

## Identification of Mathematics Anxiety Through Gesture

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**Abstract:** Mathematics anxiety refers to stress which occurs in quite long period of time when person interacts with mathematics. It may happen in any conditions, such as when teaching and learning take place or in the real life. This case study aims at identifying the main cause of mathematics anxiety, especially; it is mathematics experience which the subjects obtained in a very young age. The research subjects were two pre-school children at the age of 4-5 years. The researchers selected the subjects consider the willingness of parents and suggestions from teachers; it, therefore, allows the researcher to do further and in depth observation and exploration about the gesture. The researcher did direct observation to identify gestures when they learnt basic number concepts, and when they used mathematical concept in daily life. In the study, the subjects made various gestures, such as hand movement and facial expression when make verbal communication. The observation was done for about six months on a daily basis. Based the data analysis, it was found that the two subjects had different anxiety levels.

**Keywords:** mathematic anxiety, gesture, pre-school

Mathematics is a very prominent subject to be taught to pre-school children because they will always need mathematic to survive in their daily life. Cargnelutti, Tomasetto, and Passolunghi (2016) stated that mathematical competence owned by adult learners is actually the learning outcomes of mathematics skill learnt in the young age; therefore, their experience learning mathematics in pre-school can determine their attitude towards mathematic in the future.

According to Lewis (2014), researches on Mathematics Learning Disabilities in general can be categorized in two main areas, they are: identifying students' learning disabilities and their character complexity. Some researches which have been conducted on the area of learning disabilities made use of mathematic learning achievement as the standard to measure students' ability. The criterion is students who get low score in mathematics are as many as 25% of the students. It is, of course, irrelevant for students' ability is not only determined by their cognitive aspect but also social and other factors.

### Mathematics for Pre-School Children

Taylor (2014) said that basic competence of five-year old pre-school children comprises of four aspects: counting and cardinality; operations and algebraic thinking; measurement and data; geometry and spatial sense. Among the four aspects, counting and cardinality should be introduced prior to other aspects. The following are the indicators for counting and cardinality which are divided into five sub topics:

Mathematic Learning Development	Indicators
Number Names	Count 1-20
Cardinality	Count up to 10 objects using one-to-one correspondence, regardless of configuration, using the number name of the last object counted to represent the total number of objects in a set

	Count out a set of objects up to five
Written Numerals	Recognize written numerals up to at least 10
Recognition of Quantity	Quickly recognize and name, without counting, the number of objects in collections of up to at least five items
Comparison	Compare sets of up to 10 objects using a visual matching or counting strategy and describing the comparison as more, less than or the same

### **Anxiety**

Anxiety refers to condition when people frequently feel insecure cause by fear, and it is normally followed by inconsistent and avoidance behavior (American Heritage Medical, 2007, p. 38). The inconsistency could be observed or may appear either from utterance or attitude, for example being inconsistence to response to the same thing. Moreover, people who feel anxious will automatically show avoidance behavior to lower their anxiety.

In this context, anxiety and fear was understood in different way. Fear is emotional response toward facts, while anxiety is an anticipation toward something which has not happened. Both fear and anxiety have the same symptoms, sleeping disorders, over exhaustion, and concentrating difficulties (APA, 2013, p.189). In this study, the researchers limited the research scope only on the difficulties to concentration problems.

In addition to concentrating difficulties and inconsistency, anxiety symptoms can also be found physically from face gesture and body gesture. Face gesture includes lip suck, lip bite, lid droop, eyes closed, and eyes turn left/right/up/down. Then, body gesture includes hands pressed together in a moving sequence, tapping the tips of the fingers on the table, biting the nails, head tilt left/right/up/down

### **Mathematics Anxiety**

People who experience mathematics anxiety feel stress and fear when they are working or interacting with mathematics (Beilock & Willingham, 2014). Commonly, anxiety was caused by two factors, internal and external factor, and sometimes combination of both factors. Internal factor is more to the affective side, for instance feeling anxious and feeling hatred with mathematics. Bad experience when studying mathematics at school (include the curriculum) at home can create anxietyas well.

Mathematic anxiety caused by internal factors can be identified since in a very young age through gesture. Novack, Wakefield, Congdon, Franconeri, Meadow (2016) has investigated gestures employed by eight to ten years old children when they did equality task  $2 + 5 + 8 = \dots + 8$ . It was found that they spontaneously made gesture, like 'V' alphabet, when they could do the task very well using grouping strategy. They have adequate exprirmental evedince that what people do influence their internal feeling (Kontra, Beilock & Goldin-Meadow, 2012). At this stage, they have little experience learning and interacting with mathematic. Furthermore, gestures can be used to identify mathematic problems because they just learn mathematics. They are still beginner. Knowing whether children experience anxiety or not is very beneficial for teachers to consider the teaching and learning process in the future.

