

Development of Teaching Materials Through Pop-Up Book Learning Media to Increase the Understanding of Mathematical Concept of SLB-C Students

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Abstract: Mental retardation means a child with below-average intelligence. In other words, they have less learning ability compared to others. This situation causes difficulties in understanding abstract mathematical materials. In addition, it appears that the materials presented by the teacher is considered to be less interesting and boring, while the model of the presentation of material that is fun, interesting, and easy to understand is one of the factors that influence learning success. Students are fed up with the presentation model of the material with media that the teacher uses repeatedly. Therefore, teachers' creativity and innovation are needed in utilizing the media, with ability to set it into concepts that are interesting and fun for their students. It is expected that future learning needs can be optimally fulfilled. Thus, this study aims to develop teaching materials through learning media in the form of pop-up books so that the understanding of mathematical concepts of mental retardation students can develop optimally. This type of research is a development model, in which teaching material is developed using the ADDIE model (Analysis, Design, Development and Production, Implementation, Evaluation) and validated by two expert councils. The implementation is conducted in a limited way that by one school to see the practicality and effectiveness of the pop-up book. The benefit of this research is to give some image of pop-books as an alternative to facilitate the mentally retarded students' learning in recognizing mathematical concepts.

Key words: mentally retarded students, understanding mathematical concepts, pop-up books

JEL codes: A21

1. Introduction

Learning in schools is carried out with the aim of optimally developing students' talents, interests and creativity. However, the hope to be achieved experiences some obstacles for those with special needs (ABK). One of the crew in question is mentally retarded. Students study in special schools called special schools (SLB). There are several types of SLB, namely SLB-A (visually impaired), SLB-B (deaf) and SLB-C (developmental

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impairment). Mental retardation can be interpreted as a child who has the power of thought and reasoning is low/lacking. As stated by Sukerti NW & Idris Ahmad (2016), mental retardation is a child who has below average intelligence. In other words, retarded students have different intellectual abilities than others. As a result, they have less social learning and adaptability compared to others, thus requiring special assistance/services to study and do daily tasks in order to develop their interests and creativity.

Mental retardation is classified into several groups, namely: (1) the ability to be educated with an IQ range of 50-75, (2) the ability to be trained with an IQ range of 25-50, and (3) the ability to be treated with an IQ range of 25 and below (Saputri S, 2017). Mild mental retardation is a child who has mental retardation and has a level of intelligence that is below normal. According to the Stanford Binet test revealed that mild retarded children have IQ intelligence levels ranging from 52-68 (Utami WZS, 2017). Based on these intelligence figures, the learning capacity of mild retarded children is very limited. Mild retarded children have the ability to think that tends to be concrete, have very limited memory, concentration is easy to switch, often forgets, lacks mastery of words, and requires a relatively long learning time. These limitations, of course, bring consequences on the difficulty of mentally retarded children in participating in learning, especially in the academic field, one of them in the field of mathematics.

According to Ariyani N1, (2016) suggested that the need for students to learn mathematics because; (1) always used in all aspects of life; (2) all fields of study require appropriate mathematical skills; (3) is a strong, concise and clear communication tool; (4) can be used to present information in various ways; (5) increasing the ability to think logically, thoroughly, and spatial awareness; and (6) providing satisfaction with efforts to solve challenging problems. Therefore mathematics is a very important field to study, because mathematics is a field of study that supports problem solving in the life sector, the goal is that students can think logically, systematically, critically and creatively. For this reason, mathematics lessons are very much needed to be able to use them in everyday life. Children with intellectual disabilities need to be educated in mathematics because it is one of the fields of study that supports the development of science and solving problems of counting in everyday life. In the curriculum of mathematics subjects given to students, it aims to have a mathematical concept, to apply concepts broadly, accurately, efficiently, and precisely, in problem solving, and to have an attitude of appreciating the usefulness of mathematics in everyday life that is having curiosity, attention and interest in learning mathematics as well as tenacity and confidence in problem solving (Susiana & Suparman, 2018).

