

ISSN 2615-2495

**International Journal of Insights for Mathematics Teaching**

Volume 02, No. 1, April 2019, pp. 75-84

## THE INFLUENCE OF TEACHER'S GESTURES TO STRENGTHENING THE UNDERSTANDING OF MATHEMATICS STUDENTS

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### *Abstract*

This (The present) research investigates gestures that can be used in learning mathematics in the classroom to strengthen the students' understanding of the concept and ideas of mathematics being taught by the teachers. In this article (paper), the researchers provide the evidence taken from the teachers and the students' gesture to show that mathematics can be realized. This is a descriptive study in which the data are collected through two sets of video recordings taken from two different teachers who carry out the teaching and learning process. The data are, then, transcribed and analyzed carefully to reveal the students' feedback on the methods used. The findings of this study suggested that gestures have the power that leads the students to understand the learning materials delivered by the teachers quickly, and different gestures revealed in the present research represent different things; (a) pointing gestures represent hands and fingers accompanied by talk to strengthened understanding students through movement within the physical environment, (b) representational gestures represent visual matters accompanied by discussion to enhance understanding students through mental simulation, action, and perception and (c) writing gestures represent a written explanation by talk to empower students through writing movement action be evidence of permanent marks on a sheet of paper, a whiteboard or visual media. Thus, the teacher's gestures are very important because it can strengthen the understanding of students of material studied in class.

**Keywords:** *Gestures, Pointing gestures, Representation gestures, dan Writing Gestures.*

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Gestures are a person's movement created through talk and treatment that aims to convey information, attitudes, or intentions of a person who appears accidentally or deliberately. There are three types of gestures that are examined in this research are: (a) marked with the pointing gestures using the fingers, hands, or sometimes stationery, to determine the physical object, place, or person, or to show the elements in space gestural mentioned in talk but visually does not appear (McNeill, 1992), (b) the representation of gestures is a movement which describes aspects and meanings, either literally or figuratively (Alibali, Heath, & Myers, 2001; Us, 2000), and (c) gestures of writing is the movement that occurs when the stationery used leave permanent marks on new media (e.g., worksheets, whiteboards, or visual representation). Three types of gestures above is meant as the movement of the body or limbs that are used in the teacher learning has a very important role in presenting the material and focusing attention students and understand the explanation that the speaker in line with advanced (Guidetti & Nicoladis, 2008; Rasmussen, Stephan, & Allen, 2004; Cochet & Vauclair, 2014).

Previous research, the researchers have shown interest to examine the role of gestures in mathematics education (Alibali et al., 2014) found research on gestures students tend to make geometric algebra and gestures when words that they cannot support the geometric reasoning, This is in line with that found (Keene, Rasmussen, & Stephan, 2012) this study reveals a productive movements that might emerge from the students as they learn with a complicated matter, it is different from the findings (Parrill, McKim, & Grogan, 2018) This descriptive study explores student movement that produces the degree program when talking about the concept of standard deviation (SD), the movement can be a

source of information about the internal representation of the underlying concepts important the mathematical, While (Rasmussen et al., 2004) suggests teachers using movement in micro-interventions adaptively in order to cultivate common ground when the instructional communication decreases, and (Richland, 2015) found about linking specific movement when their communicative analogy is designed to connect two different statements but mutually informative.

This article examines the teacher in the form of gestures convey mathematical material processed, these things have in common on research (Alibali & Nathan, 2012) who suggested that the movement which is often taken as evidence that the bodies involved in the think and talk-ing about the ideas expressed in the movement, so too with (Weinberg, Fukawa-Connelly, & Wiesner, 2015) which found that movement in mathematics helps in thinking and communication, next (Goldin-meadow, Nusbaum, Kelly, & Wagner, 2012) that with gestures can increase the load cognitive, gesturing when describing mathematical problem should take from the resources available to suit (Corts & Meyers, 2002) found that the gestures it supports talks in conveying the information from particular academic discipline, especially when it's hard, general reference, or abstract, as well as with other researchers who investigate the mathematical content in teaching that is expressed through speaking and writing in communicating, specifically the interplay among the interaction way of speaking, writing and gestures (Parrill et al., 2018; Weinberg et al., 2015), whereas (Paichi Pat Shein, 2012) found the movement of teachers are used as the Foundation to submit a problem to know the strategies students and tell the meaning of the geometric parts, but from the findings of the research no prior review of the effects of gestures used potentially to improve teacher submission problem students processed according to the content material is obtained.