The results of some studies revealed that low basic mathematics competence is not the only factor that causes mathematics anxiety, but psychological factor also have significant influence on students' performance (Necka, Sokolowski, Lyons, 2015). Those who often feel anxious tend to experience mathematics anxiety easily.

## Research Method

The subjects of the study are two students at the age of four – five years old. The name is written in initial, they are AY and MA. The researchers decided to choose them due to close relationship, so it was easier for the researchers to collect data collection. Moreover, the researchers can do further and in depth observation and exploration. Based on the observation conducted in one kindergarten in Malang city, MA and AT were very active students and often interacted with teacher and classmates. More to that, they made various different gestures compare to other students. AY and MA is cousin; they grow in the same family environment. They also attended the same school, but in different class.

This study was carried out in four steps within around six months. First, the researchers observed the teacher and learning process for five meetings respectively in order to be able to select the appropriate research subjects. Finally, the researcher decided to select AY and MA because they were very active, and they parents agreed to participate in this study.

Second, the researchers started building rapport with their parents to inform them the appropriate topics for pre-school children. The topics were counting and cardinality. The selected topics were in line with the material they learnt at school. The researcher, then, discuss about the project and the material with their mother to ease them giving treatment about the topics at home.

Third, the researchers observed AY's and MA's attitude in school and at home with the purpose of recording their gestures when they were working with mathematics. The researchers used hidden camera in order to record natural responses.

Four, the researcher did coding process for every gesture which later would be analyzed. The result of this study was mainly on the use of gesture when the subjects interacted with mathematics under the with the teacher's or parents' accompaniment. All in all, the research procedures can be seen in the diagram below:

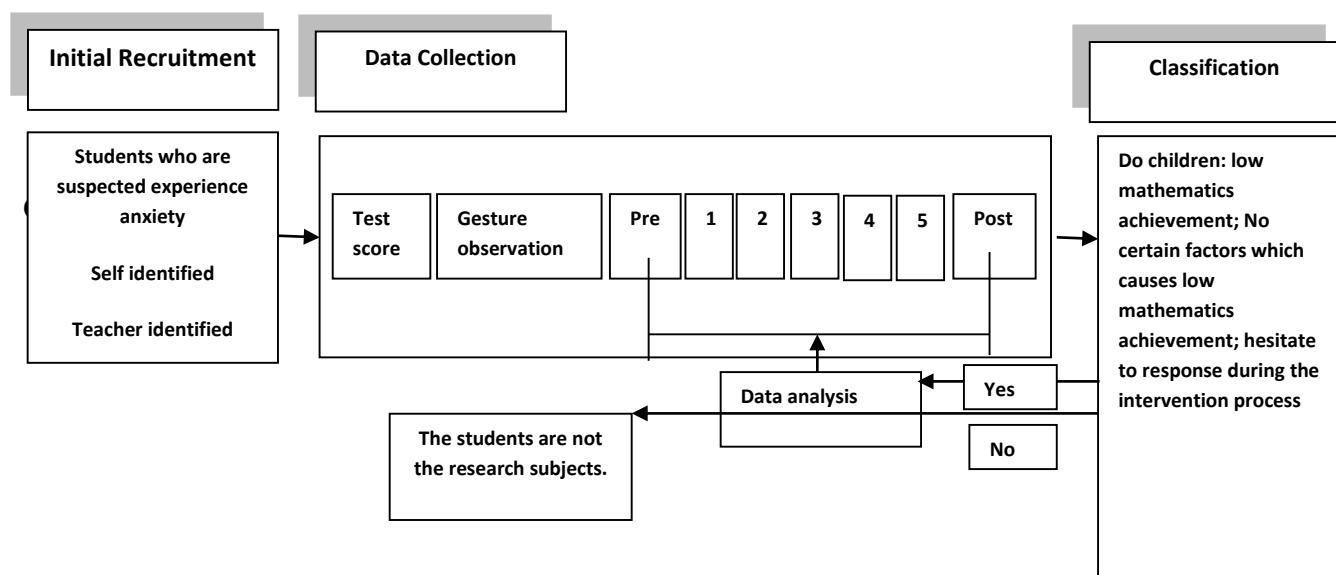


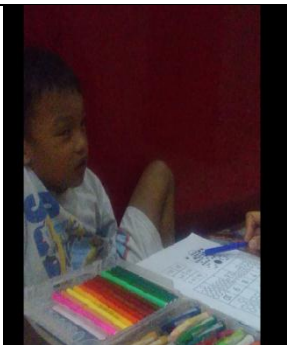
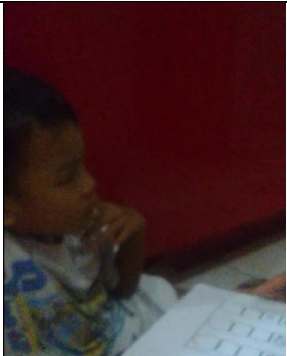