Through preliminary observations at one of the Special Schools (SLB) in Cirebon, a description of the obstacles that often arises in the learning process is obtained. One obstacle that often arises is mental retardation students are less able to understand a problem without a real example. Students have difficulty learning abstract concepts. For example in learning to count. In general, mentally disabled students need aids such as sticks, balls or abacus. In addition students are also difficult in describing the numbers one to ten. And also based on previous studies known that there are some problems faced by retarded children in arithmetic, one of which is the low motivation of students in arithmetic. This can be seen from the lack of interest and attention of students during learning, the media that are less interesting make students quickly get bored and bored when getting lessons. These problems can actually be overcome if the teacher is able to design interesting and fun learning so that the expected goals can be achieved well. From these problems, it is necessary to develop a learning media to help students with mental retardation in numeracy learning, especially in recognizing numbers one to ten. Besides this learning media can help teachers explain the concepts and ways of writing numbers, thus minimizing errors that can be made by students.

In addition, the status of this study as a supporter of existing research related to learning media for mentally retarded students. First, it must be recognized that the media make a positive contribution in a learning process. Learning that uses the right media will provide optimal results for students' understanding of the material being studied. This is in line with the opinion of Pramuditya SA & Herri S (2019) that "the use of learning media can facilitate the learning process". The media are first known as learning aids that should be able to be used by teachers, but are often overlooked. According to Irmawan W., Mohammad D. S. and Herri S. (2019) suggested that the use of the media in the learning process was generally caused by various reasons, such as difficulty in finding the right media, limited teaching preparation time, no cost, or other reasons. Kemp (in Sundayana, 2013, p. 4) suggests that the contribution of media in learning is: (1) delivery of learning can be more standardized; (2) learning can be more interesting; (3) learning delivery time can be shortened; (4) the quality of learning can be improved; (5) the learning process can take place whenever and wherever needed; (6) positive attitudes of students towards learning materials and the learning process can be improved; (7) the role of the teacher changes in a positive direction. In designing and making learning media that is suitable for students, mentally disabled teachers have difficulty. These difficulties include finding and developing media forms that are suitable for retarded students, so that the learning process can be achieved optimally. Because mental retardation characteristics are different from normal children, so the learning media that are made must be more complete than usual.

As stated by Sundawan M. D., Wawan I. and Herri S. (2019) that a teacher can use various alternative learning media that are expected to help students learn. One of the media that can be applied is multimedia learning in which there are three-dimensional images. This is based on the assumption that the visual aspect can provide clearer information than just words. In line with Khodaria S.'s opinion, Anggita M. and Herri S. (2019) about learning through image stimulus and word or visual and verbal stimulus which states that "learning through visual stimulus results in better learning outcomes for tasks such as remembering, recognizing, remembering back, and connect facts and concepts". Animation can help mild retarded children learn to count at different levels of abstraction, because the images in the book act as mediators between problems in the real world with abstract world of knowledge. This will give a strong impression on the mentally retarded children, so they will be able to maintain the response in the memory and they will easily remember it.

The renewal of this research compared to previous research is to develop a teaching material in the form of learning media namely pop-up books. This pop-up book contains animated images that are packaged as attractive as possible so that the mentally retarded students have an interest in reading or studying them. This research aims to find the latest targeted product, which is to obtain teaching materials that have been developed through media learning pop-up books to improve the ability to understand mathematical concepts of SLB-C students that are valid, effective and practical. This research is useful for SLB-C teachers when conducting KBM in class. The resulting product can make it easier for teachers to provide mathematical concepts and students are interested in paying attention to the teacher's explanation. If students can carry out the learning process based on their abilities and readiness, they will certainly feel served their learning needs. Thus, understanding of concepts that were previously felt difficult to understand will increase so as to gain complete mastery of concepts. Thus, it will simultaneously obtain the subject matter of learning that it understands. This will certainly increase the effectiveness and efficiency of the learning process and have a positive impact on the quality of the process and student learning outcomes.

2. Literature Review

2.1 Instructional Media

Learning media are all things that are used to channel messages and can stimulate the thoughts, feelings, attention, and willingness of students to learn so that it can encourage the learning process and make learning goals can be achieved easily. The more concrete the media used will further facilitate student understanding. Therefore in learning it is highly recommended to use learning media. But in the selection it is necessary to consider the learning objectives, content, student characteristics, time, cost, availability, context of use and technical quality.

