



Interactive Digital Teaching Materials with Multi-Representation Approach for Deaf Students

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Abstract: This study aims to (1) create interactive digital teaching materials design with a multi-representation approach to the LCM and GCD for deaf special students of SMPLB; (2) described the results of the prototype of interactive digital teaching materials with a multi-representation approach to the LCM and GCD material for deaf special students of SMPLB; (3) Find out the usability of interactive digital teaching materials with a multi-representation approach to LCM and GCD material for deaf special students of SMPLB. This research uses ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). Data collection using questionnaires and tests, expert evaluation questionnaires, student response questionnaires, teacher response questionnaires and evaluation test. Data analysis uses qualitative data analysis techniques and descriptive qualitative. This research was conducted at SLB Negeri 1 Buleleng. The product of this research is in the form of interactive digital representation approach that includes LCM and GCD materials, learning videos, exploration learning media, practice exercises, bibliography and developer profiles. Product trial test is carried out limited to feasible, efficient, and effective. e. Final prototype in the form of interactive digital teaching materials that already have feasible, efficient and effective criteria. The format of interactive digital teaching materials in the form of Single site, Website and Epub3 which is packaged on CD. Interactive digital teaching materials already have feasible criteria in terms of the feasibility of teaching materials, good in terms of efficiency and effective in terms of effectiveness. Classical completeness obtained after conducting trials amounted to 87.5%. with the highest value obtained at 93 and the lowest value of 73

Keywords: *Interactive digital teaching materials; KPK and FPB; multi representation; deaf; ADDIE model*

I. Introduction

A child who is born perfect is a dream for every parent. However, not all children born into this world will be in accordance with their parents' wishes. Some children are born not in normal conditions, both physically and spiritually. Children who are born abnormally usually have limitations in operating their limbs or limitations in their psyche that require special handling. Children with special needs are children who experience abnormalities or physical limitations (physical, mental, intellectual, social and emotional) in the process of growing and developing which require special services both in education and in life (Faradina, 2016). Part of children with special needs are children who are deaf. The definition of a deaf child is a child who experiences a deficiency or does not have the ability to hear, caused by the non-functioning of some or all of the hearing aids so that they experience obstacles in their language development (Somantri, 2006). The behavioral habits of children caused by limited hearing ability make it difficult to understand something abstract (Wati, 2017). Law Number 20 of 2003 concerning the National Education System, in article 5 paragraph 1 states "Every citizen has the same right to obtain quality education" and article 5 paragraph 2 states "Citizens who have physical, emotional, mental, intellectual and/or social disabilities have the right to obtain special education" (Law of the Republic of Indonesia No. 20 of 2003, 2003). Education does not look at a person's condition, either physically or economically because universal and comprehensive education is very important for humans (Maulidah & Efendi, 2016).

In Special Schools for the Deaf (SLB-B), one of the learning materials in mathematics that is useful in everyday life is the KPK and FPB material. The difficulty faced is the lack of understanding of the basic concepts of multiples of numbers and factoring numbers. According to

Musser's opinion in his book entitled "Mathematics for Elementary Teachers: A Contemporary Approach" states that the Greatest Common Factor (GCF) and the Least Common Multiple (LCM) are difficult topics for students to understand because students are confused about distinguishing between factors and multiples (Musser et al., 2011). This is also a challenge for teachers to provide basic learning of multiplication and factoring in an interesting way, so that students have an interest in understanding the material being learned.

There are 6 principles in learning mathematics in schools. These principles include (1) equity, (2) curriculum, (3) teaching, (4) learning, (5) assessment, and (6) technology (NCTM, 2000). Teachers can utilize technological developments as a tool to overcome limitations in learning and improve understanding of the material in deaf students. For teachers, technology in the form of laptops, computers and mobile phones can help teachers in finding information or can be used during the learning process. Likewise for students, technological developments can be utilized to access interactive teaching materials that allow students to spend relatively little money to print the teaching materials.

