Gesture of slow learner student in mathematical communication

A Sovia[1*], T Herman[2]
{annysovia@upi.edu}
[1,2]Program Studi Pendidikan Matematika, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No. 229, Bandung 40154, Indonesia

Abstract. This article discusses the gesture of slow learner students in solving the problem of mathematical communication. Gesture aims to understand and deepen the thinking process of students who have difficulty conveying ideas either with oral or written. This research is a qualitative research. Data were collected by giving two items of mathematical communication test to a fourth-grade slow learner student of elementary school, then the student gesture was observed through video recording which was obtained when students did the question. The results of this study reveal the pattern of slow learner gesture, i.e.: *Iconic* gesture: using the fingers and toes in counting. *Representational* gesture: the student could not answer a question with a clear rational, student was less able to explain her ideas, but did not feel embarrassed to ask. *Writing* gesture: student could write her ideas in writing after a given direction, but she still made a mistake in writing the mathematical symbols (like numbers) and forgot to write arithmetic operations (addition operation). For further research it is necessary to look at gestures with a greater number of samples and variations, both in terms of gender, grade, or cases of other children with Special Needs.

Keywords: Gesture Education, Mathematical Communication, Arithmatic, Student

Introduction

Gesture is body movement. Goldin [1] explained that the gesture will appear when the words are not understood by the listener. Roth [2] states that gesture is a bridge between the physical language and language experience of conceptual abstraction, this research has significant implications for teachers to perform diagnostics on students' understanding. Thus, the gesture can be interpreted as a body movement that appear to express a thought or feeling that cannot be conveyed through words. Reynold [3] reveals three functions of gesture: first: gesture is used to achieve, maintain, and re-focus on the problem to be solved, the second gesture is to strengthen and expand the meaning, if the words of the student or language used in problem solving are not familiar, the third: it is possible in some circumstances, gesture are the index of a degree of cognitive uncertainty that may be as a vehicle to replace the understanding (cognitive change). According to Alibali [4] in his research, it explain that the gesture serves to help children to find and coordinate understanding of the numbers to others.

There have been done many studies on gesture. It includes a research to see students' gesture in mathematics. Edward [5] found that the gesture in solving mathematical problems

WMA 2019, December 11-14, Medan, Indonesia

DOI 10.4108/eai.11-12-2019.2292270

had some uniqueness. Noto [6] conducted a study of two students of different ages about the gesture by giving a problem mathematical reasoning, on Harisman's research, he conclude that age was not the main factor that effected gesture, the gesture was influenced by experience. In another study Harisman [7] examined the gesture pattern on gender in solving mathematical problems, the study concluded that there were significant differences shown by males and females.

Most research on gesture makes students "normal" as the subject of research. It is rarely to find some researchers that examine how the gesture of children with special needs. A research on how gesture children with special needs in mathematics was done by Mustafa [8]. The findings grouped gesture autistic students into three categories in mathematical thinking, namely the *correct process, partially process,* and *contra dictory* process. However, this study only took the case on students with autism. Cases for students other children with special needs members have not been discussed in this study. Goldin [1] in their research left a question, i.e. how children with special needs gesture , how they speak and communicate.

Slow learner included in the category of students with special needs, physically the learner has the same characteristics with common students, but he has limitations in cognitive. According to Amelia [9] slow the learner is difficult to identify because they are not different in appearance outside and can function normally on most situations, then they have normal physique and have common sense. Slow Learner has an intelligence level below the average of around 75-90 [10]. Slow learner is a student who has low learning achievement or slightly below the average of normal children in general, either on one or all academic areas. This is similar to the explanation Chauchan [11], slow learner is characterized by: (1) limited cognitive abilities, (2) memory is slow,(3) impaired concentration, and (4) not able to explain the idea. The findings of the study from Supriadi [12] are also not much different, that the slow learner has problems in communicating, both verbally and in writing. Some results of this study lead us to a conclusion that the slow learner has cognitive limitations and difficulties in presenting ideas both orally and in writing.

Thus, it is important to identify slow gesture of students in mathematical learning. This is done as an effort to understand and deepen their thinking process that has trouble to convey the idea either verbally or in writing. An emerging movement can be seen as a form of verbal communication difficult manifestation they do. Achadiyah [13] argue the gesture function that students do in solving mathematical problems in groups includes (1) directing attention to important aspects of the problem (2) showing the position of something in the problem, (3) attracting, focusing, and maintaining attention to the important aspects being discussed, (4) writing something that already exists in the mind as a final form, (5) concreting something that is being considered, and (6) guiding or directing the thinking process. Alibali [4] Stated that the gesture can help children to pass on their knowledge to others. This means that when students are not able to express a problem with the language, the teacher can identify problem students through gesture. Gesture not only can reflect the children's understanding but also more of gesture may be involved in the process of cognitive change. Even the results of the study Iverson [14] explained that the gesture can replace the function of communication.

