Utilization of manipulative teaching aids to grow the numerical ability of students with disabilities

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Abstract. Children with disabilities (CwD) have limitations in conceptual understanding of mathematics. Lack of numerical conceptual understanding will cause CwD to experience difficulty in counting. The purpose of this case study was to analyze the growth of numerical abilities of students with disabilities through the application of manipulative teaching aids. This research method used a qualitative approach. The subjects of this study were students of the seventh grade of the State Extraordinary School of Salatiga (SLBN) who had limited vision, mind, hearing, or speech impairment. After the results of the students' work were corrected, the qualitative data analysis was done by analyzing the results of the test, interview, and triangulation data. The results of this research: Through the use of Manipulative Teaching Aids, the numerical abilities of CwD could be improved and developed. It is recommended that teachers in ES should use Manipulative Teaching Aids so that the numerical abilities of CwD can be improved and developed.

1. Introduction
1.1. Background of the problem
Children with Special Needs are now called Children with Disabilities (CwD). CwD have the same rights as normal children to get a standard, effective and sustainable education [1-3]. The government and the private sector have also held Special Schools (SS/SLB) and Inclusion Schools. However, a lack of numerical conceptual understanding can cause CwD to experience difficulty in counting. [4-6] wrote that students who experience disabilities need teaching aids in their learning. One idea/thought that arises is the need to create teaching aids that can be modified/manipulated so that this teaching aid can be used by teachers and students to facilitate the way students work on numerical or numerical questions.

Thus, new thinking is needed to find ways for students with disabilities to have no difficulty in counting. The effectiveness of a method such as the existence and use of manipulative teaching aids like this must be followed by a trial of the resulting teaching aids. Therefore, this article is prepared as a publication of a study with the theme of the effectiveness of using manipulative teaching aids to foster the numerical abilities of students with disabilities.

1.2. Research Questions
Based on the background of the problems described above, the research questions were as follows. Was it possible to increase the numerical ability of students with disabilities through the use of manipulative teaching aids?
1.3. Research Purposes
The purpose would be achieved through this research was to analyze the growth of the capacity of
students numerical disabilities through the implementation of teaching aids manipulative.

1.4. Literature Review
1.4.1. Model of Manipulative Mathematics Teaching Aids for CwD
The following were some manipulative teaching aids for CwD which were expected to be a tool to
improve the numerical abilities of students with disabilities. This model of manipulative teaching aids
was produced through the collaboration between the research team with students of Mathematics
Education of UNNES. The following were some manipulative teaching aids produced. Look at the
following to Figure 1 and 2 below.

Figure 1. Abacus Numbers

Figure 2. Abacus Material of KPK and FPB

Figure 3 below shows the use of Manipulative Teaching Aids

1.4.2. Learning Activities in ES
Service learning system for students with disabilities in ES can be done in segregation and integrated.
The education system for segregation is an educational system that is separate from the normal children's
education system. Disability children's education, through a segregation system, means that the delivery of education is specific and separate from the delivery of normal child education. [3] and [7] wrote that children with special needs need to be given education services to special educational institutions for children with disabilities. These educational services, such as Special Schools (Sekolah Luar Biasa/SLB) in Elementary Schools, Special Junior High Schools, and Special Senior High Schools.

The form of integrated education services is an education system that provides opportunities for children with disabilities to learn together with normal children learning on one roof known as Inclusive Education. The integration education system is also called an integrated education system which is an education system that brings disability to the atmosphere of integration with normal children. Such integration can be comprehensive, partial, integrated into the framework of socialization. In the full and partial integration system, the number of children with disabilities in one class is a maximum of 10% of the total number of students. [8-9] wrote that in one class there should only be one type of disorder. This is to keep the class teacher's burden from being too heavy, compared to if the teacher has to serve a variety of disorders.

Mathematics lessons in SS are often called difficult lessons, especially for children with disabilities. Therefore, the researcher as Chairman of the Learning Study Center for CWD - FMIPA of UNNES has conducted research on how to bring up a Manipulative Teaching Aids specifically for children with disabilities provided through Joyful learning in a research activity.

2. Methods
2.1. Research Approach
Research methods with a qualitative approach were used in this study. The qualitative approach has natural characteristics by taking data through direct, descriptive, and process data sources prioritizing obtaining accurate research results in accordance with the research goals and problems.

2.2. Research Subjects and Activities
Research Subject: The subject of this study was to take 6 students with disabilities who were studying at State Special School (SSS) of Salatiga. This research activity involved 4 students of Mathematics Education of UNNES who involved in the design and manufacture of manipulative teaching aids, and SES of Salatiga teachers.