## **GESTURES IN MATHEMATICS LEARNING**

Several studies have investigated the mathematical content in teaching that is expressed through speaking and writing compared aspects of the communication, in particular, the interaction of interplay between the manner of speaking, writing, and gestures. But the words, written symbols, and gestures still less is examined in detail. This is because previous research less observe what students learned from any given by the teachers.

On (Chue, Lee, Tan &, 2015) further classify the gestures according to some non-exclusive basis dimension: detect movement, which leads to an existing object or virtual; movement metaphor that refers to the abstract thinking; use the cue used for emphasis, and iconic gestures shown directly, next (Paichi Pat Shein, 2012) modifying gestures into three types of motion is investigated, namely: (a) pointing gestures are characterized by the use of the fingers, hands, or sometimes writing instruments, to determine the physical object, place, or person, or to show the elements in space gestures called in a speech but not visually (McNeill, 1992), (b) acts or gestures is representational of the movement which describes ideas and concrete and abstract entities, or events delivered with words, and (c) writing gestures occur when actions signaled to leave permanent marks on the new media.

The following is a description of a preliminary study based on opinion (Paichi Pat Shein, 2012) about the type of the basic gestures; (a) pointing gestures, (b) representational gestures, and (c) writing gestures. This preliminary study is kept in class 5 SDN Bontopajja gowa Regency, South Sulawesi, an important study was conducted to obtain information and an overview of potential gestures from teachers at the moment carry out learning in the classroom with identifying the teacher as a subject that will be observed through a video in accordance with three types of gestures on top.

Based on the preliminary studies with the teacher's gestures on identifying implementation process of learning in the classroom when the teacher explains that obtained about units of length by using markers pointing from top to bottom and vice versa from bottom to top that shows the unit of measure is pointing gestures, then when the teacher illustrates using the hand on the table right in the middle of the table, and each side is moved laterally to inquire into the way students measure the length of the table, and when the gestures representational teachers write down an example of problem-solving that accompanied the previous explanation is appropriate speech writing gestures. In addition to the findings of a preliminary study based on three gestures found 3 students who always wanted to pose problems for his friend, but when his friend is not able to solve the problem of these three children raced brandishing a hand to resolve the issues involved. This researcher thinks it is interesting because in addition to the three types of gestures are obtained, and some findings have not been examined in another study.

## **METHOD**

### **This type of research and the subject**

This research uses descriptive approach, types of qualitative research and 5 elementary school teacher who participated in the study, but only 1 video of teachers representing the participants observed “present videos converted to image” in this article. Deemed to have teaching experience in the subject areas of mathematics and using gestures in mathematics learning in the classroom. The selection of the subject through observation in the classroom that meets the three gestures typology characterization (Paichi Pait cents, 2012), namely, pointing gestures, representational gestures, and writing these observations on the gestures and the teacher has met 3 the criteria of gestures.

### **Data Collection**

Corpus data in this article consists of 2 processes of learning mathematics that was recorded with the video, which includes of the approximately 48-minute video first and second-minute video 49:53 field of study mathematics at grade 5 and grade 6. Teachers Teaching Teachers are 1 senior and 1 Novice Teachers deemed to have teaching experience in the subject areas of mathematics and using gestures in mathematics learning in the classroom. However, data collection is just learning the teacher transcribed word by Word as well as his movement. Talks and movement teacher copied during observation and inspected accurately or detail in accordance with the observed video, we next create a written description about motion and the talk of teachers based on games, based on three types of

gestures (Paichi Pat Shein, 2012) on the kind of the basic gestures; (a) Pointing Gestures, (b) Representational gestures, and (c) Writing Gestures. Observation on gestures about an already defined gestures rubrics based on the exploration of teachers ' gestures that appeared at the time of carrying out of mathematical learning in class.