Experimental Method

Based on the explanation above, it was carried out a study to see how gesture of *slow learner* in solving mathematical communication. Gesture of student was observed when student was answering the questions and obtaining guidance. There were three types of gesture observed in

this study, i.e.: *iconic gesture, representational gestures,* and *writing gesture.* Shein [15] discribe three types of that gesture:
(1)*Iconic* gesture. The attitude is characterized by using fingers, stationery, physical objects, places, or people. In particular, Mc.Neil [16] he classifies the iconic gesture in reference, artifacts and visual representations associated with tasks (e.g. spreadsheets, whiteboard or other manipulative material). (2) *Representational* gesture. Attitude to illustrate the concrete and abstract ideas, entities, or events that are delivered orally and nonverbally. (3) *Writing* gesture. This movement occurs when the movement / gesture left permanent scars on new media (e. g. worksheets, whiteboard, or visual representation).

Mathematical communication problem are awarded to a fourth-grade slow learner student of elementary school in the city of Bandung.

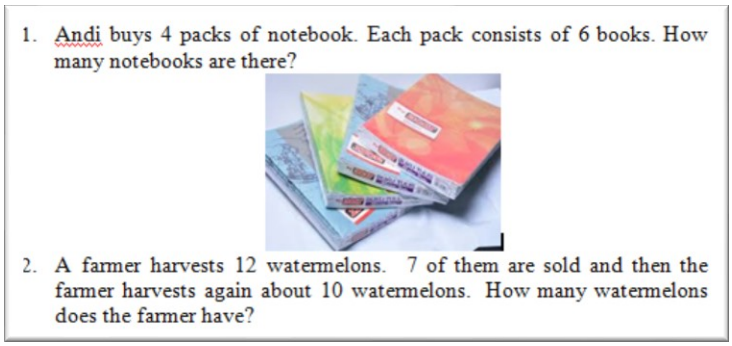

Figure 1. Mathematical Communication Problem

The questions were taken from indicator of (NCTM, 2000): (1) the ability to express ideas through speech, writing, and demonstrate and draw visually; (2) the ability to understand, interpret, and evaluate mathematical ideas, either orally, in writing, or other visual form; and (3) the ability to use terms, mathematical notation, and its structures to present ideas, describe the relationships with models of the situation. Based on these indicators, mathematical communication ability are grouped in two forms, i.e. writing and orally. Students must have mathematical communication skills, so that they can communicate mathematics both orally and in writing [17]. Written communication skills of the student were taken from the answer sheets, while the oral communication skills of students were seen from the conversation when guided by the interviewer in answering the questions. Problem is adjusted to the level of student ability *slow learner* based on the advice of master special assistants as follows.

Result and Discussion

After giving the questions to a student, the student observed the questions about a minute, then pensive, eyes blank, showed that the student did not understand the given problem. Student was given some time to think, but her eyes still empty. Seeing this, student was given a referral order to answer the question. Having directed a number of times, the student could answer the question correctly. In answering the question, the students used the help of fingers and toes to add up. Problem No. 1 is the sum of natural numbers problem. Anything written by the students looked like making patterns, not directly by summing the "6+ *6* + *6* + *6* =24", but by first summing the "6+ *6*= 12", and then repeated again "6+ *6*= 12", then written back

directly $6 + 6 + 6 + 6 =$. However, when performing the operations of addition, student was making a mistake at the final answer. Student wrote 24 to 204. Once written, the student was hesitated with his answer, and then confirmed whether the writing of 24 is 204? In the mind of the student, 24, is a combination of numbers 20 and 4, so it can be written 204. After confirming the answer, students removed the answer and replaced it with the correct answer, 24. If it is paid attention, in answering questions student also made a mistake on the last line answer No. 1, the student forgot to write two summation operations on the response. Answer No. 1 presented by the student as shown below.

