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Embodied Cognition Profile of Junior High School Students in Solving Math Problems Based on Different Learning Styles

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ABSTRACT

The purpose of this study is to describe the embodied cognition profile of junior high school students in solving math problems based on different learning styles (including visual, audio, and kinesthetic learning styles). Embodied cognition is a cognitive process resulting from a person's sensorimotor activities, involving interaction with the surrounding environment to obtain and represent their knowledge, in the form of gesture and utterance. The instruments used include: learning style questionnaire, math problem solving tasks, interview guidelines, observation sheets. The results of this study are: (1) students with visual learning styles bring up gestures, namely pointing, representational, and writing gestures, and bring up utterances such as clear speech and tone of voice, calm facial expressions, focused gaze and eye movements, body calmness; (2) students with audio learning styles bring up two gestures, namely pointing gestures and writing gestures, and bring up utterances such as clear speech and tone of voice sometimes soft, calm facial expressions sometimes hesitant, focused gaze and eye movements, hands moving when explaining something; (3) students with kinesthetic learning styles bring up gestures, namely pointing, writing, and representational gestures, and bring up utterances such as clear speech and tone of voice, calm facial expressions, focused gaze and eye movements, hands moving when explaining something.

Keywords: *Embodied Cognition, Problem Solving, Learning Style*

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INTRODUCTION

Mathematics is one of the branches of science that is often used in various educational sciences. Mathematics is also a universal science that is responsible for the development of modern technology (Hidayat & Pujiastuti, 2019). That is, it can be said that the role of mathematics as a branch of science is the basis for the development of other sciences. Therefore, mathematics needs to be learned from an early age so that students can think critically, logically, systematically, and effectively in solving problems.

Polya (2004) defines problem-solving as an effort to find a way out of a difficult situation to achieve a goal that cannot be achieved immediately. Students need to have the confidence to achieve goals in solving the problems face. This is supported by Kvedere (2014), "Students with higher levels of self-efficacy set higher goals, apply more effort, persist longer in the face of difficulty and are more likely to use self-regulated learning strategies". That is, students with high levels of self-efficacy tend to set more ambitious goals, exert greater effort, have higher persistence in the face of challenges, and tend to use self-regulated learning strategies. Another statement by Ganley and Lubienski (2016) is, "A person will perform better on difficult and complex problems because they are more confident that they can solve these problems". This means that a person will be more effective in dealing with difficult and complex problems because they have strong confidence that they can overcome these challenges.

Students' self-confidence can be seen from their behavior, and gestures while solving the problem at hand. According to Oktariani's (2018) statement, students who have high self-confidence tend to show active behavior in the learning process. In addition, individual self-confidence will encourage them to show behavior that can lead to achieving the expected results (Fatwikiningsih, 2020).

Student behavior in the form of gestures and ordinary speech is involved in solving the problem at hand. This is supported by Wellsby and Pexman (2014) who stated that students use their thinking skills in solving math problems by involving gestures and spontaneous speech. Body movements and spontaneous speech can facilitate a person in the process of solving problems. The same thing was also said by Susan Wagner Cook et al (2017), "..children who learn using gestures are more likely to transfer and generalize their knowledge". That is, body movements have a special effect in transferring knowledge and generalizing their knowledge so that they can find solutions to the problems at hand. According to Nemirovsky et al (2013), the use of gestures has better effectiveness in delivering material and solving math problems than without using gestures.

Williams and his colleagues (2012) revealed that these gestures and speech are Theories of Embodied Cognition. This theory explains that a person's cognitive abilities are related to the person's behavior and perception (Williams et al., 2012). Embodied Cognition theory states that the body participates in a person's thought process. When a person faces a problem, he will naturally think for a moment, and respond to the problem spontaneously through the interaction of body movements. Embodied Cognition can be in the form of gestures and speech (Dwijayanti et al., 2018). Thus, the gestures and words displayed by students when solving math problems

are a form of embodied cognition. Embodied cognition itself can be in the form of gestures and utterances (Dwijayanti et al., 2018). According to Alibali and Nathan (2012), gestures in embodied cognition are divided into three types, namely pointing gestures, representational gestures, and writing gestures. Meanwhile, Nemirovsky and Ferrara (2009) revealed several aspects of utterance, namely speech, facial expressions, gaze and eye movements, tone of voice, and body poise.

Embodied cognition of each student in the form of gestures and speech shown can vary in solving problems. This difference is due to students' different learning styles, namely visual, audio, and kinesthetic learning styles. Learning style refers to the consistent way used by a student to absorb stimuli or information, remember, think, and solve problems during the learning process (Nasution, 2017). Students with kinesthetic learning styles usually use body movements in solving problems while students with audio and visual learning styles tend to speak in solving problems (Thobroni & Mustofa, 2017). This shows that gestures and speech will be displayed by students according to their learning style (Ginosar et al., 2019). Therefore, embodied cognition is related to each student's learning style, so different types of learning styles affect the embodied cognition profile that each student shows in solving math problems.

Based on research by Ida Dwijayanti (2018) found that students use speech and gestures as a form of embodied cognition of mathematical imagination. The purpose of the study was to describe students' mathematical imagination in understanding algebraic concepts. In addition, research has been conducted by Ema Surahmi (2023) to describe the embodied cognition profile of elementary school students in solving math problems based on gender. However, the research that researchers will do is different, namely describing the profile of embodied cognition in the form of gestures and speech of students who have different learning styles in solving math problems.

METHOD

The type of research used is exploratory research with a qualitative descriptive approach. The subjects in this study consisted of three female students of SMP Negeri 39 Surabaya with visual, audio, and kinesthetic learning styles who had equal (medium) mathematics abilities.

Data collection through math problem-solving tasks, observation, in-depth interviews, and recording documentation. The main instrument in this research is the researcher himself, while the auxiliary instruments include: math ability tests, learning style questionnaires, math problem-solving tasks, interview guidelines, and observation sheets.

Data validity is carried out using time triangulation techniques. Time triangulation is a method used to test the credibility of data by checking through interviews and observations of subjects at different times (Sugiyono, 2016). The reason researchers use time triangulation is because this research focuses on subject behavior, especially the subject's embodied cognition in solving mathematical problems, it is important to observe whether the subject's embodied cognition is consistent or remains the same at different times. Then analyze the data through stages: classifying data, data reduction, data presentation, data interpretation, and conclusion (Lexy J. Moleong, 2019).

RESULTS AND DISCUSSION

Embodied Cognition Profile of Students with Visual Learning Style (S_V) in Solving Mathematics Problems

1. Understanding The Problem

S_V reads problems by not making speech and sound, calm facial expressions, moving eyes focused on the questions read, calm body. S_V subjects do not use any gestures when reading problems or can be called non-gesture utterances (Francaviglia & Servidio, 2011; Nemirovsky & Ferrara, 2009; Salle, 2020). The non-gesture utterance used by S_V is a form of response from the brain sensors to the problem-solving task given. The brain sensors respond to the "read" instruction from the researcher to find out the information in the task. The brain sensors themselves cannot carry out this instruction, but rather the motor nerves take on the role of following up on the reading instruction, which is carried out through non-gesture utterances. Therefore, at this stage, it can be said that the non-gesture utterance acts as an executor, indicating that the utterance has quite an important role. The information obtained is then processed in the brain (information processing), and S_V tries to understand the meaning of what is read, generating ideas. The activities of Subject S_V reading the questions can be shown in Figure 1 below.

