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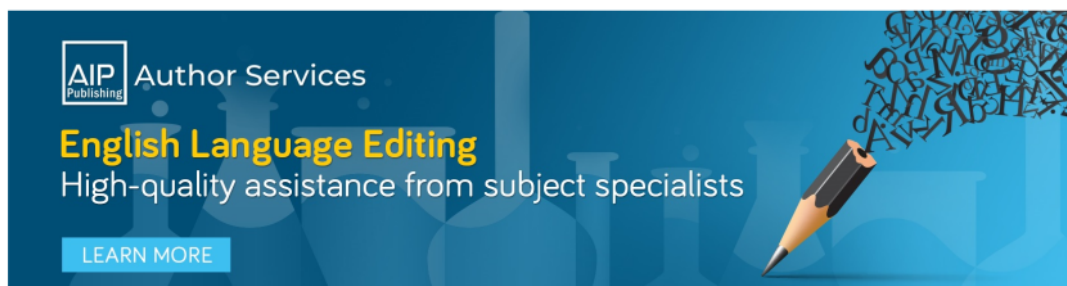
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Task Instrument that Support Children's Gesture with Special Needs Learning Mathematics

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Abstract. Mathematics learning is essential for children with Special Needs (CSN). In this study, we are focused on autism. All students must have the opportunity and support needed to study mathematics in-depth, which is done in task instrument development. The learning process on the CSN is not as easy as normal children. The learning process of CSN, in particular mathematics learning, requires a strategy or a special treatment according to their needs. Because, specifically, the CSN has difficulty understanding the meaning of mathematical symbols, so teachers must be able to teach mathematics in a concrete and straightforward definition of symbols by using parables in real. This research aims to describe the form of instruments that can support the CSN gesture in mathematics learning, so we hope that the mathematical learning process can be meaningful and enjoyable. We use observation techniques to collect data. We give instrument tasks as learning media for CSN in doing math tasks given by teachers. Observations were performed explicitly against the CSN gesture when working on the task. Furthermore, the data is analyzed exploratively by describing the instruments' forms of mathematics. The research's results are in the form of instrument development that supports CSN gesture learning mathematics.

INTRODUCTION

In relation to the learning process of Children with Special Needs (CSN), it can be defined as a child who experiences communication, social, and behavior developmental disabilities as the criteria established by The Diagnostic and Statistical Manual of Mental Disorders, namely social interaction, communication, restricted behavior (DSM-IV). Children with Special Needs (CSN) have various categories. There are 14 CSN categories, including one with autism [1]. According to the Diagnostic and Statistical Manual of Mental Disorders, autism is classified into three types of significant disorders, namely social difficulties, communication disorders, and behavior restricted (restricted behavior) [1]. This is also confirmed by the autism diagnosis of "Wing's Triad of Impairment" [2].

Regarding mathematics learning conducted at CSN, a preliminary study was conducted at the autistic special school, special school (ASC), and inclusive school description [3].
1. There are motor movements not in accordance with speech or observation. Communication can be done verbally and nonverbally, but the fabric is through body movements, cues, or by showing pictures.
2. Students must "struggle hard" to do "appreciation of the body" to remain seated, stay focused, and endure an activity. Some students can be calmer if they have particular objects to manipulate throughout the lesson. Some cannot calm down (like running around screaming and communicating alone with particular objects/things around them).

3. Students' learning difficulties understand the material and use of language, speaking, and writing, if individuals say, then echolalia (repeating words or sentences that are difficult to understand).
4. Students have difficulty in solving problems in order. For example, when the teacher asks to solve questions number 3, questions number 1 and number 2 are first solved.
5. Students have difficulty recognizing objects, understanding symbols, and connecting knowledge based on procedures, language, and formal symbol notation. So, the processes undertaken by students while doing assignments are partially correct/partially wrong. Some are all wrong or all correct.
6. If the teacher checks/confirms the results of student work (communicating with students), then it is found that "student gestures are in accordance with what they say" and "student gestures that are not in accordance with what they say."
7. The efforts made by the teacher in helping students in understanding the material are being studied, for example, by using pictures or doing a drill (repetition).