2.2 Mathematics Pop-Up Textbook

Pop up according to the English dictionary which means it appears. In a large Indonesian dictionary the meaning to appear is to come out to appear. Book according to the English dictionary which means book. The book is in a large Indonesian dictionary which means bound paper, which contains writing or blanks. Pop up book is a book that has movable parts and gives rise to two or three dimensional elements. At first glance pop-ups are almost the same as origami where both of these arts use paper folding techniques.

Actual media or real objects can be used in learning mathematics. In the world of education the actual media or objects are actually considered the most accessible and interesting learning media as information media. Using the media is actually able to explain something abstract with little or no verbal description. However, in terms of practicality of the media and in terms of the attractiveness of students the pop-up book media is more interesting and practical to use in learning mathematics. Pop-up book media has the ability to stimulate the imagination of students to better understand what students are learning if explained verbally it will be clearer.

2.3 ABK students (Children with Special Needs) SLB-C

Children with special needs (ABK) are defined as individuals who have different characteristics from other individuals who are considered normal by society in general. More specifically children with special needs show physical, intellectual, and emotional characteristics that are lower or higher than normal children their age or are outside the normal standards that apply in society. So it has difficulty in achieving success both in terms of social, personal, and educational activities (Bachri, 2010). Their specificity makes ABK require special education and services to optimize their potential perfectly (Hallen & Kauffman 1986, in Hadith, 2006). Heward (2003) defines ABK as a child with special characteristics that are different from children in general without always showing mental, emotional or physical disabilities.

2.4 Research Framework

The research was carried out at the Beringin Bakti Foundation SLB-C, Kecomberan village, Sumber, Cirebon Regency. Subjects in this study were students in the Beringin Bakti Cirebon school. The model used in this study is the ADDIE development model. This study aims to make products from teaching materials that have been developed through learning media pop-up books to improve the ability to understand mathematical concepts of SLB-C students. In addition to knowing the results of the implementation of books that have been developed in order to improve the ability to understand mathematical concepts of SLB-C students. Pop-up books will be tested for validity, effectiveness and practicality, so that in the future teachers are expected to more easily develop students' mathematical concept skills with the learning media of this pop-up book. The data obtained are primary data. The data collection techniques in this study used interview sheets and activity sheets to analyze student learning needs and situations. The results of interviews and activity sheets will be used as a basis for preparing

teaching materials through learning media for pop-up books. After that the pop-up book that has been compiled is validated by an expert validator. Then the effectiveness and practicality is tested by using the effectiveness and practicality sheets. The stages of the research can be explained in the Figure 1.