Figure 1. S_V reads the problem

Just like the previous process, the brain responds to commands from researchers to retell in its language. However, because the brain cannot do it alone, the motor nerves respond and act on the activity. This gave rise to non-gesture utterance as the executor in the activity of retelling the information obtained after reading the problem. S_V stated that the material in the problem was the concept of an upright triangular prism and recounted it by saying, "Adi and his friends want to go to the forest for camp and they want to make a tent. The tent they want to make is made of tarpaulin, is in the shape of an upright triangular prism, and has a size in the picture. The price per square meter of tarpaulin is Rp 8,000.00" accompanied by a clear tone of voice, smiling facial expression, gaze and eye movements directed at the researcher, as an embodiment of embodied cognition self-confidence that what is told is based on facts and information that has been read. S_V's attitude is by the theory that cognitive processing involves the recreation of direct sensory experience (Meteyard et al., 2012; R. A. Wilson & Foglia, 2013). This shows the importance of S_V's experience, both from personal experience and from their environment, in constructing conceptual knowledge. Prior information owned by a child is an important aspect of encouraging cognitive development (Laakso, 2011). The activity of Subject S_V retelling the problem solving task in her language can be shown in Figure 2 below.

Figure 2. S_V retells the problem in her language

S_V made a pointing gesture when expressing what was known along with the logical reason for using a pen, as a manifestation of embodied cognition S_V

pointed to the object being discussed. Referring to pointing gestures, gestures used to indicate objects using fingers or writing tools (Alibali & Nathan, 2012; McNeill, 2013; Shein, 2012). The S_V revealed the known information by saying, "The height of this door is 4 meters, then the base of this tent measures 6 meters by 10 meters, and the price of tarpaulin is Rp 8,000.00/m^2" accompanied by a clear tone of voice, calm facial expressions, gaze and eye movements focused on the problem then the researcher. S_V also revealed logical reasons related to known information by saying, "because the question has written these sizes of 4 meters, 6 meters, and 10 meters, and also the price of tarpaulin is IDR 8,000.00/m^2" accompanied by a clear tone of voice, calm facial expressions, gaze and eye movements focused on the researcher. Based on Nemirovsky Ferrara's research (2009), utterance and gesture synergize in providing an explanation where gesture supports the explanation conveyed through utterance. The S_V activities to reveal known information along with logical reasoning can be shown in Figure 3 below.

Figure 3. S_V reveals known information along with logical reasoning

S_V revealed what was asked by saying, "the cost Adi needed to buy a tarpaulin" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the researcher, as an embodiment of embodied cognition of self-confidence in stating what was asked in the question. S_V paused for a moment with his gaze and eyes fixed on the question, calm facial expression before giving logical reasons, as a manifestation of thinking. S_V gave logical reasons related to what was asked by saying, "That's all that is asked because the question asks the cost Adi needs to buy a tarpaulin" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the researcher, as a manifestation of embodied cognition self-confidence in giving logical reasons in mentioning what is asked in the question. The non-gesture utterance raised by S_V is by the research of Nemirovsky and Ferrara (2009), Francaviglia and Servidio (2011), and Salle (2020). The activities of S_V expressing what is asked along with logical reasoning can be shown in Figure 4 below.

Figure 4. S_V expressed what was asked along with logical reasoning

S_V was silent for a moment with his gaze and eye movements focused on the problem, as an embodiment of thinking. S_V then nodded his head while saying, "In my opinion, it is enough to answer what is asked in the question, ma'am" with a clear tone of voice, calm facial expression, gaze, and eye movements focused on the researcher, as a manifestation of embodied cognition confirming his confidence in answering agreeing that what is known is sufficient to answer the question. This is supported by the research of Nemirovsky and Ferrara (2009). The S_V activities to reveal the sufficiency of information can be shown in Figure 5 below.

Figure 5. S_V reveals the sufficiency of information to answer what is asked

Based on the data analysis that has been carried out, the embodied cognition profile of S_V in solving math problems at the stage of understanding the problem is as follows: 1) Pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; 2) Speech as a manifestation of embodied cognition responding or answering the questions given; 3) Facial expressions as a manifestation of embodied cognition responding to the problem at hand and self-confidence in his words; 4) Gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to, the object in question or what is being thought about and self-confidence in what is said; 5) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed and understanding the entire content of reading in depth; 6) Body calmness as a manifestation of embodied cognition serious about what is being read and confidence in what is said.

2. Devising A Plan

S_V paused for a moment with his gaze and eye movements focused on the problem, as an embodiment of thinking. S_V explained the problem-solving plan with the words, "Find the surface area of the tent, then multiply it by the price of the tarpaulin Rp 8,000" accompanied by a clear tone of voice, calm facial expression, gaze, and eye movements focused on the researcher, as an embodiment of embodied cognition confirming the statement about the problem-solving plan. Furthermore, S_V gave reasons with words, "because the tent is made of tarpaulin to find the surface area of the tent and then multiply it by the price of the tarpaulin Rp 8,000.00 so find the cost Adi needs" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the problem then on the researcher, as a manifestation of embodied cognition confirming the reasons for planning problem-solving. The non-gesture utterance raised by S_V is by the research of Nemirovsky and Ferrara (2009). The activities of S_V explaining the solution plan along with logical reasoning can be shown in Figure 6 below.

Figure 6. S_V explained the problem-solving plan along with logical reasoning

S_V revealed the strategy used to calculate the surface area of the tent, namely the surface area of upright triangular prisms, with clear speech and tone of voice, calm facial expressions, gaze, and eye movements focused on the researcher, as a manifestation of embodied cognition of self-confidence in the strategy to be used. Furthermore, S_V moved his eyes to the right for a moment as an embodiment of eye tracking the memory of the formula for the surface area of an upright triangular prism. Then, S_V made a representational gesture by drawing a triangular upright prism using a pen on paper, as an embodiment of embodied cognition to help in remembering the formula for the surface area of a triangular upright prism. Furthermore, S_V said "The surface area is 2 times the base area plus the circumference of the base times the

height", with a clear tone of voice, calm facial expression, gaze, and eye movements focused on the picture, as a manifestation of embodied cognition of self-confidence in the formula of the equation area of the triangular upright prism that he remembered. Referring to representational gestures, a way of illustrating an intended thing, such as real or figurative objects (imagination), through the shape or movement of the hand, can also be realized by describing abstract forms into real forms or vice versa (Achadiyah & Abdussakir, 2015). Based on Nemirovsky Ferrara's research (2009), utterance and gesture synergize in providing explanations where gesture supports the explanation conveyed through utterance. The activity of S_V explaining the strategy chosen to calculate the surface area of the tent can be shown in Figure 7 below.