In addition, the results of Febriyanti's research 2018 explain that mathematics learning is carried out on special children (students with special needs) to give limits on abilities in accordance with the assessment abilities of psychologists. This is done so that the learning of mathematics given and received is in accordance with the initial level of ability possessed by the student. This is done so that the learning of mathematics given and received is in accordance with the initial level of ability possessed by the student. In addition, the study explained that CSN's mathematical thinking process (a case study on autism) was compensated a lot through motor movements that have characteristics partially, correctly, and contradictory gestures [4].

There are 5 (five) ways of autistic students in learning, namely: (a) Rote Learner, memorizes information as it is without understanding the meaning of the symbols they memorize; (b) Gestalt Learner, memorizes whole sentences without understanding the meaning of the word; (c) Visual Learner, processes information that they can see rather than what they hear; (d) Hands-on Learner, dabbling and gaining knowledge through hands-on learning experiences, and (e) Auditory Learner, gets information through his hearing [5].

The symptoms shown by CSN (diagnosed with autism) vary greatly depending on age, intellectual ability, the severity of language disorders, and adaptive skills (DSM-IV). Generally, CSN can be identified by knowing the symptoms, including (a) It is good to sleep lazily or sit alone with an indifferent, pale face and eyes always look down; (b) Often silent all the time, or hyperactive; (c) If there is a question to him, the answer is prolonged in a monotonous tone, then in a strange voice will tell himself with a few words then silence again; (d) Never asked, showed no fear and did not like the surroundings; (e) Does not look cheerful, and; (f) Do not care about the environment, except for objects he likes.

The learning process at CSN is not as easy as normal children, especially in learning mathematics. They require a separate strategy or treatment according to their individual needs because, precisely, CSN has difficulty understanding the meaning of mathematical symbols. So, the teachers must teach mathematics concretely and simply from the definition of symbols by using actual parables. For this reason, in learning mathematics, teachers need to deliver material using learning tools that can support CSN gestures during the learning process. One tool that can be used is a task sheet containing a mathematic problem presentation in the form of a representative picture that can support the creation of conducive learning. The purpose of this study is to describe the form of instruments that can support CSN gestures in learning mathematics, so it is expected that the process of learning mathematics can be meaningful and fun.

The National Council of Teachers of Mathematics (NCTM) recommends that all students learn mathematics, including CSN. All students must have the opportunity and support needed to study mathematics profoundly and with understanding [6]. The mathematical learning process in the CSN can be initiated from concrete to abstract, e.g., in geometry-building materials [7]. In learning mathematics, children with special needs (especially autism) produce a lot of body movements. Wing and Gould [4] reveal 2 (two) categories of CSN gestures in learning mathematics, namely matching and discrepancy gestures. The matching gesture is a representational gesture characterized by conformity when observing, pointing, and revealing/mentioning problems.

In contrast, a discrepancy is a representative gesture characterized by discrepancies when observing, pointing, and revealing/mentioning problems because they are distracted. They used gestures more than controls to facilitate conversational turn-taking, demonstrating a novel nonverbal strategy for regulating conversational dynamics. Autistic adults were more likely to gesture unilaterally than bilaterally, a motoric feature of gesture that was individually associated with autism symptoms. Co-speech gestures may link nonverbal communication symptoms and known differences in motor performance in autism [8].

