the difficulties experienced by students using interview. The interview technique used is an unstructured interview or not strictly bound to the interview guidelines.

The mechanism used in this study includes three stages, namely (1) the preparation stage for the preparation of research instruments; (2) validation phase and trial of research instruments; (3) the stage of conducting data research and analysis. While the data analysis process follows the concept by Miles and Huberman (Moleong, 2017) that "which consists of three activities that occur interactively and lasts continuously until the end. Activities in data analysis are data reduction, data display, and conclusion".

DATA ANALYSIS & RESULT

Results of grouping students' learning style

Based on the results of filling out the Kolb's learning style questionnaire which has been carried out by 35 students of class VIII A SMP Negeri 42 Medan. The results of grouping learning styles are presented in Table 2.

Table 2 Result of Grouping Students' Learning Style

Learning Style	Number of student	Percentage
Accommodation	7	20%
Divergent	13	37,14%
Assimilation	10	28,57%
Convergent	5	14,29%

In Table 2 it is obtained that 35 students class VIII A, 7 students' have accommodation learning style, 13 people have divergent learning styles, 10 people have assimilation learning style, and 5 people have convergent learning styles. The percentage of the existence of accommodation, diverging, assimilation, and convergent learning styles were 20%, 37.14%, 28.57% and 14.29% respectively. This means that the existence of divergent learning styles is the most compared to other learning styles, then followed in the second position, namely the assimilation learning style, the third position is the accommodation learning style, and the last is convergent learning style.

The level MCTA reviewed from learning style through problem based learning

There are 7 students' (20%) had a accomodation learning style with the level of MCTA criteria 'moderate' as much as 2 students', and criteria 'low' as much as 5 students'. There are 13 students' (37,14%) had a divergent learning style with the level of MCTA criteria 'high' as much as 2 students', criteria 'moderate' as much as 4 students', and criteria 'low' as much as 7 students'. There are 10 students' (28,57%) had a assimilation learning style with the level of MCTA criteria 'moderate' as much as 3 students', and criteria 'low' as much as 7 students'; there are 5 students' (14,29%) had a convergent learning style with the level of MCTA criteria 'high' as much as 1 students', criteria 'moderate' as much as 2 students', and criteria 'low' as much as 2 students'.

Analysis difficulties experienced by students in solving the problem of MCTA reviewed from learning styles through problem based learning

Students' with accomodation learning style

Results of students' answers with accommodation learning styles and errors in the three indicators of MCTA are presented in Figure 2,

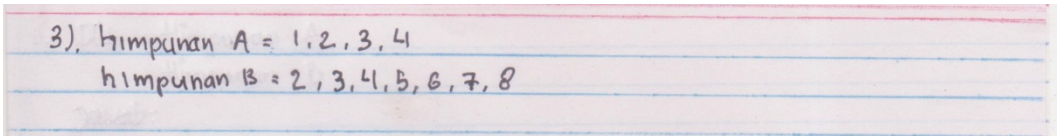


Figure 2 Students Answers in Problem 3

Based on the analysis of Figure 2. It appears that students only rewrite what is known in the problem, students cannot solve the problem correctly or are still at a low score. Unable students on all three indicators of MCTA. Errors in fluency indicator that is the inability to provide many ideas in solving problems. Error in flexibility indicator that is the inability of students to solve problems with no strict rules or from a different perspective. And the error in novelty indicator that is the inability to solve problems in its own way. Researchers conduct interviews to find out and analyze in depth about the ability to think MCTA students'. The following are the excerpts of the interview with s-1:

> *"Two sets, set A = 1,2,3,4 set B = 2,3,4,5,6,7,8, poor answer, do not remember, do not know, diagram One arrow doesn't know, A is attached to B, A is attached to B with the father from, doesn't know how to graph or matrix".*

Subjects can understand the symbols and mathematical symbols when the subject can understand what is meant by symbols A and B while simultaneously communicating mathematical ideas through symbols and symbols when the subject can state the full knowledge of the problem. The subject has not been able to state the meaning that represents a particular concept and is unable to understand the concept with his own understanding when the subject cannot state the meaning of the function, nor has he been able to understand the example and not the example when the subject cannot show an image stating the function of the given example. Subjects have not been able to plan problem solving when the subject has not been able to explain how to solve the given problem. Also the subject has not been able to apply a principle even though students can state a principle when the subject has understood the meaning of not a function but cannot apply it to answer the given question.

Based on the results of interviews and patron difficulties in solving the problem of MCTA it was found that students with accommodation learning styles still had difficulties in solving the problem of MCTA that is difficulties in concept indicators, procedure indicators, and principle indicators.

Students' with divergent learning style

Results of students' answers with divergent learning styles and errors in the three indicators of MCTA are presented figure 3.