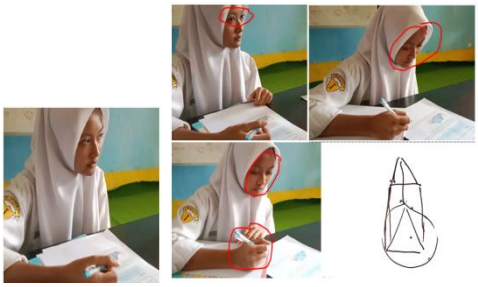

FIgure 7. S_V explained the strategy chosen to calculate the surface area of the tent

Based on the data analysis that has been carried out, the embodied cognition profile of S_V in solving mathematical problems at the stage of thinking about the problem-solving plan is as follows: 1) Representational gestures as a manifestation of embodied cognition of trying to find a memory of knowledge and affirmation of what is said; 2) Speech as a manifestation of embodied cognition responding or answering questions given; 3) Facial expressions as a manifestation of embodied cognition responding to the problem at hand; 4) Gaze and eye movements as a manifestation of embodied cognition focus on the person spoken to, the object he is thinking about or talking about, and tracking (eye tracking) against a memory of knowledge; 5) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; 6) Calmness of the body as a manifestation of embodied cognition confidence in what is said.

3. Carrying Out The Plan

S_V made a writing gesture which was writing the problem-solving procedure, shown in Figure 8 below.

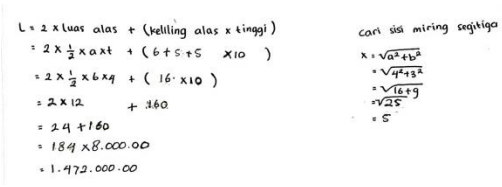

Figure 8. S_V wrote the problem-solving procedure

S_V moved his eyes to the right, left, and up for a long time as a manifestation of eye tracking the memory of the Pythagorean formula, as shown in Figure 9 below.

Figure 9. S_V does eye-tracking

S_V worked on problem-solving with a serious facial expression accompanied by silent lip movements in performing calculations, gaze and eye movements focused on his work, as an embodiment of embodied cognition focus in solving problems, shown in Figure 10 below.

Figure 10. S_V solved the problem

S_V moving the lips silently can help in performing calculations and as self-confirmation of the calculations performed (Nemirovsky & Ferrara, 2009). Referring to writing gestures, as what is thought with hand movements in writing (Shein, 2012).

S_V concluded with the words, "So the cost Adi and his friends need to buy a tarpaulin is 1.472.000" accompanied by a clear tone of voice, calm facial expression, gaze, and eye movements focused on the researcher, as a manifestation of embodied cognition self-confidence in the conclusions he made. The non-gesture utterance raised by S_V is by the research of Nemirovsky and Ferrara (2009). The activities of S_V making conclusions from the results obtained can be shown in Figure 11 below.

Figure 11. S_V makes conclusions from the results obtained

Based on the data analysis that has been done, the embodied cognition profile of S_V in solving math problems at the stage of implementing the problem-solving plan is as follows: 1) Writing gestures as a manifestation of embodied cognition writing problem-solving to make it easier to find answers; 2) Speech as a manifestation of embodied cognition responds or answers the questions given; 3) Facial expressions as a manifestation of embodied cognition of effort in solving problems, helping in doing calculations, and as self-confirmation of the calculations made and self-confidence in their words; 4) Gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or what he is doing and eye tracking of a knowledge memory; 5) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; 6) Calmness of the body as a manifestation of embodied cognition confidence in what is done.

4. Looking Back

S_V checked the steps of problem solving with gaze and eye movements focusing on the problem then writing his work, serious facial expressions, as an embodiment of embodied cognition focusing on checking at every step of problem solving. The non-gesture utterance raised by S_V is by the research of Nemirovsky and Ferrara (2009). The activities of S_V checking the steps of problem-solving can be shown in Figure 12 below.

Figure 12. S_V checked the problem-solving steps

S_V also checked the calculations with the movement of writing calculations on another paper, with gaze and eye movements focused on the calculations, serious facial expressions accompanied by lip movements without making a sound, as a manifestation of embodied cognition focusing on the calculations. S_V moving lips without making a sound can help in doing calculations and as a self-confirmation of the calculations he does (Nemirovsky & Ferrara, 2009). Referring to writing gestures, as what is thought with hand movements in writing (Shein, 2012). The S_V activities to check the

calculations in problem-solving can be shown in Figure 13 below.

Figure 13. S_V checked the problem-solving calculations

S_V confirmed checking the problem-solving steps with clear speech and tone of voice, "I read the problem again and checked my methods starting from finding the surface area of the tent using the formula for the surface area of an upright triangular prism, then multiplied by the price of the tarpaulin Rp 8,000". S_V also confirmed checking the problem-solving calculations with clear speech and tone of voice, "I rechecked my calculations such as the hypotenuse is correct 5, then 2 ×the base area is correct 24 and the perimeter of the base × the height is correct 160, then added up to 184, multiplied by 8,000 the result is 1,472,000".

Based on the data analysis that has been done, the embodied cognition profile of S_V in solving math problems at the looking back stage is as follows: 1) Pointing gesture as a manifestation of embodied cognition in pointing to an object being discussed; 2) Writing gestures as a manifestation of embodied cognition in writing calculations to make it easier to find answers; 3) Speech as a manifestation of embodied cognition responding or answering questions given; 4) Facial expressions as the embodiment of embodied cognition efforts in rechecking problem solving, assisting in performing calculations, and as self-confirmation of the calculations performed, as well as self-confidence in his words; 5) Gaze and eye movements as the embodiment of embodied cognition focus on the person being spoken to or what he is doing; 6) Tone of voice as the embodiment of embodied cognition confidence in every expression conveyed; 7) Calmness of the body as a manifestation of embodied cognition of confidence in what is done.

Embodied Cognition Profile of Students with Audio Learning Style (S_A) in Solving Mathematics Problems

1. Understanding The Problem

S_A reads the problem with no speech and sound, a calm facial expression then furrows his brow, his gaze moves to focus on the problem being read, plays with the pen on his finger, as a manifestation of embodied cognition that focuses on the sentence being read, and tries to understand what is being read. This is in line with Stainthorp (2021) who stated that reading is the initial stage in understanding the problem. The movement of rotating the pen while reading is an attempt to understand the reading (De Porter & Hernacki, 2007). Furrowing the eyebrows shows difficulty understanding the sentences he reads (Matsumoto & Hwang, 2011). The activities of S_A reading the problem can be shown in Figure 14 below.