One method that can be used in helping the CSN math learning is using the Prompt method. The Prompt is any assistance given to produce the correct response. Prompts give CSN additional information or help to run the instruction at the time of learning mathematics. Some prompts are as follows:

1. Verbal Prompt. A form of verbal information provides additional education on the task and tells the CSN what to do.
2. Modeling. It provides information to the CSN about what to do or how to do it by demonstrating the task
3. Gestural Prompt. It helps in cues that can include hands, arms, face, or other body movements that can communicate specific unique visual information.
4. Physical Prompt. It involves physical contact. We use this method when the other prompts do not provide enough information on the CSN to perform the task. We also use this method when the CSN can't develop their physical capacity in doing the activities.
5. Peer Tutorial. It is pairing the CSN with their friends who have difficulties/barriers. Here, CSN can act as a tutor.
6. Cooperative Learning. It is one of the most effective and enjoyable ways to direct multiple students with varying degrees of ability to work together in completing one of the tasks. Cooperative learning develops a positive and supportive environment that encourages self-esteem, appreciates the opinions of others, and accepts individual differences.

Various methods are used to facilitate the teacher in delivering learning. Teachers should conduct the application of various methods in the class according to the needs of CSN. In addition to the prompt type, teachers can also use the Task Method Analysis (Analysis of tasks) on the learning. Task analysis is a process to guide decisions and help identify what will be taught next. In this method, CSN has difficulty when trying, and can not complete the tasks, so given the treatment steps needed to complete the whole task. So the task analysis is the process of making tasks very detailed or small [9].

Various methods require teachers to play an active role in learning by 1). Inviting the CSN to communicate constantly, and; 2) Providing activities that can develop potential with the assistance of offering continuous instruction or giving the example of the criteria so that the CSN can accept learning in class despite the difference in needs.

We can use all methods on all types of CSN. But there are differences in the teacher's technique in addressing it. In the application, the teacher must deliver the material one by one by approaching the students, but these few methods can make it easier to convey learning in the classroom.

Based on the preliminary description, in this study, the researcher focused on the problem of learning instruments or mathematical assignment devices used by CSN in learning mathematics. Therefore, this study aimed to develop the task instruments that could support CSN in learning mathematics.

METHOD

This research is a type of quality research descriptive. The data were collected using observation techniques by giving task instruments as learning media for CSN in doing math tasks assigned by the teacher. The research instrument is a Task Sheet (Instrument Task) whose contents are developed based on learning tasks that CSN routinely gives in school. The instrument development is carried out through the Tryout phase and the expert validation. Example of Instrument Task form:

form of Building Space   Shape of Objects

Ball   Watermelon   Marbles   Meatball

FIGURE 1. Shape of objects.

The next step was data collection techniques using observation techniques. The observation was explicitly carried out by using a digital camera (audiovisual recording) of CSN gestures during the learning process in the classroom when doing the task. The data collected will then be analyzed qualitatively. Data analysis includes the steps carried out by Sussman [4]: (1) Process and prepare data for analysis. This step involves data transcription

derived from audiovisual learning recordings; (2) Read the entire data. The first step is to build general awareness of the information obtained and reflect its overall meaning. What general ideas are contained in learning interactions and how CSN gestures are, then examines the task instrument that allows it to be developed, and; (3) Analyze more details by developing the task instruments.

RESULT AND DISCUSSION

Figure 2 below shows us the outlined at school.

Lesson Material:
1. Know how to build a simple space Basic competency:
2. Group shapes up space: cubes, beams, cones, balls
3. Shows the shape of waking Room: cube, beam, cone, ball

FIGURE 2. Lesson material.

The student's condition is mild, so the curriculum is used based on the BSNP SDLB-C (mentally disabled). Students tend to still be able to follow the instructions/instruction of the teacher during the learning process but not be able to communicate verbally well. Starting learning, the teacher explained the material by showing concrete objects such as beams, cubes, cones, and others. Furthermore, teachers give the task of drawing objects in daily life. Students are required to observe and give the name of the waking type. The task is done independently, after which the teacher is guided to check the truth of Students ' answers.

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FIGURE 3. Gesture taking cone-shaped objects.