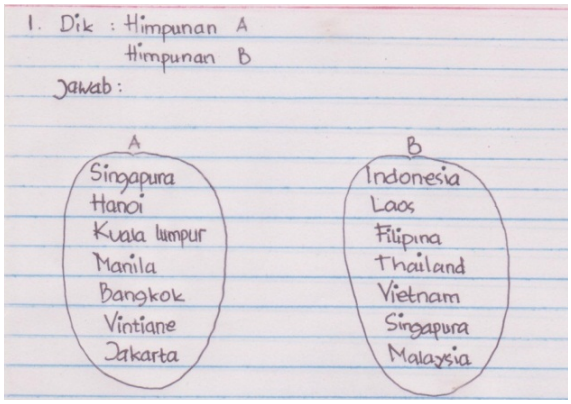


Figure 3 Students Answers in Problem 1

Based on the analysis of Figure 3. It appears that students are still wrong in writing what is known in the problem, students cannot solve the problem correctly or are still at a low score. Unable students on all three indicators of MCTA. Errors in fluency indicator that is the inability to provide many ideas in solving problems. Error in flexibility indicator that is the inability of students to solve problems with no strict rules or from a different perspective. And the error in novelty indicator that is the inability to solve problems in its own way. Researchers conduct interviews to find out and analyze in depth about the ability to think MCTA students'. The following are the excerpts of the interview with s-2:

> *"Two sets, Yes only that, do not know, made 2 circles, one for the set A stu for set B, and some just know the arrow, there are arrows Yes, that's what it means, don't know how, don't know, just domain, Mr. Abdillah to Ali, Mr. Abdillah to Nisa, Mr. Abdillah to Fatimah, Mr. Somad to Hafiz, Mr. Somad to Zahra, Mr. Yusuf to Umar, don't understand, don't know".*

Initially the subject was able to understand the symbols and mathematical symbols when the subject could understand what is meant by symbols A and B. However, the subject has not been able to communicate mathematical ideas through symbols and symbols when the subject cannot fully state what is known about the problem. Subjects have not been able to state the meaning that represents a particular concept when the subject cannot state what is meant by "First Lady of the First Lady". But the subject has been able to understand the example and not an example when the subject understands the way in question by showing another example. Also able to understand concepts in their own language when the subject is able to mention ways to draw arrow diagrams. Subjects have not been able to plan problem solving when the subject has not been able to explain how to solve the problem given to produce the correct answer. And on the principle indicator that the subject cannot apply a principle even though the subject can state a principle when the subject cannot state an arrow diagram.

Based on the results of interviews and patron difficulties in solving the problem of MCTA it was found that students with divergent learning styles still had difficulties in solving the problem of MCTA that is difficulties in concept indicators, procedure indicators, and principle indicators.

Students' wtih Assimilation learning style

Results of students' answers with assimilation learning styles and errors in the three indicators of MCTA are presented figure 4.

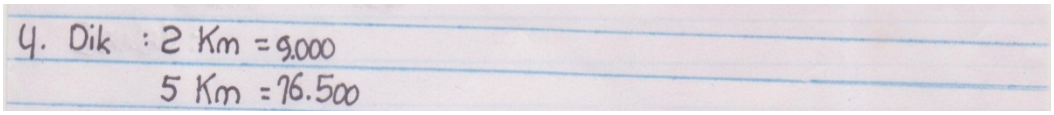


Figure 4 Students Answers in Problem 4

Based on the analysis of Figure 4. It appears that students are still wrong to write down what is known in the problem, students cannot solve the problem correctly or are still at a low score. Unable students on all three indicators of MCTA. Errors in fluency indicator that is the inability to provide many ideas in solving problems. Error in flexibility indicator that is the inability of students to solve problems with no strict rules or from a different perspective. And the error in novelty indicator that is the inability to solve problems in its own way. Researchers conduct interviews to find out and analyze in depth about the ability to think MCTA students'. The following are the excerpts of the interview with s-3:

> *"The set, not knowing, cannot solve the problem, all A is attached to B, diagram 1, all A is attached to B, confusing, many ways to do it, arrow diagrams, sets A and B, with Capital City rules from, 2x = 9,000, how to eliminate, do not know how to matrix and graphics".*

Initially the subject was able to understand the symbols / symbols of mathematics when the subject was able to capture what is meant by symbols A and B. but the subject was not able to communicate mathematical ideas through symbols and symbols when the subject could not express into mathematical form what is known in question. Subjects cannot express the meaning that represents a particular concept when the subject cannot answer the meaning of the function. Also unable to understand examples and not examples and also unable to conclude a concept when it can show an image stating the function of the example given and provide an explanation of the picture. Subjects have not been able to plan problem solving when they have not been able to explain how to solve the given problem. Subjects have not been able to apply a principle when the subject cannot solve the given problem.

Based on the results of interviews and patron difficulties in solving the problem of MCTA it was found that students with assimilation learning styles still had difficulties in solving the problem of MCTA that is difficulties in fact indicators, concept indicators, procedure indicators, and principle indicators..

Students' with convergent learning style

Results of students' answers with convergent learning styles and errors in the three indicators of MCTA are presented figure 5.