Gambar 14. S_A reads the problem

S_A raises non-gesture utterances as an implementer in the activity of retelling information obtained after reading the problem. S_A stated that the material in the problem was the concept of an upright triangular prism and told it with words, "Adi and his friends will go camping, they need a tarp for the tent and this is a picture of the tent that will be made while the price of the tarp is

IDR 8,000.00" accompanied by a clear tone of voice, calm facial expression, gaze, and eye movements focused on the researcher, as a manifestation of embodied cognition self-confidence that what is told is based on facts and information that has been read. As for S_A, it brings up a gesture of pointing to a picture of a tent using a pen when retelling, as a manifestation of embodied cognition that S_A points to the object being discussed. Referring to pointing gestures, gestures used to show objects using fingers or stationery (Alibali & Nathan, 2012; McNeill, 2013; Shein, 2012). The activity of S_A retelling the problem in her language can be shown in Figure 15 below.

FIgure 15. S_A retells the problem in her language

S_A makes a pointing gesture when expressing what is known along with the logical reason for using a pen, as a manifestation of embodied cognition that S_A points to the object being discussed. Referring to pointing gestures, gestures used to indicate objects using fingers or writing tools (Alibali & Nathan, 2012; McNeill, 2013; Shein, 2012). S_A revealed the known information with speech, "known tent sizes, this triangular shape is 4 meters, then the base of the tent is 6 meters and 10 meters, there is also a known price of tarpaulin Rp 8,000.00/m^2" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the problem then the researcher, as a manifestation of embodied cognition self-confidence in providing statements about the information known in the problem. S_A gave logical reasons related to the information known with the words, "that's it, because it is known in the question about the sizes of this tent 4 meters, 6 meters, and a 10-meter tent, and also the price of tarpaulin Rp 8,000.00/m^2" accompanied by a clear tone of voice, calm facial expressions, gaze and eye movements focused on the researcher, with hands moving around, as a manifestation of embodied cognition self-confidence in giving logical reasons in mentioning the information known in the question. The remarks delivered by S_A are in line with Radford & Barwell's (2016) opinion that gestures such as moving hands can help students. Language is a tool for communication, while students' movements are actions in communication (Ng, 2019; Sfard, 2009). Based on research by Nemirovsky Ferrara (2009), utterance and gesture synergize in providing explanations for known logical reasons where gesture supports the explanation conveyed through utterance. The S_A activities reveal known information along with logical reasons can be shown in Figure 15 below.

Figure 15. S_A reveals known information along with logical reasoning

S_A revealed what was asked by saying, "the cost Adi needed to buy a tarpaulin" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the researcher, by moving his hands, as a manifestation of embodied cognition self-confidence in stating what was asked in the question. S_A provides logical reasons related to what is asked

by saying, "because the question only asks that" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the question then the researcher, with his hands moving, as a manifestation of embodied cognition self-confidence provides logical reasons in mentioning the information known in the question. The non-gesture utterance raised by S_A is by the research of Nemirovsky and Ferrara (2009), Francaviglia and Servidio (Francaviglia & Servidio, 2011), and Salle (2020). Gesturing while speaking can help students communicate what they want to say (Radford & Barwell, 2016). The S_A activity of expressing what is asked along with logical reasons can be shown in Figure 16 below.

Figure 16. S_A expressed what was asked along with logical reasoning

S_A expressed the adequacy of information by saying, "I think it's enough" with a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the researcher, by playing with a pen in his hand, as a manifestation of embodied cognition confirming his confidence in answering agreeing that what is known is sufficient to answer the question. This is supported by the research of Nemirovsky and Ferrara (2009). The S_A activities to reveal the adequacy of information can be shown in Figure 17 below.

Figure 17. S_A reveals the sufficiency of information to answer what is asked

Based on the data analysis that has been done, the S_A embodied cognition profile in solving math problems at the stage of understanding the problem is as follows: 1) Pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; 2) Speech as a manifestation of embodied cognition responding or answering the questions given; 3) Facial expressions as a manifestation of embodied cognition responding to the problem at hand; 4) Gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or the object in question and self-confidence in his speech; 5) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed and understanding the entire content of the reading in depth; 6) Calmness of the body as a manifestation of embodied cognition of self-habits and helps in speaking clearly.

2. Devising A Plan

S_A made a gesture pointing to the picture of the tent in the problem using a pen when explaining the solution plan to be used. As a manifestation of embodied cognition S_A points to the object being discussed. Referring to pointing gestures, gestures used to show objects using fingers or writing tools (Alibali & Nathan, 2012; McNeill, 2013; Shein, 2012). S_A explained the problem-solving plan with the words, "Calculate the surface area of the tent first, then multiply it by the price of the tarpaulin Rp 8,000.00." accompanied by a clear tone of voice, calm facial expression, gaze, and eye movements focused on the researcher, the embodiment of embodied cognition confirmed the statement regarding the problem-solving plan. Furthermore, S_A gave reasons with speech, "Because it takes tarpaulin to make a tent, so you have to find the surface area of a tent

made of tarpaulin, then multiply it by Rp. 8,000" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the problem then on the researcher, moving his hands, as a manifestation of embodied cognition confirming the reasons for planning problem-solving. Utterance non-gesture raised by S_A are by the research of Nemirovsky and Ferrara (2009). Utterance and gesture synergize in explaining the logical reasons known where gesture supports the explanation conveyed through utterance (Nemirovsky & Ferrara, 2009). The S_A activities explain the solution plan along with logical reasoning can be shown in Figure 18 below.

Figure 18. S_A explained the problem-solving plan along with logical reasoning

S_A revealed the strategy used to calculate the surface area of the tent, namely using the surface area of a triangular upright prism, with clear speech and tone of voice, calm facial expressions, gaze, and eye movements focused on the researcher, moving his hands as a manifestation of embodied cognition of self-confidence in the strategy to be used. Furthermore, S_A moved his eyes up, left, left, and down long enough as an embodiment of eye tracking on the memory of the formula for the surface area of an upright triangular prism, as an embodiment of embodied cognition of eye tracking on a memory of knowledge. In line with the research of Haataja et al (2018) regarding the use of eye movements when solving problems. Furthermore, S_A stated the formula for the surface area of an upright triangular prism by saying, "$2 \times (\frac{1}{2} \times a \times t) + (perimeter\ of\ triangle \times height)$", accompanied by a clear tone of voice, a confused facial expression, gaze, and eye movements focused on the researcher, hand movements covering the mouth as a manifestation of embodied cognition of self-confidence in the formula for the surface area of an upright triangular prism that he remembered. This is in line with the research of Nemirovsky and Ferrara (2009). The activities of S_A explaining the strategy chosen to calculate the surface area of the tent can be shown in Figure 19 below.

Figure 19. S_A explained the strategy chosen to calculate the surface area of the tent

Based on the data analysis that has been done, it is obtained that S_A's embodied cognition profile in solving math problems at the stage of thinking about the problem-solving plan is as follows: 1) Pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; 2) Speech as a manifestation of embodied cognition responding or answering the questions given; 3) Facial expressions as a manifestation of embodied cognition responding to the problems faced and self-confidence in his words; 4) Gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to and eye tracking on a memory of knowledge; 5) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; 6) Calmness of the body as a manifestation of embodied cognition of self habits, helping in speaking clearly, and self-confidence in the expression

conveyed.