**Table 1. Rubric Gestures**

Component	Description	Behavior
Pointing Gestures	Reflects the Foundation of cognition in the physical environment (talk speech gestures and verbal with the basic perception)	<ul style="list-style-type: none"> <li>• The use of pointing fingers marks the movement.</li> <li>• The use of a pointing hand marks the movement.</li> <li>• The movement was marked by pointed use of physical objects</li> <li>• The movement by designating the visual object</li> </ul>
Representation Gestures	Simulation of mental action and perception (action or movement that describes the ideas, or the concrete and abstract events conveyed by words)	<ul style="list-style-type: none"> <li>• Iconic,</li> <li>• metaphorical,</li> <li>• simulation,</li> <li>• connection</li> </ul>
Writing gestures	Writing or drawing anything that happens along with greeting	<ul style="list-style-type: none"> <li>• The motion of writing occurs when action gestures leave permanent marks on a sheet of paper, a whiteboard or other media</li> <li>• A visual representation</li> </ul>

**Interview**

In this article there are 3 students interviewed to find out the feedback on how fast the student obtained understanding for teachers implementing the learning in the classroom with the use of gestures: (1) one of the students who were interviewed to find out the feedback of pointing gestures teachers, (2) one of the students who were interviewed to find out the feedback from the teacher's gestures, representation (3) one of the students who were interviewed to find out the feedback from the writing teacher's gestures.

Interview conducted for 25 minutes were recorded by using the Notes field and audio. During the interview, the researcher follows the guidelines of the interview which was developed previously include asking students to explain the meaning of the gestures in the exploration of the use of teachers, such as: teachers use the depiction of teachers ' gestures, the understanding of students of teacher's gestures, the intent of teacher's gestures related ideas of mathematical ideas and concepts, even up to the type of gestures, and gestures that are more easily understood.

**Data and analysis**

The data on this research in the transcript and make the framework in five steps, which are described below:

1. Individually we identify potential gestures based on video and transcript. After that, discuss our ideas with the teacher to get advice and input in the writing of this article.

2. Collectively we call and identify the movements of teachers based on changes that occur every time.
3. Individually and then collectively, we describe the talks and movement associated with the material and the mathematical ideas of teachers.
4. Based on the transcript and video, we individually identify the appropriate teacher with gestures typology gestures (Paichi Pat Shein, 2012).
5. We do the coding process open and axial (Strauss & Corbin, 1994), based on typology gestures (Paichi Pat Shein, 2012), that is, pointing gestures, representational gestures, and writing gestures

To identify and describe examples of conceptual blending, we check every movement (in the context bundle semiotic) to identify ways in which the "concrete" aspects "of the gesture is connected to the mathematical concept of" abstract "appropriate mathematical concepts and ideas on learning material.

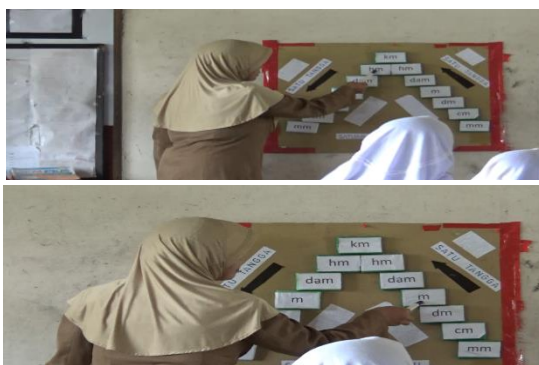
## RESULTS AND DISCUSSION

### Mathematical teachers in learning gestures

The study of teacher's Gestures on mathematical teacher's gestures of this research at the time of carrying out the process of learning mathematics processed 5 elementary school material "disambiguation" as for studies that retrieved every type of gestures are:

#### a. Pointing Gestures

The initial discussion of this research in discover interesting things when teachers use pointing gestures at the moment of delivering learning and discover based on transcripts of the interviews the students as a feedback learning maths are funded teachers in the classroom, and his findings are as follows.