2.3. Data Collection Techniques
Data collection instruments are the researchers themselves in this qualitative research,. On the other hand, in determining which data must be collected, researchers have limitations. Researchers therefore need tools in the form of teaching aids, guidelines for the evaluation of teaching aids, guidelines for interviews, guidelines for observation, diaries, and documentary studies in order to collect the research data directly and focused on the problems to be solved

2.4. Data Validity Technique
The data collected needs to be tested for validity in order to obtain objective data and in accordance with the objectives of this study. Some data validity testing techniques such as extended time or research period, increased persistence of research studies, reviews on research subjects, additional interviews, and triangulation.

2.5. Data Analysis and Interpretation Techniques
Analysis of data in this study was based on the theories of Matthew B. Miles & A. Michael Huberman. [10] wrote that in principle activities in qualitative data analysis were carried out interactively and continued continuously until complete. Data completeness was measured by not obtaining new data or new information. Activities in data analysis include data reduction (data reduction), data presentation (data display), data interpretation (data interpretation), and drawing conclusions and verification (conclusion drawing/verification).
Data reduction is interpreted narrowly as a data reduction process, but in a broader sense is the process of improving data, both the reduction of unnecessary and irrelevant data, as well as the addition of data that is still lacking. Data presentation is a process of gathering information that is arranged based on the categories or groupings needed. Data interpretation is a process of understanding the meaning of a series of data that has been presented, in a form that does not merely see what is explicit, but rather understands or interprets what is implied in the data that has been presented. Conclusion/verification is the process of formulating the meaning of the research results which are expressed in short, concise, and easily understood sentences, and carried out repeatedly by reviewing the truth of the conclusion, especially with regard to relevance and consistency of the title, purpose, and formulation existing problems.

In interpreting the results, the research team created a recapitulation table like the following. Recapitulation of the growth of numerical abilities of students with disabilities in 5 categories, namely: very good, good, moderate, lacking, and very lacking. Determination of this category depends on the results of the assessment, observation, interview, and the results of the triangulation. The results table is recapitulated as shown in Table 1 below.

| No  | Category of growing numerical ability of students after the use of manipulative teaching aids | Able to create teaching aids for CwD in the direction of Joyful Learning after triangulation: | Numerical Test Results Score | Interview result               |
|-----|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------|--------------------------------|
| 1.  | Growing very well                                                                            | 86 - 100                                                                                    | Very Good in numerical       |
| 2.  | Growing well                                                                                | 70 - 85                                                                                    | Good in numerical            |
| 3.  | Growing Medium                                                                              | 60 - 69                                                                                    | Enough in numerical          |
| 4.  | Less growth                                                                                 | 45 - 59                                                                                    | Less in numerical mastery    |
| 5.  | Very Less Growth                                                                            | 0 - 44                                                                                    | Failed                       |

3. Results and Discussions
Based on the results of class visits, class observations, interviews, triangulation and reinforced with the results of the research team's FGD, the results of this research are as follows. First, the use of manipulative teaching aids in mathematics learning can foster and enhance the numerical abilities of students with disabilities. Second, the numerical improvement of students with disabilities reduces the disability students’ dependence on their teachers when students solve numerical related problems. Third, found and made several types of manipulative teaching aids in mathematics learning can foster and improve the numerical abilities of students with disabilities.

The application of manipulative teaching aids in mathematics subjects to students with disabilities in SS of Salatiga needs to be preceded by the preparation of researchers to provide appropriate manipulative teaching aids. [11] wrote that the use of mathematics teaching aids for students experiencing blindness or Visually Impaired would be very useful. To make the teaching aids used in this study, researchers were assisted by several students of UNNES Mathematics Education who were interested in helping to overcome the problems in mathematics learning for students with disabilities in SS. After the manipulative teaching aids are completed, they are applied in the learning process by the SS teacher.

The learning atmosphere is conducive and fun because the use of manipulative teaching aids is presented with an atmosphere of Joyful Learning. When students practice counting, it turns out that students with disabilities who need teacher assistance in solving the questions are significantly reduced.

From this incident, the teacher and the research team can conclude that the use of manipulative teaching aids can improve the ability of students with disabilities to do numerical or numerical questions. The implementation of this research, it was also able to produce manipulative teaching aids for students with disabilities which is expected to be a model for manipulative teaching aids created by students.
This teaching aid can be developed towards Joyful Learning (learning that seems easy and fun). [12] stated that joyful learning can increase students' absorption in learning. With this research activity clearly provides the results of analysis that the use of manipulative teaching aids in mathematics learning can foster and enhance the numerical abilities of students with disabilities.

4. Conclusion
From the results of the research and description in the discussion above, it can be concluded as follows. (1) The use of manipulative teaching aids in mathematics learning can foster and improve the numerical abilities of students with disabilities. (2) Improving numerical abilities of students with disabilities, reducing students' disability dependence on their teachers when students solve numerical related problems.

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