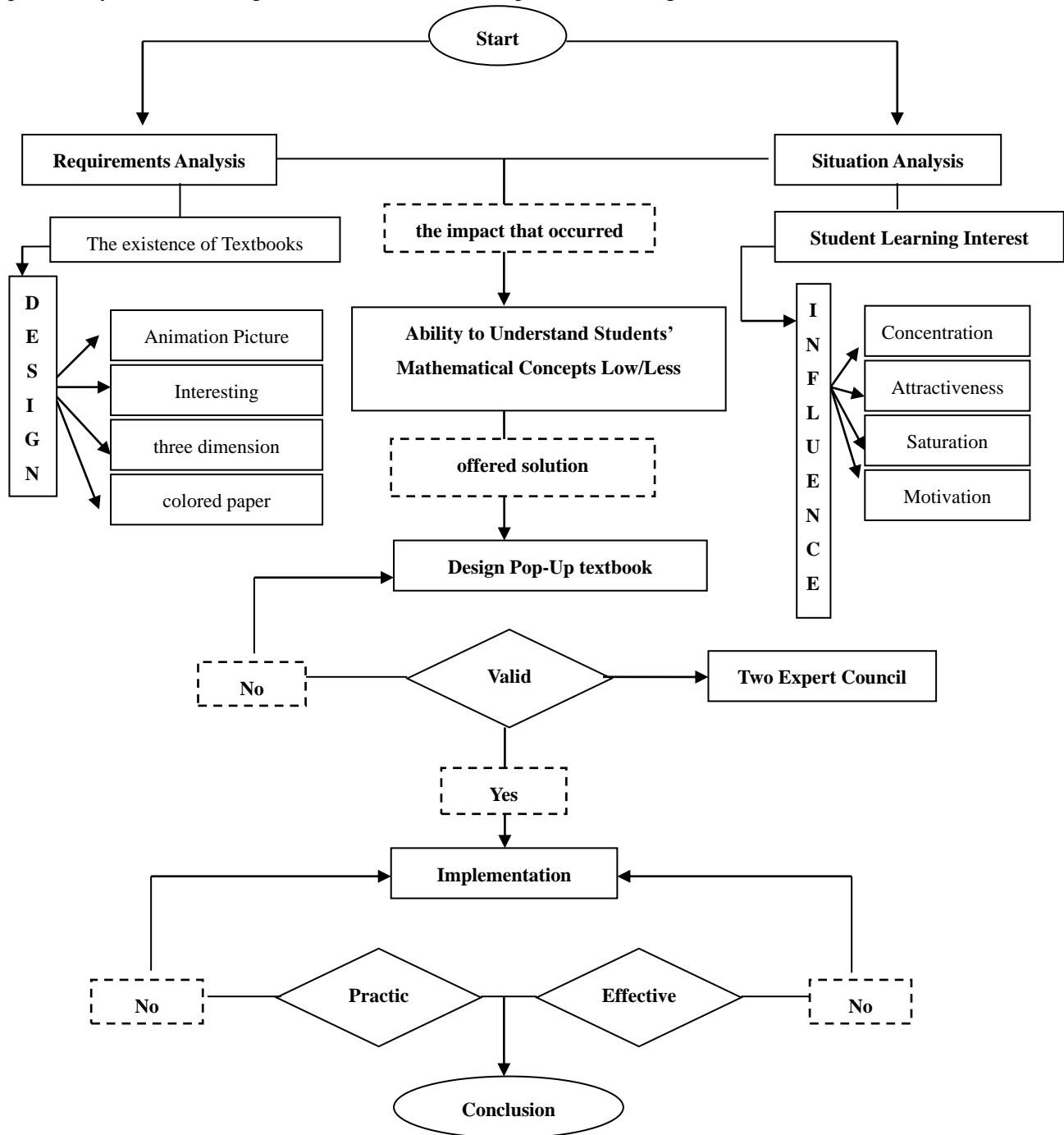


Figure 1 Research Stage Diagram

3. Case Study

Pop-up is one of the creative and innovative industries of engineering paper that is increasingly popular and

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developing in Indonesia. Until now, many pop-up books have been provided in bookstores and art and cultural exhibition outlets. The definition of a pop-up book is a type of card or book that when opened can display a 3-dimensional or raised shape. According to the history of its development, pop-ups began with a fairly simple design. In the 13th century the design technique was called a movable book, which involved mechanical effects on paper arranged so that the image/object/some parts of the paper seemed to move and have shapes or dimensions. Movable books were first implemented in Europe and began mass-produced as the movable type developed by Johannes Gutenberg. Movable books first appeared with the volvelles technique (or now known as the rotary technique), which involves the role of the shaft in the mechanical arrangement of paper. This theory about volvelles was coined by Matthew Paris (1200-1259) and Ramon Llull (1235-1316).

The process of making pop-up books for learning media in SLB C, Beringin Bakti Foundation, Talun District, Cirebon District, was carried out by students at the 3rd level of PGSD UGJ Cirebon. The following is a picture of the practice of making a pop-up book and the results of the finished pop-up book.



Figure 2 Practices for Making Pop-Up Books and Their Results

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From the picture above it can be seen that the pop-up book has been developed and designed in three volumes. The first volume is the concept of fractions, followed by the second volume which is the concept of addition and subtraction of numbers, and the last is the third volume of introduction of numbers 1-10. Furthermore, the pop-up books that have been made are validated in advance by two expert validators selected based on their capabilities as curriculum experts and learning media. The results of the validation of pop-up books that have been assessed by expert validators can be stated in the Table 1.