3. Carrying Out The Plan

S_A gave rise to writing gestures, namely writing problem-solving with a serious facial expression, gaze, and eye movements focused on his work, as a manifestation of embodied cognition focused on writing the solution procedure. The S_A writing activities are as in Figure 20 below.

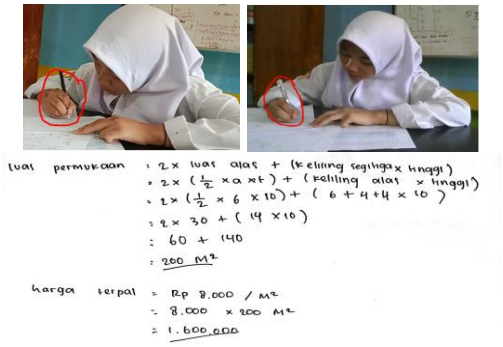

Figure 20. S_A wrote the problem-solving procedure

The S_A moves the eyes to the right, and left, up long enough as a manifestation of eye tracking to understand a concept of upright triangular prism. The activities of S_A calculating the costs required to buy tarpaulins can be shown in Figure 21 below.

Figure 21. S_A does eye-tracking

S_A concluded with the words, "So the cost of buying tarpaulins is IDR 1.600.000" accompanied by a soft tone of voice, a doubtful facial expression, gaze, and eye movements focused on the researcher, and slightly bowed his head as a manifestation of embodied cognition of doubt about the results he obtained. The utterance non-gesture raised by S_A is by the research of Nemirovsky and Ferrara (2009). The activities of S_A making conclusions from the results obtained can be shown in Figure 22 below.

Figure 22. S_A makes conclusions from the results obtained

Based on the data analysis that has been done, it is obtained that S_A's embodied cognition profile in solving math problems at the stage of thinking about the problem solving plan is as follows: 1) Writing gestures as a manifestation of embodied cognition writing problem solving to make it easier to find answers; 2) Speech as a manifestation of embodied cognition responds or answers the questions given; 3) Facial expressions as a manifestation of embodied cognition of effort in solving problems and self-confidence in the results obtained; 4) Gaze and eye movements as a manifestation of embodied cognition focus on the person he is talking to or what he is doing and tracking (eye tracking) of a memory of knowledge; 5) Tone of voice as a manifestation of embodied cognition of doubt about something he does; 6) Body calmness as a manifestation of embodied cognition of uncertainty about the results he obtained.

4. Looking Back

S_A checks the steps of problem-solving with gaze and eye movements focusing on his work writing, and serious facial expressions, as an embodiment of embodied cognition focusing on checking each step of problem-solving. The non-gesture utterance raised by S_A is by the research of Nemirovsky and Ferrara (2009). The S_A activities to check the steps of problem-solving can be shown in Figure 23 below.

Figure 23. S_A checked the problem-solving steps

S_A also checks the calculations by writing calculations on other paper, accompanied by gaze and eye movements focused on the calculations, and serious facial expressions, as a manifestation of embodied cognition focused on the calculations. The non-gesture utterance raised by S_A is by the research of Nemirovsky and Ferrara (2009). Referring to writing gestures, as what is thought with hand movements in writing (Shein, 2012). The S_A activity checks the calculations in problem-solving, which can be shown in Figure 24 below.

Figure 24. S_A checked the problem-solving calculations

S_A confirmed checking the steps of problem-solving with clear speech and tone of voice, "I checked the methods starting to find the surface area of the tent, then multiplied by Rp 8,000". S_A also confirmed checking the problem-solving calculations with clear speech and tone of voice, "Yes, ma'am. I have checked the calculation of the surface area of the tent and the price of the tarpaulin again and it is correct".

Based on the data analysis that has been done, the S_A embodied cognition profile in solving math problems looking backstage is as follows: 1) Pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; 2) Writing gestures as a manifestation of embodied cognition in writing calculations to make it easier to find answers; 3) Speech as a manifestation of embodied cognition responding or answering questions given; 4) Facial expressions as a manifestation of embodied cognition efforts in rechecking problem solving and self-confidence in his words; 5) Gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or what he is doing; 6) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; 7) Calmness of the body as a manifestation of embodied cognition serious about what is being read and confidence in what is being said.

Embodied Cognition Profile of Students with Kinesthetic Learning Style (S_K) in Solving Mathematics Problems

1. Understanding The Problem

S_K reads the problem with no speech and sound, calm facial expressions, eye gaze moves to focus on the problem being read, rotates the pen with the fingers, as a manifestation of embodied cognition that focuses on the sentence being read, and tries to understand what is read. This is in line with Stainthorp (2021) who stated that reading is the initial stage in understanding the problem. The movement of rotating the pen while reading is an effort to understand the reading (De Porter & Hernacki, 2007). The activities of S_K reading the questions can be shown in Figure 25 below.

Figure 25. S_K reads the problem

Utterance non-gesture as an implementer in the activity of retelling

information obtained after reading the problem. S_K stated that the material in the problem was the concept of building space and narrated it by saying, "There is a group of boys, Adi and his friends, who want to go to camp and they need tarpaulin to make a tent. Well, the picture of the tent is like in this picture which looks like an upright triangular prism. The sizes in the picture are 4 meters, 6 meters, and 10 meters, and the price per square meter of tarpaulin is IDR 8,000.00" accompanied by a clear tone of voice, smiling facial expressions, gaze and eye movements focused on the researcher, and hands moving while telling the story, as a manifestation of embodied cognition of self-confidence that what is told is based on facts and information that has been read. S_K gave rise to a representational gesture of a tent with a clenched hand movement. Language and gesture have formed a well-integrated system in communication, each having distinct characteristics that are effective in supporting meaning (Radford et al., 2009). The representational gestures used by S_K are validated by the opinions of Alibali & Nathan (2012) and Shein (2012), who state that representational gestures are hand or arm movements that represent certain objects, actions, concepts, and relationships. The activity of S_K retelling the problem in her language can be shown in Figure 26 below.

Figure 26. S_K retells the problem in her language

S_K makes a pointing gesture when expressing what is known along with the logical reason for using a pen, as a manifestation of embodied cognition that S_K points to the object being discussed. Referring to pointing gestures, gestures used to indicate objects using fingers or stationery (Alibali & Nathan, 2012; McNeill, 2013; Shein, 2012). The activity of S_K pointing to the information discussed is as in Figure 27 below.

Figure 27. S_K pointed to the known information

S_K revealed the known information with speech, "there is a triangular tent door, the height is 4 meters, the base is 6 meters, then there is a tent length of 10 meters, also known the price of tarpaulin is Rp 8,000.00/m^2" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the problem, as a manifestation of embodied cognition of self-confidence in providing statements about the information known in the problem. S_K gave logical reasons related to the known information with the words, "That's it because what is written in the question is 4 meters high, 6 meters base, 10 meters long tent, and the price of tarpaulin is Rp 8,000.00/m^2" accompanied by a clear tone of voice, calm facial expressions, gaze and eye movements focused on the question then the researcher, with his hands moving, as a manifestation of embodied cognition self-confidence in giving logical reasons in mentioning the information known in the question.