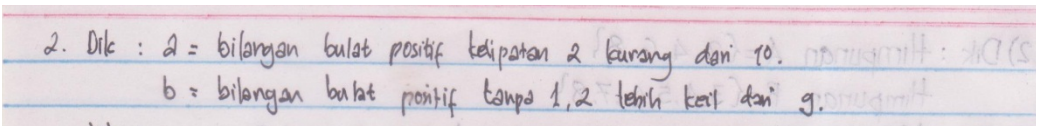


Figure 5 Answers Students in Problem 2

Based on analysis of Figure 5. It appears that students only rewrite what is known to the problem, students cannot solve the problem correctly, or are still at a low score. Unable students on all three indicators of MCTA. Errors in fluency indicator that is the inability to provide many ideas in solving problems. Error in flexibility indicator that is the inability of students to solve problems with no strict rules or from a different perspective. And the error in novelty indicator that is the inability to solve problems in its own way. Researchers conduct interviews to find out and analyze in depth about the ability to think MCTA students'. The following are the excerpts of the interview with s-4:

> *"The sets, tidak know, looking for their members do not know, figure 1, figure 2, the origin of call, less understood, arrow diagram and graphs, domains and kodomain, Mr. Abdillah father of Ali Nisa, with Fatimah, Mr. Somad, father of Hafiz, and Zahra, if Pak Yusuf's father is from Umar, 2x + 9,000, he does not know how to matrix or graph".*

The subject was initially able to understand the symbols and mathematical symbols because the subject can understand what is meant by symbols A and B. but the subject is unable to communicate mathematical ideas through symbols and symbols because the subject cannot fully state what is known to the problem . Subjects are not able to understand the concept with their own understanding because the subject cannot state each member of the A and B set. The subject is not able to plan the problem solving when the subject has not been able to explain how to solve the given problem. Subjects cannot find relevant relationships between mathematics in solving problems when the subject is called an image that states that it is not a function of the problem given.

Based on the results of interviews and patron difficulties in solving the problem of MCTA it was found that students with convergent learning styles still had difficulties in solving the problem

of MCTA that is difficulties in fact indicators, concept indicators, principle indicators, and indicators procedure

DISCUSSION

Based on the results of data analysis in Table 2, presence of divergent learning styles is the most compared to other learning styles, followed by the second position is assimilation learning styles, third position is accommodation learning styles, and the last is convergent learning styles. This is supported by the results research by Cavas (2010) "the results obtained from data analysis are more dominant divergent learning styles by 40.4%. Then followed by assimilation of 27.7%, convergent by 17%, and accommodation by 7.43% ". "Students with divergent learning styles tend to prefer to work in groups and receive feedback that is personal and likes to gather information. He is able to hear with an open mind "(Zholgadri, 2015) (Kolb's, 2013).

While the research findings of Gohara & Sadhegib (2014) state that "from the research that has been done with 123 selected students, the dominant students with convergent learning styles (62.60%), followed by assimilation learning styles (17.89%), accommodation (11.38%) and divergent (8.13%) ". The second position in Gohara & Sadhegib's research is the style of learning assimilation. As explained by Gohara & Sadhegib (2014) that "the tendency of students with learning styles of assimilation and assimilation implies that they prefer practical applications of opinions with little emotion, assessment and development of abstract theories and ideas".

The level MCTA of with high category only for students with divergent and convergent learning styles. Of the 13 students (37.14%) had divergent learning styles, 2 students were in the high category. In divergent learning styles there are already students with high categories this is ignored because "in learning situations, he prefers to work in groups and receive personal feedback" (Kolb's, 2013). And from 5 students (14.29%) have a converging learning style of 1 student in the high category. In convergent learning styles there are already students with high categories this is caused "in learning situations, best in finding practical uses of ideas and theories. He is able to solve problems and make decisions effectively "(Kolb's, 2013). In each learning style the level MCTA of students' is still dominant in the low category. This shows that the level MCTA of students' are still very far from what is expected. As Munandar (2012) said that "Indonesian students achieved the lowest rank in the score of creativity in the creative thinking test that was followed by eight countries". Whereas "creative thinking is very important in the current global era, it needs to solve the complexity of problems from all aspects of life" (Nasution, 2017).

Students with accommodation learning styles experience difficulties in aspects concepts, procedures and principles; students with divergent learning styles experience difficulties in aspects facts, concepts, procedures, and principles; students with assimilation learning styles experience difficulties in aspects facts, procedures, and principles; students with convergent learning styles experience difficulties in aspects facts, concepts, procedures and principles

CONLUSION

Based on the results of data analysis and research results, the conclusions which are the answers to the proposed research questions are:

1. The level of MCTA for learning styles of accommodation 2 students (moderate), and 5 students (low); the level of MCTA for divergent learning styles 2 students (high), 4 students (moderate), and 7 students (low); the level of MCTA for assimilation learning

styles 3 students (moderate), and 7 students (low); the level of MCTA for convergent learning styles 1 students (high), 2 students (moderate), and 2 students (low).

2. Students with accommodation learning styles experience difficulties in aspects concepts, procedures and principles; students with divergent learning styles experience difficulties in aspects facts, concepts, procedures, and principles; students with assimilation learning styles experience difficulties in aspects facts, procedures, and principles; students with convergent learning styles experience difficulties in aspects facts, concepts, procedures and principles.

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