Figure 3 shows that students observe a number of concrete-shaped objects such as beams, tubes, and cones in their presence. The student seeks to listen to the teacher's direction, which asks him to take a beam-shaped concrete

object. The hand gestures of students respond by taking a cone-shaped "hat," of course, the gesture is wrong. The teacher directs the students by guiding/mentoring, observes the concrete objects one by one, and then asks them to take things shaped like cones because the previous answer was wrong. At the time of repetition, students can finally take concrete objects of "pencil boxes" that are shaped like beams. The conditions under the CSN in Fig. 3 indicate that CSN tends to understand the task when repeated guidance is given. The next activity is in Fig. 4.

FIGURE 4. Gesture naming shape objects.

Figure 4 shows the CSN gesture when writing the form of waking up space on objects that have been observed. After repeated, students call the picture "cube," The teacher asks students to write it. Students' repeated actions show "consistent speech," a voice/speech sound used by CSN to refer to a specific object. Gestures pointing while sounding indicate an emphasis is being put on the object being observed, as Sweller *et al.* [10] explain that gestures and speech are tightly linked, and Ozieblo [11] explains that gesture and speech have a strong relationship. When the student repeatedly wrote the image's name, the student also wrote a "beam," whereas when the teacher requested, the student answered the "Cube." This condition shows students experiencing mismatch (discrepancies between gestures and speech). But in the end, the student can write a "cube" with the teacher's guidance. The conditions experienced were also reinforced by Maes, Stercq, Kissine [12] that autistic children, independently of their level of language, pay little attention to pointing when no other social cues are available and fail to discriminate intentional pointing gestures from incidental ones. They seem to grasp neither the spatial nor the social value of points.
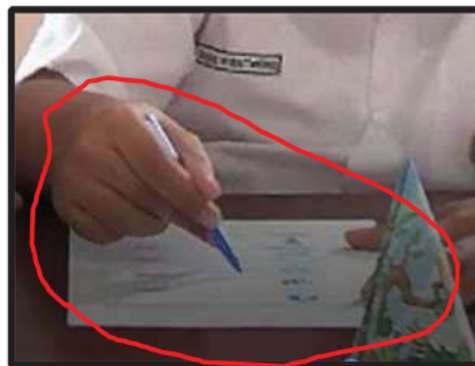

FIGURE 5. Matching concrete objects to build the space.

In the next task, CSN matches the image according to the name of the already prepared room build. We can see it in Fig. 5. The observation shows that before matching the picture, the teacher first guided the students to read one by one the names of the available spaces, such as "Cube, beam, and cone," after which the teacher pointed the picture and asked the students to answer "what form?". Students do not focus on answering the questions in this activity, which inconsistent answers indicate, but it remains incorrect. The teacher will ask the students to look at the picture and spell the object's name if this happens. If the students still answered wrong, for example, they mentioned

"tube" whereas the image is a cube, teachers help students by spelling "Cu....". Then the teacher asked students to point to the inscription "Cube." In the beginning, the students pointed to the caption "cone" because that was what they memorized. But then they corrected it quickly by spelling "c u b e" and marking the object's name by pulling a line on the cube image.

The students work found that if there are two objects/pictures of the same type, the line is drawn to match it with the writing that always meets at the end. Look at Fig. 4 above, the lines pointing to the tubes, beams, cubes, and balls.
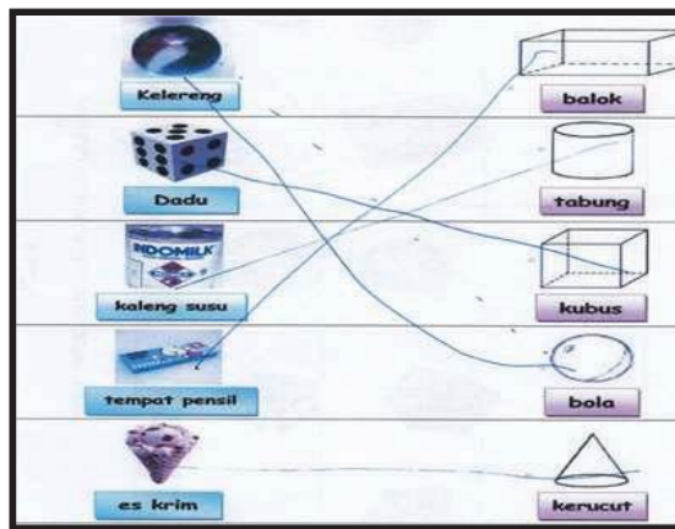

FIGURE 6. Matching concrete objects to build the space.