Figure 28. S_K reveals known information along with logical reasoning

S_K expresses what is asked with speech, "what is asked is how much it

costs to buy a tarpaulin" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the researcher, with hands moving around, as a manifestation of embodied cognition self-confidence in providing statements about what is asked in the problem. S_K gave logical reasons related to what was asked by saying, "Only that one is asked because Adi and his friends want to camp and need a tent made of tarpaulin, so what is needed is the cost to buy a tarpaulin like in the question" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the question then the researcher, with hands moving, as a manifestation of embodied cognition self-confidence provides logical reasons in mentioning the information known in the question. The non-gesture utterance raised by S_K is by the research of Nemirovsky and Ferrara (2009), Francaviglia and Servidio (2011), and Salle (2020). Gesturing while speaking can help students communicate what they want to say (Radford & Barwell, 2016). The activity of S_K expressing what was asked along with logical reasons can be shown in Figure 29 below.

Figure 29. S_K expressed what was asked along with logical reasoning

S_K expressed the sufficiency of information by saying, "In my opinion, it is enough, ma'am. Because the length of some sides of the tent is known and enough to solve the problem in the question" with a clear tone of voice, calm facial expression, gaze and eye movements focused on the researcher, with hands moving, as a manifestation of embodied cognition confirming his confidence in answering agreeing that what is known is sufficient to answer the question. This is supported by the research of Nemirovsky and Ferrara (2009). SK's activities to reveal the sufficiency of information can be shown in Figure 30 below.

Figure 30. S_K reveals the sufficiency of information to answer what is asked

Based on the data analysis that has been carried out, the embodied cognition profile of S_K in solving math problems at the stage of understanding the problem is as follows: 1) Pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; 2) Representational gestures as a manifestation of embodied cognition in representing the object being discussed; 3) Speech as a manifestation of embodied cognition responding or answering questions given; 4) Facial expressions as a manifestation of embodied cognition responding to the problem at hand and self-confidence in their speech; 5) Gaze and eye movements as a manifestation of embodied cognition focusing on the person being spoken to or the object in question and self-confidence in their speech; 6) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed and understanding the entire content of the reading in depth; 7) Calmness of the body as a manifestation of embodied cognition of self-habits and helps in speaking clearly.

2. Devising A Plan

S_K made a gesture of pointing to the picture of the tent in the problem using a finger when explaining the solution plan that would be used. As a

manifestation of embodied cognition, S_K pointed to the object being discussed. Referring to pointing gestures, gestures used to indicate objects using fingers or writing tools (Alibali & Nathan, 2012; McNeill, 2013; Shein, 2012). S_K explained the problem-solving plan with the utterance, "need to calculate the surface area of this tent first, then add up all the areas, then multiply by the price of the tarpaulin Rp 8,000.00." accompanied by a clear tone of voice, calm facial expression, gaze, and eye movements focused on the researcher, the embodiment of embodied cognition confirmed the statement regarding the problem-solving plan. Furthermore, S_K gave reasons with utterances, "Because what is asked is how much tarpaulin costs to make the tent needed by Adi and his friends, so you need to know the area of the tarpaulin on the sides of the tent, then add it up, well later it will be multiplied by the price of tarpaulin Rp 8,000.00/m^2" accompanied by a clear tone of voice, calm facial expressions, gaze, and eye movements focused on the problem then on the researcher, moving his hands, as an embodiment of embodied cognition confirming the reasons for planning problem-solving. Utterance and gesture synergize in providing explanations for known logical reasons whereas gesture supports the explanation conveyed through utterance (Nemirovsky & Ferrara, 2009). The activity of S_K explaining the solution plan along with logical reasoning can be shown in Figure 31 below.

Figure 31. S_K explained the problem-solving plan along with logical reasoning

S_K made a representational gesture of raising the index finger on his right hand when saying the word "the first", then raising the index and middle fingers when saying the word "the second", as a manifestation of embodied cognition in expressing what he said. These gestures involve hand, finger, or arm movements that represent some objects, actions, and concepts (Alibali & Nathan, 2012; Shein, 2012). Alibali & Nathan (2012) stated that representational gestures that coincide with speech occur when someone is thinking or trying to explain something, either to themselves or to others. S_K revealed the strategy used to calculate the surface area of the tent, namely using the area of a triangle and the area of a rectangle, with clear speech and tone of voice, calm facial expressions, gaze, and eye movements focused on the researcher, as a manifestation of embodied cognition of self-confidence in the strategy to be used. Furthermore, S_K moved his eyes to the right for a moment as an embodiment of eye tracking the memory of the triangular area and rectangular area formulas, as an embodiment of embodied cognition of eye tracking a knowledge memory. In line with the research of Haataja et al (2018) regarding the use of eye movements when solving problems. Furthermore, S_K said, "The area of a triangle is $\frac{1}{2}$ times the base times the height, sis. The area of a rectangle is length times width", with a clear tone of voice, calm facial expression, gaze, and eye movements focused on the researcher, as a manifestation of embodied cognition of self-confidence

in the formula for the area of a triangle and the area of a rectangle that he remembered. This is in line with the research of Nemirovsky and Ferrara (2009). The activity of S_K explaining the strategy chosen to calculate the surface area of the tent can be shown in Figure 32 below.

Figure 32. S_K explained the strategy chosen to calculate the surface area of the tent

Based on the data analysis that has been carried out, the embodied cognition profile of S_K in solving math problems at the stage of thinking about the problem solving plan is as follows: 1) Pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; 2) Representational gestures as a manifestation of embodied cognition in representing the object being discussed; 3) Speech as a manifestation of embodied cognition responding or answering questions given; 4) Facial expressions as a manifestation of embodied cognition responding to the problem at hand and self-confidence in his words; 5) Gaze and eye movements as a manifestation of embodied cognition focusing on the person being spoken to and tracking (eye tracking) on a memory of knowledge; 6) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; 7) Calmness of the body as a manifestation of embodied cognition of self-habits, helping to speak clearly, and self-confidence in the expression conveyed.

3. Carrying Out The Plan

S_K moved his eyes to the right, left, up long enough as an embodiment of eye tracking on the memory of the Pythagorean formula and calculations. This is in line with the research of Haataja et al (2018) regarding using solving tasks between eye movements and cognitive processes. The activities of S_K remembering the Pythagorean formula and performing calculations, can be shown in Figure 33 below:

Figure 33. S_K does eye-tracking

S_K brought up representational gestures when calculating 3×4 on the triangle area, accompanied by the movement of three fingers and then four fingers, as a manifestation of embodied cognition representing the object he was thinking about and helping in the calculation. Gestures are used as cognitive scaffolding that helps students solve math problems (Francaviglia & Servidio, 2011). An example is the movement of the fingers used by S_K as a counting tool in the calculation process to find answers. This is in line with Wilson (2002), who states that finger counting can be used as a representation of relevant numerical information, such as linking number words to objects to track quantities. Several studies have found that finger gnosis is related to the level of numerical competence (Barrocas et al., 2020; Penner-Wilger & Anderson, 2013). The activities of S_K eliciting representational gestures when calculating the triangle area can be shown in Figure 34 below.