Interactive teaching materials are learning media in the form of text, audio, video, or graphics, some of which are combined into one form of teaching materials (Prastowo, 2014). The advantages of interactive teaching materials are: (1) interactive, (2) providing an individual affective climate, (3) increasing learning motivation for its users, (4) providing feedback and (5) full control of utilization is in the hands of the user. An interesting approach is needed so that students do not get bored quickly in the learning process. One approach that can be chosen to make this teaching material interesting is the multi-representation approach. Learning using the multi-representation approach can produce a more interesting and memorable learning process for students (Yahya & Tahar, 2016).

Multi-representation means retranslating the same concept with different formats, including verbal, images, graphics and mathematics (Waldrip et al., 2006). There are three main functions of multi-representation, namely multi-representation as a complement in the cognitive process, multi-representation helps limit the possibility of other misinterpretations, and multi-representation builds a deeper understanding of concepts (Farhanah, 2016).

II. Method

This research was conducted using the research and development approach of the ADDIE model which has five steps, namely (1) analysis, (2) design, (3) development, (4) implementation and (5) evaluation. This study used a modified ADDIE model (the implementation step was not applied) due to time, cost and capability limitations of the researcher.

The first stage in this study is the analysis stage. At this analysis stage, the instruments used to assess the teaching materials were also prepared. The instruments prepared were: teaching material validation instruments, language validation, presentation validation, graphic validation and teacher and student response questionnaires. The validity of these instruments will be tested by experts using validation calculations from Gregory (Candiasa, 2010).

The second stage is planning (design). At this stage, planning or designing the appearance (Storyboard) is carried out and describing the contents of the teaching materials to be created. The design of teaching materials (Storyboard) serves to facilitate the creation of interactive digital teaching materials. The results of the design planning and content of the teaching materials are then referred to as prototype I.

The third stage is development. Prototype I which has been declared feasible is called prototype II. Prototype II will be tested on a limited basis (small group trials and large group trials) to determine the efficiency and effectiveness of teaching materials. The efficiency of teaching materials is seen from the teacher response questionnaire and the student response questionnaire. While the effectiveness of teaching materials is seen from the completeness of student learning outcomes after using the teaching materials.

The fourth stage is evaluation. Product evaluation is carried out based on suggestions and input from students and teachers during limited trials. After the product goes through the evaluation and revision process and is declared feasible, efficient and effective, the product can be declared as a final prototype. If during the product evaluation revisions are carried out continuously, the

researcher will only revise the product a maximum of 3 times due to the limited time and costs of the researcher.

This study involved 3 students and a grade VII mathematics teacher of SLB N 1 Buleleng in the implementation of small group trials, and 8 students and a grade VII mathematics teacher of SLB N 1 Buleleng in the implementation of large group trials. Other participants in this study were 8 experts who validated the instruments and validated the products.

III. Results and Discussion

A. Result

Results of the Design and Prototype of Interactive Digital Teaching Materials with a Multi-Representation Approach on KPK and FPB Material for Class VII Deaf SMPLB.

The design of this interactive digital teaching material can be seen in Figure 1. Figure 1 shows the design consisting of 7 designs, namely: (1) cover page design, (2) material page design, (3) learning video page design, (4) learning media page design, (5) practice question page design, (6) bibliography page design and (7) developer profile page design.



Fig. 1. Build Plan

The design was then implemented into prototype I of Interactive Digital Teaching Materials with a Multi-Representation Approach to KPK and FPB Material for SMPLB for Class VII Deaf. When teachers or students use teaching materials, the first page that is visible is the cover page, the next page is the material page as shown in Figure 2.