Similarly, in Fig. 6, a line is drawn from the same two types of images. The position of the drawn line in Fig. 6 equals the position of the line drawn in the next image. This indicates that autistic students have a visual-spatial ability, a tendency to perform a routine, and a structured rule [4]. The gesture indicates that gesture seems to activate semantic meanings that are useful for comprehension and learning [10].

The problem of learning mathematics for CSN can not be solved only from within the mathematics itself but is related to other aspects. These aspects include: (a) The ability of spatial relations (space), (b) Motor skills and visual perception, (c) language and reading skills, and (d) the ability of children to remember. Autistic students have the ability in the field of spatial visuals better than those associated with something abstract. One of the difficulties that CSN faced in math learning was that they were unable to organize the knowledge he learned (not being able to relate knowledge already learned to the knowledge that has been studied, although it is still in one subject).

Based on the learning activities done by CSN, the task sheet (instrument tasks) helps CSN individually in completing desired learning tasks. For this reason, learning strategies can be carried out using concrete objects or known as visual strategies or visual supports. This is reinforced by The National Autistic Society [13], which revealed that visual supports could be used to help individuals learn mathematics. The use of visual aids such as concrete objects in mathematics learning can also make learning more meaningful.

5 CONCLUSION

Based on the results of research and discussion, it can be concluded that CSN can learn mathematics when given an active, structured, and supported approach with the task instrument representative for the learning activities. In learning mathematics, task instruments that support CSN gestures are in the form of Visual supports is a communication tool that can be used to learn mathematics, for example, using concrete objects.

REFERENCES

1. M. Farrell. *Educating Special Children* (USA Routledge, 2008).
2. L. Wing and J. Gould, J. Autism Develop. Disord. **9**, 11–29 (1979).
3. S. Mustafa, "Strategi Pembelajaran Matematika dengan Gesture pada Anak Berkebutuhan Khusus," in *Buku Pembangunan Berkelanjutan: Pemikiran Dosen UMPAR tentang Pertanian, Ekonomi, Pendidikan, Kesehatan dan Lingkungan* (Parepare, UMPAR Press, 2014).
4. F. Sussman, *More Than Words* (A Hanen Centre Publication, Canada, 1999).
5. S. Mustafa, "Proses berpikir matematis dalam representational gesture anak kerkebutuhan khusus (studi kasus pada siswa autis)," Dissertation, Universitas Negeri Malang (UM), Malang, 2015.
6. National Council of Teachers of Mathematics, (2000), available at https://www.nctm.org/uploadedFiles/Standards_and_Positions/PSSM_ExecutiveSummary.pdf.
7. D. Koswara, *Pendidikan Anak Berkebutuhan Khusus Berkesulitan Belajar Spesifik* (PT. Luxima Metro Media, Jakarta, 2013).
8. A. D. Marchena, E.S. Kim, A. Bagdasarov, J. Parish-Morris, B.B. Maddox, E. S. Brodkin, and R. T. Schultz, J. of Autism and Develop. Disorders, **49**,1438–1454 (2019).
9. A. Setiawan, (2016), available at https://rumahdifable.blogspot.com/2016/08/pengertian-manfaat-cara-mengevaluasi.html.
10. N. Sweller, Sekine, K., and Hostetter, Front. Psychol. **12**, 732357 (2021).
11. R. L. Ozieblo. Lingua **208**, 1 – 18 (2018).
12. P. Maes, F. Stercq, and M. Kissine, J. Exp. Child. Psychol. **210**, 105205 (2021).
13. The National Autistic Society. (2003), available at http://www.autism.org.uk/visualsupports.

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