Figure 34. S_K elicits representational gestures when calculating the area of a triangle

S_K gave rise to writing gestures, namely writing problem-solving, with a serious facial expression, gaze, and eye movements focused on his writing, and playing with the pen in his hand, as a manifestation of embodied cognition focused on writing the solution procedure. Referring to writing gestures, what is said is integrated with hand movements in writing (Shein, 2012). The movement of playing with a pen when solving problems is a manifestation of thinking (De Porter & Hernacki, 2007). The activity of S_K writing the problem-solving procedure can be shown in Figure 35 below:

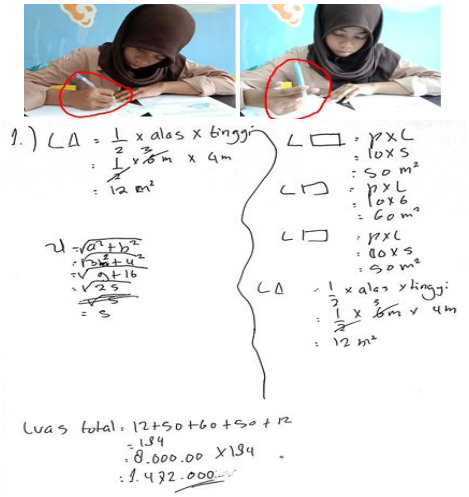

FIgure 35. S_K wrote the problem-solving procedure

S_K concluded with the words, "Because what is asked is the cost needed to buy tarpaulin as a tent material, the conclusion is that the cost required is IDR 1.472.000" accompanied by a clear tone of voice, calm facial expression, gaze, and eye movements focused on the researcher, and moving his hands as a manifestation of embodied cognition self-confidence in the conclusions he made. The non-gesture utterance raised by S_K is by the research of Nemirovsky and Ferrara (2009). The activities of S_K making conclusions from the results obtained can be shown in Figure 36 below.

Figure 36. S_K makes conclusions from the results obtained

Based on the data analysis that has been carried out, the embodied cognition profile of S_K in solving math problems at the stage of implementing the problem solving plan is as follows; 1) Pointing gestures as a manifestation of embodied cognition in pointing to an object that is being thought about; 2) Representational gestures as a manifestation of embodied cognition represent the object he is thinking about and help in calculations; 3) Writing gestures as a manifestation of embodied cognition writing problem solving to make it easier to find answers; 4) Speech as a manifestation of embodied cognition responding or answering the questions given; 5) Facial expressions as a manifestation of embodied cognition efforts in solving problems and self-confidence in his words; 6) Gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or what he is doing and tracking (eye tracking) of a knowledge memory; 7) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; 8) Calmness of the body as a manifestation of embodied cognition of self habits, helping to speak clearly, self-confidence in the expression conveyed, and helping to solve the problems faced.

4. Looking Back

S_K made a gesture of pointing to the problem-solving steps using his

fingers, as a manifestation of embodied cognition in pointing to an object that is thought or discussed. Referring to pointing gestures, gestures used to show objects using fingers or writing tools (Alibali & Nathan, 2012; McNeill, 2013; Shein, 2012). S_K checked the steps of problem-solving with gaze and eye movements focused on the problem then his work writing, serious facial expressions, and playing with the pen on his fingers, as an embodiment of embodied cognition focusing on checking each step of problem-solving. The non-gesture utterance raised by S_K is by the research of Nemirovsky and Ferrara (2009). The activities of S_K checking the steps of problem-solving can be shown in Figure 37 below.

Figure 37. S_K checked the problem-solving steps

S_K made a representational gesture, namely bringing up some of his fingers when doing calculations on another paper, as a manifestation of embodied cognition representing the object he was thinking about and helping in calculations. This gesture involves hand, finger, or arm movements that represent some objects, actions, and concepts (Alibali & Nathan, 2012; Shein, 2012). S_K made a gesture of writing calculations on another paper, with a serious facial expression, gaze and eye movements focused on his calculations, as a manifestation of embodied cognition focusing on rechecking problem-solving calculations. Referring to writing gestures, as what is thought with hand movements in writing (Shein, 2012). The activity of S_K checking the problem-solving calculations can be shown in Figure 38 below.

Figure 38. S_K checked the problem-solving calculations

S_K confirmed the checking of the problem-solving steps with clear speech and tone of voice, "So I checked the area of the tent which consists of the triangle area and the rectangle area. There are two triangles and three rectangles. Then add up all the areas and multiply by Rp 8,000". S_K also confirmed checking the problem-solving calculations with clear speech and tone of voice, "Yes, Ma'am. God willing. I calculated the area of a triangle with a base of 6 meters and a height of 4 meters correctly equal to 12 m2. Then the length of the hypotenuse is 5 meters using the Pythagorean formula with a being 3 meters and b being 4 meters. Then there are three calculations for the area of this rectangle, the first is the length of 10, the width is 5 the result is 50, the second is the length of 10 the width is 6 the result is 60, the third is the length of 10 the width is 5 the result is 50. Then the last triangle area is the same as the first one, which is 12 m2. All the areas are totaled $12 + 50 + 60 + 50 + 12 = 184$ then multiplied by Rp 8,000 to make Rp 1.472.000".

Based on the data analysis that has been carried out, the embodied cognition profile of S_K in solving math problems at the look back stage is as follows; 1) Pointing gestures as a manifestation of embodied cognition in pointing to an object that is thought or discussed; 2) Representational gestures as a manifestation of embodied

cognition represent the object he is thinking about and help in calculations; 3) Writing gestures as a manifestation of embodied cognition writing calculations to make it easier to find answers; 4) Speech as a manifestation of embodied cognition responding to or answering the questions given; 5) Facial expressions as a manifestation of embodied cognition efforts in rechecking problem solving and self-confidence in his words; 6) Gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or the thing he is doing; 7) Tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; 8) Calmness of the body as a manifestation of embodied cognition of self habits, helping to speak clearly, self-confidence in the expression conveyed.

CONCLUSION and SUGGESTION
CONCLUSION

Based on the results of the research data analysis and discussion previously described, the following conclusions can be drawn.

