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Development of Fractional Mathematics Textbook with Canva-Based Multirepresentation Approach for Deaf SMALB Students to Improve Conceptual Comprehension and Systematic Communication Skills

Alisha Natzwa Arinalhaq[1], Hanna Laylia Qania[2], Roshana Putri Hartami[3*], Ediyanto[4]

State University of Malang, Jl. Semarang No. 5 Malang, East Java, Indonesia

*Author of correspondence, Email: roshana.putri.2201546@students.um.ac.id

Abstract

This research developed math teaching materials for fractional materials designed for Deaf Extraordinary High School (SMALB) students, using a Canva-based multirepresentation approach. Deaf students face challenges in understanding the concept of fractions due to their abstract nature and lack of vocabulary and visual comprehension required. This module aims to facilitate students' understanding through visual representations in the form of simple images, symbols, and text that are designed to be interactive and fit their communication needs. Using the Research and Development (R&D) method with the ADDIE model, this research includes analysis, design, development, implementation, and evaluation. Trials show that this approach is effective in improving the understanding of fractional concepts and mathematical skills of deaf students, so that it can be an inclusive learning alternative.

Keywords: *SMALB, Deaf, Teaching Materials, Multi-Representation, Canva*

1. Introduction

Law No. 20 of 2003 concerning the National Education System Article 32 states that: "special education is education for students who have a level of difficulty in following the learning process due to physical, emotional, mental, and social disorders". The law guarantees equal rights to education for people with disabilities or disabilities. Law No. 20 of 2003 provides a strong foundation that children with disabilities need to have the same opportunities as other normal children in terms of education and teaching. This law is important because the state not only has citizens who are physically and mentally perfect but also has citizens with special needs who need the same attention in all fields, especially in the field of education.

Teaching for children with special needs is obtained from schools, one of the schools that accepts children with special needs is the Special School (SLB). Extraordinary Schools (SLB) is one of the places of education and teaching provided for those with special needs. Special Schools (SLB) are prepared as educational institutions to handle and provide special educational services for people with special needs. Especially for the deaf, they are accepted into SLB B school. The function of SLB B is as a school that provides equal educational opportunities for children with special needs who are deaf to continue their education, participating in a learning process that improves the quality of students, both academic quality and social quality so that the main goal of education, which is to educate the life of the nation by humanizing human beings can be achieved.

The problem of deafness in learning is affected by the loss or reduction of hearing ability, resulting in a reduction in the acceptance of information sources through hearing. In the learning process at school, teachers also experience obstacles caused by difficulties in providing and receiving information by students due to limited vocabulary and minimal

abstract skills, in addition to the limitations of textbooks or textbooks which are often equated with regular, learning aids, and teachers' limitations in learning innovations with IT media greatly affect the completeness in the process of delivering learning materials.

Findings in the field show that deaf students have difficulty in arranging letters or words into something meaningful. The same goes for counting in math lessons. Facts in the field show that mathematics is a subject that is considered difficult by students, especially for children with special needs, especially deaf children. Gottardis et al (2011), argue that there is a lag of deaf students from regular students in mathematics aspects. Therefore, more attention needs to be paid to efforts to transform the mathematics learning model in the learning of deaf children. One form of mathematical problems that can be encountered in daily life is the concept of fractions. Fractions are important subject matter to learn, (Gabriel, 2016). However, many students find it difficult to understand the concept of fractions. Deaf students have difficulty understanding the concept of fractions in the mathematics learning process, (Mujahid et al., 2017).

Some of the skills that are able to help students to think logically, rationally, systematic, critical, and creative are mathematical representation skills. Lestari & Yudhanegara (2015), stated that the ability of mathematical representation is the ability to represent symbols, tables, pictures, graphs and diagrams of equations into other forms. The process of representation transforms a problem or idea into a different and new form. With this, it can be concluded that the concept of student representation has a role in helping to understand the concept of mathematical calculation in depth in order to find ways to solve mathematical problems by looking at the process of solving them, (Artiah, 2017). In addition, with the development of increasingly advanced information technology, learning difficulties with multirepresentation are no longer an obstacle because they are supported by the use of technology (Putra, 2020). The rapid use of this technological advancement can support the development of teaching materials that are dynamic, attractive and easy to understand. Fitriani (2013), stated that the development of teaching materials for fractional materials with a digital-based contextual model can be easily understood by students because it is interesting and. Dhaneswara, (2019), also stated that in delivering learning materials using computers, it has advantages, including being able to be presented with interesting content, and both in the form of audio, video and can accelerate responses and direct responses from students.