The teacher describes the units of length by using markers pointing from top to bottom and vice versa from the ground up while talking.

Fig. 1 Instructor gesture showing pointing

#### Interview 1 (the subject of Surya)

In the picture above the teacher pointed to accompanied markers using a talk explaining the material to give understanding to the students the process of counting units of the desired length at any resolution, for example with a marker pointing gestures the teacher do when accompanied by indicated while saying "if it goes up a ladder (split 10), if the ride 2 times (divided 100), were up 3 times (divided 1000), etc. As well as the teacher's pointing back instead accompanied a talk "the same also if down one time

(multiplied by 10), if go down twice (multiplied by 100), and if it's down 3 times (increased by 1000) and so on. Based on the teacher's explanation, researchers get feedback from students (a. n. Surya) at the time of the interview said that when the teacher does not designate in accordance with the submitted so quickly, students do not understand, and say that if only talk and say up and down it must be students still confused because students don't know when multiplied and when shared, how many times the ride if increased 10 or times 100 divided down if, as well as on, so the researchers concluded that there is strength behind the teacher's pointing gestures because the right is looking at objects that talk about teachers, students can more quickly understand the material. Additionally, the researcher asks the students to make inquiries in accordance with the content but the question is different to that submitted the teacher and as a result the student able to make questions and solve them themselves.

### **b. Representation of Gestures**

Representation is the mental simulation action Gestures and perception (action or movement that describes the ideas, or concrete and abstract events conveyed by words) with a treat, iconic, metaphorical, simulation, and connection.



The teacher illustrated by using the hand on the table how to measure the length of the table while you talk.

Fig. 2 Instructor gesture showing a representation

### **Interview 2 (the subject of Aisha)**

Figure 2 above, the simulation shows a teacher with both hands on the table in the middle of the next table fit moving each hand laterally accompanied the talk, when the teacher says just talk without simulation "consider children, how How to measure this desk, and what use, students were silent, but when the teacher talk accompanied simulation on a table and talk "about if I want to know the length of the table is what's used? Students are simultaneously answering" meters." From the explanation teachers, researchers get feedback from students (a. n. Aisha) at the time of the interview said that when teachers just talk only all students silent for a moment, but when the teacher talk accompanied by simulating a hand on the table all the students answer immediately, students also said that the first question of the teachers of yesteryear are not too obvious but at the next question talk accompanied simulation students can understand the meaning of questions the teacher. So the researchers concluded that the movement simulation conducted an appropriate teacher may correspond to the objects that talk about teachers; students can more quickly understand the teacher's question. On the second subject, the researchers also ask the students to make inquiries in accordance with the material, but the problem is

different to that submitted the teacher and as a result the student able to make questions and solve them themselves.

### c. Writing Gestures

Writing gestures is writing or drawing anything that happens along with greeting treat movement writing occurs when action gestures leave permanent marks like on a sheet of paper, a whiteboard or media such as representation Visual.



The teacher writes down an example problem and problem-solving on the material unit of length.

Fig. 3 Instructor gesture showing writing

### Interview 3 (Subject Gaffar)

Figure 3 above, teachers write on the whiteboard write with markers one reserved accompanied previous explanations based on talk, the teacher shows the existence of movement gestures so that students who do not correspond to understand speech with the teacher, so the teacher write students who do not know can instantly know the teacher. From the teacher write writing gestures reserved on board, researchers get feedback from students (a. n. Gaffar) at the time of the interview said that teachers should indeed write after telling the students to understand more clearly the talk teachers, students say because we can see directly on the Board, so without talking armpit teacher write students can know the meaning of conversation teachers, students say teachers writing unless there is not good is definitely more complicated, we understand the reason students because if the explanation is not good teachers keep the writing teacher is also not right then, it's difficult to accept the students lessons in explaining teacher. Based on the student's explanation above, researchers concluded that indeed district teacher needs to be accompanied by writing that the teacher may consider that there is a language teacher who is not yet known when the teacher-student explaining gestures and students as listeners just sat quietly without kat said. On the subject of the third, giving the researcher a question about units of length and the subject was able to finish it, then I also asks the students to make inquiries in accordance with the material but the question differently, presented teacher, and the result is the student able to make questions and solve them themselves.