Table 1 Validity Test Results for Pop-Up Books

No	Assessment Components	Validity Value	Criteria
1.	Content Feasibility	80.26%	High
2.	Linguistic Elements	85.52%	Very High
3.	Presentation Form	86.60%	Very High
4.	Graphic Design and Animation	84.80%	Very High
Mean		84.29%	Very High

From the above table it can be concluded that the pop-up books that have been designed have very high criteria. This means that this pop-up book can be used and implemented for students in the SLB-C Tunagrahita class of the Beringin Bakti Cirebon Foundation. After the validity test is done, then the next step can be done practicality test. The practicality test of the pop-up book to improve the ability to understand mathematical concepts of retarded students is conducted on the teacher. The analysis of the practicality of the pop-up book is seen based on the results of a questionnaire analysis containing the responses of five teachers. The pop-up book practicality assessment component consists of four components, namely the ease of use component, the benefits component, the attractiveness component, and the clarity component of the pop-up book. The results of the pop-up book practicality test can be seen in Table 2.

Then the effectiveness of the pop-up book is tested. The effectiveness test can be seen from the results of the test of the ability to understand mathematical concepts of retarded students. Student test scores can be seen based on the results of the pretest and posttest. The material being tested is the concept of operating numbers and fractional forms. The number of students who take the test is 15 people. The pretest and posttest questions are given in the form of a brief description of 10 questions. Data on the results of students' mathematical concept comprehension ability test before and after using the pop-up book can be shown in the Table 3.

Table 2 Pop-Up Book Practicality Test Results

No	Assessment Components	Validity Value	Criteria
1.	Ease of Use	83.33%	Very High
2.	Usefulness	82.14%	Very High
3.	Attractive Design	87.50%	Very High
4.	Clarity	82.50%	Very High
Average		83.86%	Very High

Table 3 Pretest and Posttest Results Ability to Understand Mathematical Concepts of Students with Developmental Disabilities

No	Descriptive Statistics	<i>Pretest</i>	<i>Posttest</i>
1.	Average	43,88	71,25
2.	Standard Deviation	9,12	6,87
3.	Variance	87,55	55,60
4.	Lowest value	27	61
5.	The highest score	57	98

Based on the table above the lowest value obtained by retarded students at the time of the pretest is 27 and the highest value obtained is 57, so that the range of pretest scores is 30. The average value of the test results of students' understanding of mathematical concepts before using the pop-up book is 43.88. The standard deviation of the pretest value is 9.12 and the variance value is 87.55. Based on the data analysis, an increase in the average value of students after the use of teaching materials with the content of the values of spiritual intelligence is from an average of 43.88 to 87.55. In the standard deviation value decreased from 9.12 to 6.87. In addition, information about the teacher's activities while implementing media for learning pop-up books and wooden scales. Observations on teacher activities were carried out by seven observers during implementation. The focus of the observation is on four stages, namely: the preliminary stage, the exploration stage, the elaboration and confirmation stage, and the closing stage. The following is the recapitulation of the teacher's observation activities.

Table 4 Observation Results of Observation of Teacher Activity

Teachers Name	Teacher Activity		
	Average Scale	Average Percentage	Category
Khoirul Ikhwan S.Pd	97	89.70%	Very Good
Abdul Walim, S.Pd	98	90.73%	Very Good
Elka Asmartuti, S.Pd	100	92,58%	Very Good
Nanu Danuhari, S.Pd	101	93,51%	Very Good

4. Conclusion

Based on the analysis of the results of the research and the discussion carried out, four conclusions can be put forward. First, the pop-up book has been validated by expert validators with the criterion the value of the validation results is very high. The quality of the contents of the pop-up book is in accordance with the curriculum set by the Ministry of Education, the revised edition K13. Second, pop-up books with mental retardation students' mathematical concept abilities have an average validity value that is very high at 84.29. This means that the pop-up book that has been created has a valid value. Third, pop-up books with the content of students' mathematical concept abilities are practically used in the learning process of fraction concepts and number operations. Fourth, pop-up books with students' mathematical concept skills are effectively used in learning to improve students' mathematical concept abilities.

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