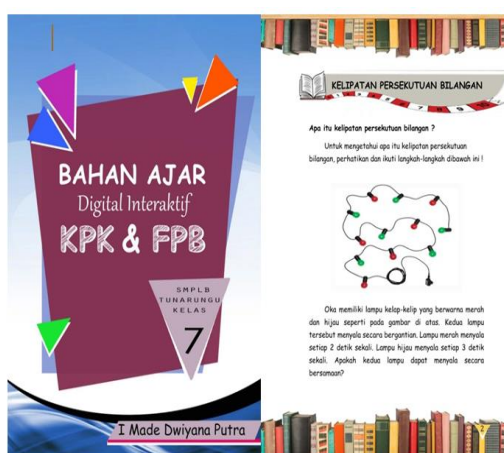


Fig. 2. Cover Page and Materials

When students have finished studying the KPK and FPB material on the material page, students can watch the learning video on the next page as shown in Figure 3. The learning video is equipped with a sign language interpreter located in the lower right corner of the video.

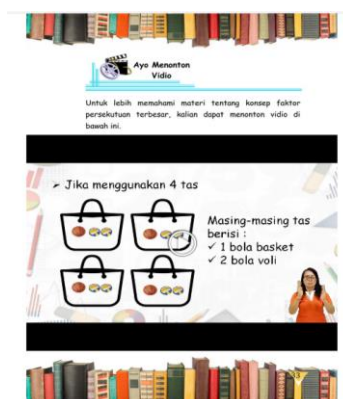


Fig. 3. Cover Page and Materials

After students finish watching the KPK and FPB learning videos on the learning video page, students can use the learning media on the next page. The next page after students finish using the KPK and FPB learning media on the learning media page, students can practice their abilities and understanding on the practice questions page. Teachers can also use the practice questions to assess the level of

Results of the Assessment of the Feasibility, Efficiency and Effectiveness of Interactive Digital Teaching Materials with a Multi-Representation Approach on KPK and FPB Material for Class VII Deaf SMPLB. The assessment of the feasibility of prototype I was carried out by 2 material experts, 2 language experts, 2 presentation experts and 2 graphic experts. After the assessment by the experts, a revision was carried out based on the results of the expert assessment so that prototype II was obtained.

The assessment given by the two material experts showed that the material in the interactive digital teaching materials was declared feasible with an average score of 3. Specifically, the material used was in accordance with core competencies, basic competencies and indicators. The concept of the material has also been presented correctly and the material is in accordance with the level of student development and the examples given are appropriate to clarify the material. The input and suggestions given by the experts were mostly related to the illustrations in the teaching materials so that the delivery of material in the teaching materials was more appropriate

The assessment given by the two language experts showed that the language used in the interactive digital teaching materials was declared feasible with an average score of 2.95. In general, the sentence structure and language used were in accordance with the level of student thinking development. The input and suggestions given by the experts were mostly related to grammar that was easy for students to understand when using the teaching materials so that students could more quickly understand the intent of the delivery in the interactive digital teaching materials. The assessment given by the two presentation experts showed that the presentation of the interactive digital teaching materials was declared feasible with an average score of 3. In general, the material presented was systematic and the material and test questions/assignments were balanced.

The assessment given by the two graphic experts showed that the graphics in the interactive digital teaching materials were declared feasible with an average score of 3. In general, the appearance and clarity of the media used were good and attractive to students. The input and suggestions given were mostly related to the appearance, font size and background color and media in the interactive digital teaching materials.

The recapitulation of the overall assessment results from the experts showed that the interactive digital teaching materials had met the criteria for being feasible, but input and suggestions from the experts were still implemented so that the interactive digital teaching materials would better facilitate students in learning.

Based on the results of the analysis of the teacher and student response questionnaires, it was obtained that the efficiency of the interactive digital teaching materials had met the criteria for being good with an average student response questionnaire of 4.1 and an average teacher response questionnaire of 4.15.

Of the 8 students in total, there was one student who did not complete and 7 students who completed. The lowest score on the cognitive test was 73, while the highest score was 93 with an average score of 8.3. The classical completion obtained after students used the developed interactive digital teaching materials was 87.5%. So the category of effectiveness of interactive digital teaching materials is very good.