## DISCUSSION

The results showed that gestures can be investigated in detail based on gesture typology (Paichi Pat Shein, 2012) pointing gestures, representation gestures, and writing gestures, in contrast to previous studies that examined gestures on deixis dimensions based on the framework of McNeill (2005), deixis which describes the stages that show the position of objects or writings that describe the aspects of

mathematical gestures that influence each other, just as when fingers are used to describe an object to interpret gesture aspects that represent ideas such as the movement of the teacher's fingers making a geometric line; fingertips represent numbers as points on a number line, whereas in this study not only with digits, but also with, hands, other physical objects or visual displays to ground objects or writing, and movements to utilize the physical environment in various ways (Butcher, Mylander, & Goldin-Meadow, 1991; Morford & Goldin-Meadow, 1997).

In this study when the teacher designates a media that has a picture of a unit of ladder length, the teacher points with the stationary movement of the marker jumps one unit of direction down with a talk "km to hm (multiplied by 10), km to dam (multiplied by 100), km to m (increased by 1000), km to dm (multiplied by 10000), km to cm (multiplied by 100000), and lastly, km to mm (multiplied by 1000000), and vice versa when using unit ladder with direction to the teacher (mm to cm (divided by 10), mm to dm (divided by 100), mm to m (divided by 1000), mm to dam (divided by 10000), mm to hm (divided by 100000) and mm to km (divided by 1000000). Students all compete to solve it, pointing gestures studied in this study are accompanied by talking to provide students with an understanding of the material being taught and pointed to is the most commonly used movement to give a signal (Alibali, Nathan, & Fujimori, 2011).

After that the teacher uses other movements but the same object or material that is discussed or different objects "the teacher uses fingers and hands to paint or simulate in the air step by step up and down in accordance with the movements used when pointing at the media, (Jeannerod, 2001) Simulation of actions and perceptions involves activating the nerve regions involved in action planning, and produced as attitudes that depend on the strength of the simulation component actions of Hostetter and Alibali (2008, 2010). Representational movements come from simulations and actions and perceptions that also underlie language and mentality, Hostetter and Alibali (2008). Thus, imagining an object can evoke a simulation of perception (i.e., from actions related to understanding objects) or potential actions involved in interacting with objects.

In the gesture study of this study, in addition to investigating gesture gestures and representational gestures, it was also studied about the teacher's writing gestures. Writing movements occur when stationery is used to leave a permanent mark on new media (for example, worksheets, whiteboards, or visual representations), as explained by Vygotsky (1997) movement of writing in the air and written signs are very often done according to movement. In this study each teacher explained the material accompanied by speech and simulation, the teacher rewrote it on the chalkboard of the material described, besides that the writing movement serves a highlighting function (Goodwin, 1994) and as a form of action that can be proof of what was done (Goodwin, 2003). In addition, the researchers also found other results that when the teacher consistently used three types of gestures in each part of the mathematics material, students were not only quick to understand but also able to solve mathematical questions even able to raise problems according to the content described, and these



findings were in line with the movements can be a source of information about internal representations that underlie important mathematical concepts, while (Rasmussen et al., 2004).

## CONCLUSION

In this work, we have identified three ways in which the teacher as the subject is observed and students as informants to get feedback from the learning done by the teacher in the class, in this gesture study, using a resource-based body, especially movement, teaching and learning settings: (a) pointing gesture reflects grounding cognition in the physical environment, (b) gesture representation (i.e., iconic and metaphoric) movements manifest mental simulations of action and perception, and (c) some writing gestures that reflect body-based conceptual matters, and metaphor. Also, the researchers found other results that when the teacher consistently used three types of gestures in each part of the mathematics material, students were not only quick to understand but also able to solve mathematical questions even able to raise problems according to the content described. In carrying out this work, we strive to advance empirically developed businesses supported methods to enhance the educational experience of students and teachers. At the same time, we strive to improve the understanding of the nature of mathematical thinking, how it changes with development and learning, and how it is fostered through instruction.

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