Based on the study that has been described, this research focuses on the Development of Mathematics Teaching Materials for Fractional Materials with a Canva-Based Multi-Representation Approach for Deaf SMALB Students.

Definition of Deaf Children

According to Soewito in the book Deaf Orthopedagogics, "A person who has severe to total deafness, who cannot catch speech without reading the lips of his interlocutor". Deaf children are children who experience hearing loss, either partially or completely, due to partial or total damage to hearing function, which has a complex impact on their lives.

Deaf children are children who have hearing impairments so that they cannot hear sounds perfectly or even cannot hear at all, but it is believed that no human being cannot hear at all. Although there are very few, there are still remnants of hearing that can still be optimized in the deaf child. Regarding deafness, especially about the definition of deafness, there are several definitions according to their respective views. According to Andreas Dwidjosumarto, it is stated that a person who is not or is less able to hear sound is said to be deaf. Deafness is divided into two categories, namely deaf or hard of hearing (Laila, 2013: 10).

Murni Winarsih stated that deafness is a general term that indicates hearing difficulties ranging from mild to severe, classified as deaf and hard of hearing. Deaf people are those who lose the ability to hear so that they hinder the process of language information through hearing, whether or not they wear hearing aids where the limitations of their hearing are enough to allow the successful process of language information through hearing. Tin Suharmini said that deafness can be interpreted as the condition of an individual who experiences damage to the sense of hearing so that it is unable to capture various vocal stimuli, or other stimuli through hearing (Laila, 2013: 10). Some of the definitions and definitions of deaf are complex definitions, so it can be concluded that a deaf child is a child who has a hearing impairment, either in its entirety or still has residual hearing. Even though deaf children have been given hearing aids, deaf children still need special education services. Gottardis et al (2011), argue that there is a lag of deaf students from regular students in mathematics aspects. Therefore, more attention needs to be paid to efforts to transform the mathematics learning model in the learning of deaf children. One form of mathematical problems that can be encountered in daily life is the concept of fractions.

Definition of Fraction

Mathematics is an abstract, structured, and deductive science. Mathematics is a science that contains forms, arrangements, quantities, and concepts that are interrelated with each other in large numbers and is divided into three aspects, namely algebra, analysis, and geometry. Counting is part of an aspect in mathematics that is very important for every individual, especially deaf children. This is in accordance with the findings of Susilowati (2009) research, that counting is important for daily practical life which is based on two aspects, namely social and mathematical aspects. The social aspect is necessary for social life, the mathematical aspect is necessary for the ability to addition, subtract, multiply and divide in counting.

Kritzer (2007), argues that mathematics learning is not based on the results of experiments or observations, but rather emphasizes activities in the world of ratios or comparisons and is formed by human thoughts. Mathematics is a universal science that is the basis for the advancement of renewable technology and helps improve the ability of human patterns or thinking power. According to Suyitno (2016), mathematics is the king of science because mathematical material can be developed or updated without the intervention of other sciences and is needed by all sciences. However, students often have difficulty understanding fractions. This is because students have never understood the basic concept of fractions. Students are more likely to be introduced to formulas without involving the concepts themselves, and learning is separate from the students' daily experiences, (Haris & Putri, 2010). Yusrianti (2016) stated that many students cannot understand even the simplest parts when learning mathematics, and many concepts are misunderstood, so mathematics is considered a complex and difficult science.