B. Discussion

The interactive digital teaching materials developed are designed in such a way that they are in accordance with the needs of deaf children, so that they can help deaf children in learning the KPK and FPB material in grade VII. The delivery of material in this interactive digital teaching material is arranged with a multi-representation approach. In accordance with the opinion of (Noto et al., 2016) related to multi-representation, namely if there is a problem, then the problem can be represented as an object, picture, words, or mathematical symbol. The evaluation results from material experts show that this interactive digital teaching material for KPK and FPB material obtained an average score of 3.00 with a feasible criterion. The evaluation results from language experts show that this interactive digital teaching material for KPK and FPB material obtained an average score of 2.95 with a feasible criterion.

The evaluation results from presentation experts show that this interactive digital teaching material for KPK and FPB material obtained an average score of 3.00 with a feasible criterion. The evaluation results from graphic experts show that the interactive digital teaching materials for the KPK and FPB materials obtained an average score of 3.00 with a feasible criteria. Based on Table 8, namely the results of the assessment by material experts, presentation experts, graphic experts and linguistic experts, an average score of 2.99 was obtained, which means that the interactive digital teaching materials meet the overall feasible criteria. Interactive digital teaching materials that have met the feasible criteria are referred to as prototype I and can be used for small group trials and large group trials to determine the efficiency and effectiveness of the teaching materials.

The efficiency of this interactive digital teaching material is seen from the scores obtained using teacher response questionnaires and student response questionnaires. Based on the analysis of the teacher response questionnaire, it shows that the interactive digital teaching material obtained an average score of 4.1 with good criteria. Meanwhile, based on the analysis of the student response questionnaire, it shows that the interactive digital teaching material obtained an average score of 4.15 with good criteria. So based on the efficiency criteria, overall the interactive digital teaching material on the KPK and FPB material obtained good criteria. The effectiveness of interactive digital teaching materials is determined from the completion of student learning outcomes classically after using interactive digital teaching materials. Based on the analysis of student learning outcome tests, classical completion was obtained at 87.5% with the number of students who completed as many as 7 out of 8 students. So the category of effectiveness of interactive digital teaching materials is very good.

The interactive digital teaching material developed has gone through various assessment processes and trials with the category "Good". Therefore, this interactive digital teaching material can be used as a reference for special mathematics teaching materials for deaf children. Currently, the availability of special teaching materials for deaf children is still limited, in accordance with the opinion of (Astuti & Trisnawati, 2013) who stated that special teaching materials for deaf children are very rare, while these teaching materials are very much needed by deaf children.

There are several researchers who have conducted research related to the development of interactive media specifically for deaf children, such as (1) Maulidah & Efendi (2016) who have developed interactive media in the early reading process of children with hearing impairments, (2) Suarcita et al. (2020) who have developed interactive media in mathematics subjects on integer material, and (3) Beni et al. (2017) who have developed interactive media in mathematics subjects on the area of flat shapes.

Based on the assessment/evaluation of experts and the results of the implementation of small and large group trials that have been carried out, the interactive digital teaching materials on the KPK and FPB materials that have been developed are declared feasible, efficient and effective and can be used as mathematics teaching materials for class VII of SMPLB for the Deaf.

IV. Conclusion

The design of interactive digital teaching materials with a multi-representation approach to the KPK and FPB material for deaf SMPLB students in grade VII is arranged simply, clearly, and contains several things that are worthy of being implemented as teaching materials.

The final prototype of interactive digital teaching materials with a multi-representation approach to the KPK and FPB material is in the form of software that contains learning materials, learning videos equipped with sign language and interactive learning media.

The feasibility of the product has met the criteria for feasibility according to the assessment of experts, the efficiency of the product has good criteria according to the results of the analysis of the teacher response questionnaire and the student response questionnaire, and the effectiveness of the product has effective criteria according to the percentage of classical completeness obtained, namely 87.5%.

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