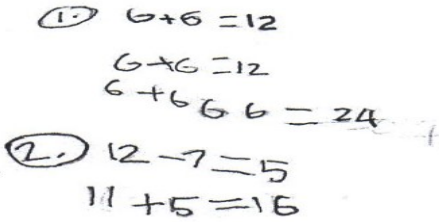

Figure 2. Students answer to Problem No. 1 and 2

Students also found difficulties to answer the question No. 2. At first, the student looked confused, meditated, and blank stares. Having directed, the student was able to answer correctly the provided questions, but in answering questions, students did not directly combine the operations of reduction and the sum. But, she did the subtraction operation first and then the addition operation as shown in Figure 2. When student was answering the questions and obtaining guidance, gesture of student was observed. The observation through a video presented in the following table.

Table 1. Protocol from Conversation and Gesture

Time (seconds)	Conversation	Gesture of Student
00: 00-02: 14	There was no conversation	Student was silent, quiet, a blank stare, and reading the question
02: 15-02: 20	Interviewer: How many packs of books do we have? There are 4 packs of books, right? (helping the student to understand the problem)	Looking at the question, while reading the question back
02: 21-02: 29	Student: (no answer)	Did not focus, looked back, and was pensive 
02: 30-02: 48	Interviewer: If every pack consists of 6 books, how many books are owned by Andi? (redirect)	Pointing toward problem by using a pencil, directing pencil to figure 4 packs of books

Time (seconds)	Conversation	Gesture of Student	
02: 49-02: 53	Student: five	Noting picture on the book to the question, as if calculating, then suddenly replied	
02: 54-04: 00	Interviewer: Uh...why 5? Let us count again, each pack consists of 6 books	Pointing at picture on the book to the question, trying to steer by using her fingers to indicate the number of books	
04:01: 04:12	Student: 1, 2, 3, ..., 12	Student calculated the interviewer' fingers, then wrote the answer on the book	
04: 13-04:23	Interviewer: Those are 2 packs of book, what about the other 2 packs?	Pointing toward an image of two packs of books that had not been counted by the student	
04: 24-04: 30	Student: (no answer)	Thinking, her eyes were looking up	
04: 31-04: 40	Interviewer: count 2 packs of other books!	Guided the student by calculating together with fingers	
04: 31-04: 43	student: 1, 2, 3, ..., 12	Student was counting the fingers of interviewer	
04: 44-04: 50	Interviewer: so, how many books are there? What is twelve plus twelve?	Re-directing the student to use fingers	
04: 51-06: 55	Students: (Pause a bit long)	Thinking as she was clapping her hands repeatedly, her eyes were looking up	
06: 55-07: 00	Interviewer: Let us count together!	Redirecting of using fingers to count	
07: 00-08: 50	Student: 1, 2, 3, ..., 24	She was inclusively counting by using her fingers and toes	
08: 50-	Interviewer: so, how many	Asking the student's answer again,	

Time (seconds)	Conversation	Gesture of Student	
08: 54	books are there? Write the answer!	so that the student was sure of her answer	
08: 55-09: 25	Student: six plus six, plus six, plus six, plus six, are twenty-four	She wrote while she was spelling addition operation	
09: 26-09: 28	Interviewer: so, what is the answer?	Convincing the student	
09: 29-09: 34	Student: Twenty-four. Does twenty-four have zero?	The student was confused, then the student asked the interviewer how to write 24	
09: 34-09: 36	Interviewer: it is two hundred forty	Looking at the student's answer	
09: 37-09: 49	Student: (silent)	Thinking, biting fingers, and her eyes were looking up	
09: 50-09: 52	interviewer: twenty-four were no null	Pointing towards the students' answers	
09: 53-09: 55	students: (no voice)	Looked back when the door was open, did not pay attention to the interviewer who was explaining	
09:56 - 10: 00	Interviewer: so twenty-four does not have "zero"	Crossing out the "zero" on the student's answer sheet	
10: 11-10: 12	Student: So, is this wrong?	Asked to the interviewer	
10: 13-10: 16	Interviewer: Just delete the "zero"!	Pointing at "zeros" that was already crossed	
10: 17-11: 12	Student: Deleted	Looked for an eraser, and then wrote the correct answer	

Gesture indicated by student in answering question No. 2 was almost the same with gesture while she was doing problem No. 1. Generally, gesture shown by the student based on video recordings are: student was often pensive and did not focus on the given problem; while she was working on the problems, her concentration was easily distracted; and if the student did not understand, she would show gesture of eyes looking up, biting fingers, and moving the body.