Fraction is terminologically, according to Bennett, Burton, & Nelson derived from the Latin fractio of the form frangere meaning pause. Historically, fractions were first used to represent amounts that were less than one or one unit, such as half a candy, one-third of a pizza, and others. Fractions as matter have several definitions. Novak & Renzo argue that a fraction is a division or representation of a part of a number. Fractional numbers are numbers that describe parts of a set, are the ratio of equal parts to the whole of the integer that has a sum of less or more than the whole denoted by a/b, a is called a numerator and b is called a denominator with a, b is an integer and $b \neq 0$.

Textbooks

Suharjono (2001) stated that books are books that function as subject matter for certain fields of study, which are compiled by relevant experts as reference books for teaching purposes. According to Mintowati (2003), textbooks are one of the important tools in the success of the teaching and learning process. Textbooks are a unit of learning that contains information, discussion, and assessment. Textbooks that are arranged regularly will make it easier for students to understand the material, so that it can help achieve learning goals. Therefore, the preparation of textbooks needs to be done in an orderly, interesting, and easy-to-understand manner. Based on the explanation of the textbook above, it can be concluded that a textbook is a writing that comes in a book format with a focus on a specific field, which functions as a standard book that is used by teachers and students in teaching and learning activities for educational purposes. Textbooks are equipped with teaching tools that are mutually supportive and easy to understand by users in schools, so that they can strengthen the teaching program.

2. Method

This research uses the Research and Development (R&D) method. According to Sugiyono (2015), Research and Development research is a research method used to produce certain products and examine the effectiveness of existing products, as well as develop and create new products. The method used in this study uses the ADDIE approach. According to Branch (2010), there are five stages in the ADDIE approach, namely: 1) analysis, 2) design, 3) development, 4) implementation, 5) evaluation.

The first stage is analysis, at this stage of analysis after conducting interviews with deaf students at SLB Eka Mandiri and teachers at SLBN Nanga Bulik, it was found that there are similarities in the problems faced by teachers and deaf students in mathematics learning. Problems that often arise in learning mathematics for children, especially deaf children, is the difficulty of understanding basic mathematical concepts, for example, understanding the concept of fractions. This can be caused by several factors such as lack of understanding of abstract concepts in mathematics and limited communication between teachers and deaf students which can have a misperception impact by students.

The second stage is design, then in the design stage we design a mathematics textbook for fraction chapters. This textbook is structured as inclusive as possible, with many illustrations of fractions to help deaf students understand the concept of fractions. The third stage is development, at this stage we develop a canva-based textbook, where in the textbook there will be a barcode that will be connected to canva which contains practice questions about fractions. The fourth stage is implementation, at this stage after the textbook is completed, the results will be implemented to the subject. In this case we try to implement the results of our textbook with our peers. The fifth stage is evaluation, at this stage the researcher evaluates the product through the results of the implementation stage so that product shortcomings are known so that improvements can be made. This research aims to produce a product, namely a fractional material mathematics textbook with a canva-based multi-representation approach for deaf SMPLB students.

3. Results and Discussion

The technological developments that occur in this day and age are the result of the development of science that can be used in the world of education. One of them is the Canva application, which is an application that can be used by teachers in making additional teaching materials. The Canva application is designed online in which there are various features. (Rukman, 2022) argues that the Canva application can make it easier for teachers to design additional teaching materials. The Canva application can make it easier for teachers to use it

to learn by using the benefits of technology both from skills and creativity. This design of the Canva application can increase the attractiveness of students in learning activities by presenting a variety of additional teaching materials.

Before creating Canva-based teaching materials, the researcher plans and formulates specific objectives that want to be achieved from the modules to be developed, such as determining the order of design and materials, how to use the modules, and the concept of learning materials. The development of Fraction Mathematics Teaching Materials with a Canva-Based Multi-Representation Approach with Pizza design makes it easier for students to imagine and makes it easier for students to understand the concept of fractions, especially for children with special needs who have hearing impairments. This textbook can be used in individual or group learning. In this textbook, there are also suggestions for the use of books. The way to use this textbook is the same as other textbooks, the only difference is that the questions in the textbook will be connected to the canva link.