1. Embodied Cognition Profile of Students with Visual Learning Style in Solving Mathematics Problems:
   a. At the stage of understanding the problem, students with visual learning styles bring up pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; speech as a manifestation of embodied cognition in responding or answering questions given; facial expressions as a manifestation of embodied cognition responding to the problem at hand and self-confidence in their speech; gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to, the object in question or what is being thought about and self-confidence in what is said; the tone of voice as a manifestation of embodied cognition confidence in every expression conveyed and understanding the entire content of reading in-depth; body poise as a manifestation of embodied cognition serious about what is being read and confidence in what is said.
   b. At the stage of devising a plan, students with visual learning styles bring up representational gestures as a manifestation of embodied cognition of trying to find a memory of knowledge and affirmation of what is said; speech as a manifestation of embodied cognition responding to or answering questions given; facial expressions as a manifestation of embodied cognition responding to the problems faced; gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to, the object he is thinking about or talking about, and eye tracking of memory of knowledge; the tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; body poise as a manifestation of embodied cognition confidence in what is said.
   c. At the stage of carrying out the plan, students with visual learning styles bring up writing gestures as a manifestation of embodied cognition writing problem-solving to make it easier to find answers; speech as a manifestation of embodied

cognition responding to or answering questions given; facial expressions as a manifestation of embodied cognition of effort in solving problems, helping in calculating, and as self-confirmation of the calculations made and self-confidence in their words; gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or the thing he is doing and eye tracking of a knowledge memory; the tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; body poise as a manifestation of embodied cognition confidence in what is done.

d. At the stage of looking back, students with visual learning styles bring up pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; writing gestures as a manifestation of embodied cognition writing calculations to make it easier to find answers; speech as a manifestation of embodied cognition responding or answering questions given; facial expressions as a manifestation of embodied cognition in checking the problem solving, helping in doing calculations, and as a self-confirmation of the calculations made, as well as self-confidence in his words; gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or what he is doing; tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; body calmness as a manifestation of embodied cognition confidence in what is done.

2. Embodied Cognition Profile of Students with Audio Learning Style in Solving Mathematics Problems:
   a. At the stage of understanding the problem, students with visual learning styles bring up pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; writing gestures as a manifestation of embodied cognition in writing calculations to make it easier to find answers; speech as a manifestation of embodied cognition responding or answering the questions given; facial expressions as a manifestation of embodied cognition in checking the problem solving, helping in doing calculations, and as a self-confirmation of the calculations made, as well as self-confidence in his words; gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or what he is doing; tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; body calmness as a manifestation of embodied cognition confidence in what is done.
   b. At the stage of devising a plan, students with audio learning styles bring up pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; speech as a manifestation of embodied cognition responding to or answering questions given; facial expressions as a manifestation of embodied cognition responding to the problems faced and self-

confidence in their words; gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to and eye tracking on a memory of knowledge; the tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; body poise as a manifestation of embodied cognition of self habits, helping in speaking clearly, and self-confidence in the expression conveyed.

c. At the stage of carrying out the plan, students with audio learning styles bring up writing gestures as a manifestation of embodied cognition writing problem-solving to make it easier to find answers; speech as a manifestation of embodied cognition responding or answering questions given; facial expressions as a manifestation of embodied cognition of effort in solving problems and self-confidence in the results obtained; gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or the thing he is doing and tracking (eye tracking) on a memory of knowledge; the tone of voice as a manifestation of embodied cognition doubt in something he does; body poise as a manifestation of embodied cognition uncertainty about the results he obtained.
d. At the stage of looking back, students with audio learning styles bring up pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; writing gestures as a manifestation of embodied cognition in writing calculations to make it easier to find answers; speech as a manifestation of embodied cognition responding or answering questions given; facial expressions as a manifestation of embodied cognition efforts in rechecking problem-solving and self-confidence in their words; gaze and eye movements as a manifestation of embodied cognition focus on the person being spoken to or what he is doing; tone of voice as a manifestation of embodied cognition confidence in every expression conveyed; body poise as a manifestation of embodied cognition serious about what he is reading and confidence in what is said.

3. Embodied Cognition Profile of Students with Kinesthetic Learning Style in Solving Mathematics Problems:
   a. At the stage of understanding the problem, students with kinesthetic learning styles give rise to pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; representational gestures as a manifestation of embodied cognition representing the object being discussed; speech as a manifestation of embodied cognition responding or answering the questions given; facial expressions as a manifestation of embodied cognition responding to the problem at hand and self-confidence in their speech; gaze and eye movements as a manifestation of embodied cognition focus on the person

being spoken to or the object in question and self-confidence in their speech; the tone of voice as a manifestation of embodied cognition confidence in every expression conveyed and understanding the entire content of the reading in depth; body poise as a manifestation of embodied cognition self-habits and helps in speaking clearly.

b. At the stage of devising a plan, students with kinesthetic learning styles bring up pointing gestures as a manifestation of embodied cognition in pointing to an object being discussed; representational gestures as a manifestation of embodied cognition representing the object being discussed; speech as a manifestation of embodied cognition responding or answering the questions given; facial expressions as a manifestation of embodied cognition responding to the problem at hand and self-confidence in their words; gaze and eye movements as a manifestation of embodied cognition of focus on the person being spoken to and eye tracking of a knowledge memory; the tone of voice as a manifestation of embodied cognition of confidence in every expression conveyed; body poise as a manifestation of embodied cognition of self-habits, helping in speaking clearly, and self-confidence in the expression conveyed.
c. At the stage of carrying out the plan, students with kinesthetic learning styles bring up writing gestures as a manifestation of embodied cognition in pointing to an object that is being thought about; representational gestures as a manifestation of embodied cognition representing objects that are being thought about and helping in calculations; writing gestures as a manifestation of embodied cognition writing problem solving to make it easier to find answers; speech as a manifestation of embodied cognition responding or answering questions given and self-confirmation in solving problems; facial expressions as a manifestation of embodied cognition of effort in solving problems and self-confidence in his speech; gaze and eye movements as a manifestation of embodied cognition of focus on the person being spoken to or what he is doing and eye tracking of a memory of knowledge; tone of voice as a manifestation of embodied cognition of self-confirmation of his work and confidence in every expression conveyed; body poise as a manifestation of embodied cognition of self-habits, helping in speaking clearly, self-confidence in the expression conveyed, and helping in solving the problems at hand.
d. At the stage of looking back, students with kinesthetic learning styles bring up pointing gestures as a manifestation of embodied cognition in pointing to an object that is being thought about or discussed; representational gestures as a manifestation of embodied cognition representing the object they are thinking about and helping in calculations; writing gestures as a manifestation of embodied cognition writing calculations to

make it easier to find answers; speech as a manifestation of embodied cognition responding or answering questions given and self-confirmation in checking their work; facial expressions as a manifestation of embodied cognition of effort in rechecking problem solving and self-confidence in his words; gaze and eye movements as a manifestation of embodied cognition of focus on the person being spoken to or what he is doing; tone of voice as a manifestation of embodied cognition of self-confirmation when checking his work and confidence in every expression conveyed; body poise as a manifestation of embodied cognition of self-habits, helping to speak clearly, self-confidence in the expressions conveyed.

SUGGESTION

Based on the results, it is concluded that the tendency of students to use gestures and utterances helps the process of solving mathematical problems. Therefore, as a consideration for future teachers, it is recommended to design embodied learning-based learning. This aims to foster and develop students' courage in expressing and communicating mathematical ideas and alternative solution strategies through sensory-motor activities in solving mathematical problems.

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