Conclusion

Based on the observations found that the third type of gesture appeared while student was solving the problems. *Iconic* gesture: using the fingers and toes in counting. *Representational* gesture: the student could not answer a question with a clear rational, student was less able to explain her ideas, but did not feel embarrassed to ask. *Writing* gesture: student could write her ideas in writing after a given direction, but she still made a mistake in writing the mathematical symbols (like numbers) and forgot to write arithmetic operations (addition operation). This study was conducted on one sample of slow learner students and still at the descriptive level. For further research it is necessary to look at more and more diverse samples, both in terms of gender, class, or cases of other children with Special Needs (ABK).

Acknowledgments

Thanks to teachers and students at SDN Bandung who have participated in this research, thanks to Anaguna (UPI graduate student, magister program) who have been willing to accompany researchers recorded the collaborative process from the beginning to the end, and thanks to Prof. Tatang Herman who has guidance in writing this article.

Reference

[1] S. Goldin-Meadow and M. W. Alibali, "Gesture's Role in Speaking, Learning, and Creating Language," *Annu. Rev. Psychol.*, vol. 64, no. 1, pp. 257–283, 2013.

[2] W. M. Roth and D. Lawless, "Scientific investigations, metaphorical gestures, and the emergence of abstract scientific concepts," *Learn. Instr.*, vol. 12, no. 3, pp. 285–304, 2002.

[3] F. J. Reynolds and R. A. Reeve, "Gesture in collaborative mathematics problem-solving," *J. Math. Behav.*, vol. 20, no. 4, pp. 447–460, 2001.

[4] Alibali, M. Wagner, and DiRusso, "The function of Gesture in Learning to Count: More Than Keeping Track," vol. 54. pp. 601–606, 1999.

[5] L. D. Edwards, "A Natural History of Mathematical Gesture," *American Educational Research Association Annual Conference*. 2003.

[6] M. S. Noto, Y. Harisman, L. Harun, A. Amam, and S. Maarif, "Adult Gesture in Collaborative Mathematics Reasoning in Different Ages," *J. Phys. Conf. Ser.*, vol. 895, no. 1, 2017.

[7] Y. Harisman, M. S. Noto, M. T. Bakar, and A. Amam, "The Different Patterns of Gesture between Genders in Mathematical Problem Solving of Geometry," *J. Phys. Conf. Ser.*, vol. 755, p. 011001, 2016.

[8] S. Mustafa, T. Nusantara, S. Subanji, and S. Irawati, "Mathematical Thinking Process of Autistic Students in Terms of Representational Gesture," *Int. Educ. Stud.*, vol. 9, no. 6, p. 93, 2016.

[9] W. Amelia, "Karakteristik dan Jenis Kesulitan Belajar Anak Slow Learner," *J. Ilmu Kesehat.*

Aisyah, vol. 1, no. 2, pp. 53–58, 2016.
[10] A. N. Aziz and A. Prabowo, "Analisis Proses Pembelajaran Matematika pada Anak Berkebutuhan Khusus (ABK) Slow Learner di Kelas Inklusif SMP Negeri 7 Salatiga," *Kreano*, vol. 6, no. 2, pp. 111–120, 2015.
[11] S. Chauhan, "Slow Learners: Their Psychology and Educational Programmes," *ZENITH Int. J. Multidiscip. Res.*, vol. 1, no. 8, pp. 279–289, 2011.
[12] N. Supriadi and D. Rani, "Analisis Kemampuan Komunikasi Matematis Siswa Lamban Belajar dalam Menyelesaikan Soal Bangun Datar," *Al-Jabar J. Pendidik. Mat.*, vol. 7, pp. 1–9, 2016.
[13] N. L. Achadiyah, "Gestur Siswa Sekolah Menengah Pertama dalam Memecahkan Masalah Matematis secara Berkelompok," *Suska J. Math. Educ.*, vol. 3, no. 1, pp. 49–56, 2017.
[14] J. M. Iverson and S. Goldin-Meadow, "What's communication got to do with it? Gesture in children blind from birth.," *Dev. Psychol.*, vol. 33, no. 3, pp. 453–467, 1997.
[15] Shein Pat Paichi, "Seeing With Two Eyes: A Teacher's Use of Gestures in Questioning and Revoicing to Engage English Language Learners in the Repair of Mathematical Errors," *J. Res. Math. Educ.*, vol. 43, no. 2, p. 182, 2012.
[16] D. McNeill, "Introduction," *Language and Gesture*. pp. 1–10, 2000.
[17] N. Nurhayati, "Pengembangan perangkat bahan ajar pada pembelajaran matematika realistik indonesia untuk meningkatkan kemampuan komunikasi matematis mahasiswa," *Fibonacci*, vol. 3, no. 2, pp. 121–136, 2017.