Figure 1. Example Canva-based Questions

MEDIA VALIDATION

The results of the validation of the textbook construction aspect showed a very high level of conformity from the assessment group. As many as 88.8% of respondents stated that the language used in this book is clear, easy to understand, and in accordance with the rules of good and correct language. In addition, 88.8% of respondents agreed that the order of discussion in this book is very logical and easy to follow, and the flow of discussion between chapters is well connected and forms a complete unit. The illustrations and tables in the book are considered relevant and support in-text explanations with a 100% approval rate. This book is also considered to have succeeded in conveying information clearly and systematically by 88.8% of the assessment group. The examples and cases given in the book are considered concrete and help readers understand the concept with an approval rate of 88.8%.

The introductory chapter provides a clear overview of the overall content of the book, and the book is recognized as a good reference source, with an approval rating of 55.5% each. The writing style used is consistent and interesting throughout the book, supported by 66.6% of respondents. This book also provides significant added value for readers in the field of mathematics with an approval of 66.6%. The titles and subheadings used in the book reflect the content of their respective sections with an approval rate of 77.7%. Overall, this textbook is considered to meet the aspects of good construction, both in terms of the logic of the preparation, the connection between chapters, to the clarity and systematics of its delivery.

In terms of material, as many as 88.8% of respondents validated that the textbooks we compiled had the truth of the material, facts, and information presented that had been verified from credible and accountable sources. The titles and subheadings in the textbooks that we compiled are relevant, each section in the book directly supports the titles and subheadings that have been determined with the approval of 88.8% of all respondents and the rest are neutral. The material in the textbook we compiled was considered to be in-depth and comprehensive, and provided a thorough understanding of the topic and was validated with an approval rate of 88.8% from all respondents and the rest were neutral. Our textbooks are assessed as actual, the information presented is still relevant to the latest developments in the relevant field and has been validated by all respondents. As many as 77.7% of respondents agreed that the textbooks compiled had complete material, all important aspects of the topics discussed had been thoroughly discussed, while 22.2% of respondents chose neutral. In addition, 44.4% of respondents agreed that books have unique perspectives, while 55.5% of respondents chose neutral. The complex concepts in this textbook are explained in simple and easy-to-understand language and have been validated by 66.6% of respondents, while 22.2% stated neutrality, and there were 11.1% of respondents who disagreed. There were 77.7% of respondents who agreed that this textbook has material that suits the needs and level of understanding of the target reader, but there are still 11.1% of respondents who disagree, and the rest are neutral. Each chapter in the textbook is interrelated and forms a complete unity and gets 100% approval from the respondents. The textbooks that are prepared are considered to be able to provide significant benefits to readers, both in terms of knowledge and have been approved by 88.8% of respondents and the rest are neutral.

We received a lot of input from the respondents in the evaluation process, including that our textbooks still do not have variations in making questions, the language is still too formal and the illustrations are still not attractive. However, respondents also commented positively on our idea of Canva, the integration of textbooks with PowerPoint (PPT) offers tremendous power in the learning process. The Canva-based Getting to Know Fractions book with PPT allows material to be delivered in a more dynamic and interactive way. PowerPoint provides a visual platform that allows teaching to be more engaging, with pictures, animations, and diagrams that make it easier to understand fractional concepts. These visualizations are especially helpful for students, especially for those who find it easier to understand the material through pictures rather than text.

4. Conclusion

This study focuses on the results we have obtained when interviewing deaf students and teachers about mathematics learning. It can be concluded that there is a common opinion about the difficulty of teachers teaching mathematics and deaf students who have difficulty understanding mathematics learning. The difficulties experienced are the difficulty of

understanding and teaching basic mathematical concepts, especially fractions, students experience deaf obstacles which cause a lack of abstract thinking skills to be one of the main factors in the occurrence of these difficulties.

Our group recommends interactive mathematics learning and provides examples with objects in everyday life so that deaf students can understand mathematical concepts, as explained above that students have difficulty understanding abstract concepts. Our group also suggested the implementation of additional learning to improve the understanding of deaf students in mathematics learning in particular.

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