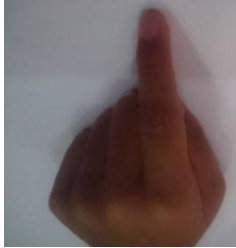
Diagram 1: Research Procedure








## FINDINGS AND DISCUSSION




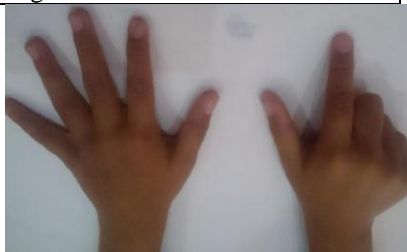


The followings table summarizes the findings of the study. The subjects made various gestures when they interacted with mathematics, such as (1) eye sight direction, (2) lips shape, (3) head position, (4) hands movements, and (5) Representation of number using fingers:

Table 1: Gesture



<b>Gesture</b>	<b>MA</b>	<b>AY</b>
Lip Suck	None	None
Lip Bite	 <p><b>Frequency: 4 times</b></p>	 <p><b>Frequency: 1 times</b></p>
Lid droop	None	None
Eyes Closed	None	None
Eyes turn left/right/up/down	 <p><b>Frequency: 10 times</b></p>	None
Hands pressed together in a moving sequence	None	None
Tapping the tips of the fingers on the table	None	None
Biting the nails	 <p><b>Frequency: 1 times</b></p>	None

<p>Head tilt left/right/up/down</p>	 <p><b>Frequency: 13 times</b></p>	 <p><b>Frequency: 3 times</b></p>
<p>Representation of number 1</p>	 <p>MA represented Number 1 twice; he used his pointed finger and thumb. His thumb was not fully kinked, so it caused misunderstanding either number 1 or 2. It reflected his inconsistency in giving response.</p>	 <p>AY represented number 1 only once. She was very consistent using her pointed finger. For this case, parents' role was very important; she used the same gesture like what had her mother taught her at home.</p>

Representation of number 2	 <p>Middle finger and pointed finger were very close. It means he worried about something.</p>	 <p>AY represented number 2 with two fingers (pointed and middle finger).</p>
Representation of Number 3	 <p>The three fingers (ring, middle, and pointed fingers) were very close. It indicated that he worried about something.</p>	 <p>The three fingers represented number 3. Her gesture indicated that she worried about something. The two fingers ( middle and ring fingers) were very close, while the pointed finger was far from the other.</p>
Representation of Number 4	 <p>Four fingers were very close, it indicated that he felt worried whether he answered the questions correctly or not. He did not fully bend thumb, therefore, it may create confusion or it is ambiguous.</p>	No response
Representation of number 5	 <p>The three fingers (pointed, ring, and little) were very close, while the thumb and the pointed finger were slightly open. It represented any doubt.</p>	 <p>All the fingers were widely open. She was very sure with her answer.</p>

Representation of number 6	 <p>To represent number 6, MA preferred to use his left hand more dominant compare to his representation for other numbers. He mostly used his right hand. Number 6 is the first number which requires five fingers from one hand and one finger from another hand. The shift of using one hand to two hands is sometimes confusing for pre-school children who experience anxiety.</p>	 <p>All the fingers were widely open. It revealed that she was very confident with her answer. She used her thumb to represent number 1. It proved that she understood the concept that number 6 is made up of five fingers plus one finger. In this case, the subject chose the thumb as it is the closest finger to the five fingers on the left hand.</p>
Representation of number 7	 <p>MA represented number 7 with all the fingers on the right hand, and two finger (ring and little finger) from the left hand. In this interesting that he used the two most left fingers.</p>	 <p>Seven fingers that represented number 7 were widely open. It showed that AY responded the question very confidently.</p>
Representation of Number 8	No Response	 <p>Eight Fingers that represented number 8 were widely open. It showed that AY responded the question very confidently.</p>
Representation of number 9	No response	 <p>Nine Fingers that represented number 9 were widely open. It showed that AY responded the question very confidently.</p>



Representing number 10	 <p>Not all MA's fingers were widely open. It represented inconsistency between the left and right hand. The position of left hand was different from the right hand indicated unsure or doubt even though he knew the correct answer.</p>	 <p>All the ten fingers were open widely when she represented number 10. It means that AY answered the questions very confidently, without any doubt.</p>
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## CONCLUSION

Mathematics anxiety is known as one factor that causes low mathematics achievement. While low mathematics achievement is not always a result of mathematics anxiety. Therefore, it is suggested that teachers and parents understand and familiar with the symptoms of mathematics anxiety in order to be able to give feedback for students' problem. In this study, MA and AY did not have good achievement on math. By observing the gesture, it is found that the subjects experience mathematics anxiety. They have different level of anxiety; in this case MA was more anxious than AY.

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