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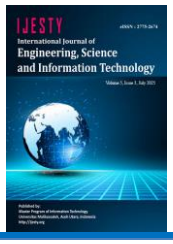

Development of Integrated Audiovisual Digital Handout Through Flipbook Application Based on Realistic Mathematics Education

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Abstract

Effective learning media that prioritizes digitalization in the learning process and curriculum development are needed to improve students' numeracy literacy skills. One type of digital learning media is digital handouts, which are expected to provide positive changes in the world of education. Digital learning media that prioritizes audiovisual is expected to provide new learning experiences for students. This study will determine whether students' numeracy literacy skills increase after studying digital audiovisual handouts through the Realistic Mathematics Education-Based Flipbook Application. This research method uses the modified Borg and Gall model with stages of needs analysis, planning, initial product development, initial field trials, revision of test results, field trials of the main product, product revision, and final product and implementation. The research was conducted at SMPN 1, SMPN 2, and SMPN 3 Dewantara. The subjects of this study were students of grade VIII. The object of the research was Integrated Audiovisual Digital Handouts Assisted by Flipbook Application Based on Realistic Mathematics Education. The results of the validity test by material experts and media experts showed that the media that had been developed was feasible to be tested on students. The results of the small group trial stated that the press created was valid in appearance, ease of use, and usefulness so that it could be used in the media effectiveness trial through evaluation.

Keywords: *Digital Handouts, Audiovisual, Flipbook Applications, Realistic Mathematics Education.*

1. Introduction

Digital-based learning media is a media that is practical to use anywhere and anytime. One type of digital learning media is digital handouts, which are expected to bring positive changes in the world of education. Digital learning media that emphasizes audiovisuals provides new learning experiences to students. The learning approach by prioritizing everyday life in the learning process, as well as practice questions that are arranged based on students' daily stories, can also increase students' learning motivation, considering that the problems faced during the teaching and learning process are common in students' daily lives [1].

Digital Handouts learning with attractive visual presentations will be of interest to students and have an impact on improving learning outcomes. This is to research conducted by [2], which shows that the development of E-Handouts obtains excellent results for student learning outcomes and has a very high average value in the class studied. It is concluded that the E-Handout learning media is straightforward to use and understand. [3] and [4] stated that developing digital learning media that sounds audiovisual is effective when combined with a realistic approach. The results obtained from the study indicated that the implementation of learning was in an outstanding category, and student learning outcomes were assessed as very high after implementing learning through digital learning media. The same results were obtained from [5] research, stating that implementing learning using Powtoon animation was outstanding. Student learning outcomes were assessed as very high after learning through digital learning media.

Therefore, to provide interesting learning media that can be used as the latest learning resources that adapt to digitalization, it is necessary to develop learning media such as digital handouts integrated with audiovisuals with the help of flipbook applications in their development. Digital handouts are created using a realistic approach, with the hope that after this teaching media is implemented, it will be able to improve students' numeracy literacy skills.

2. Literature Review

Teaching materials are all materials (both information, tools, and texts) that are arranged systematically, which display a complete figure of the competencies that will be mastered by students and used in the learning process with the aim of planning and reviewing the implementation of learning, for example, textbooks, modules, handouts, LKS, models or mockups, audio teaching materials, interactive teaching materials, and so on [5]. Learning media can be grouped into four groups: media from printed technology, media from audio-visual technology, media from computer-based technology, and media from a combination of print and computer technology. This requires a pocketbook, a small book arranged sequentially with a more concise, clear, and dense material concept equipped with illustrations to support understanding the material so that it is effective to carry anywhere and can be read anytime [2].

2.1. Handout

According to [6], a handout is a printed material that contains material and can provide information to students. According to [7], a handout is a concise, printed teaching material in writing on sheets containing material obtained from relevant literature to enrich students' knowledge of certain materials. This is because learning media or teaching materials in handouts can enable students to learn outside the school environment. This aligns with the opinion of [8] that handout teaching materials can support students' independent learning. Based on several views of the experts above regarding the definition of handouts, it can be concluded that handout teaching materials are teaching materials that contain concise material that has been systematically arranged according to basic competencies that can be used as support in the learning process. Handouts will significantly help teachers because material delivery can be done more easily.
Preparing Handouts The preparation of handouts is adjusted to the applicable curriculum so that the competencies students must achieve are covered. According to [9], the steps for making and compiling handouts include (1) conducting curriculum analysis, (2) adjusting the primary material and basic competencies, (3) literature study, (4) Writing according to the rules, (5) Evaluation and (6) using magazines, books, journals, and the internet to enrich the material and content of the handout.

2.2. Flip PDF Professional

A flipbook is a book in the form of a digital file that can be flipped through its pages. A flipbook is a digital book that can be opened page by page as if reading a book or magazine in general [10]. Flip PDF Professional is a software that can add various types of animated media features (text, images, audio, and video) Flip PDF Professional is a flipbook maker that can quickly copy and paste pages. Users can easily add images, audio, video, and files from YouTube, MP4, audio video, hyperlinks, quizzes, and Flash.
Students can use e-modules created with Flip PDF Professional to learn independently because they can be published online or offline. Using this software to develop e-modules can produce more innovative and enjoyable learning media.

2.3. Realistic Mathematics Education Approach

The realistic approach is an approach that starts with something tangible so that students can be involved in a meaningful learning process. According to [1], the main idea of learning using a realistic approach is that students must be allowed to discover concepts and principles based on their experiences interacting with the environment. Solving problems through a realistic approach can improve students' problem-solving skills, critical thinking and intuition [11]. The development of realistic education began when this idea was put forward by a Dutch mathematician, Hans Freudenthal, who stated that learning in schools, whether mathematics or other subjects, must be considered as human activities so that the problems that arise are real and contextual. According to [12], a learning approach that begins with contextual problems will make it easier for students to find solutions to each issue. After that, the teacher can slowly provide more complex problems to hone students' thinking skills.

2.4. Numeracy Literacy Skills

Literacy was first coined by the World Economic Forum or OECD in 2015 [13] & [14]. One of the six basic literacies, numeracy literacy, is closely related to the ability to think and reason [15]. According to [16}, numeracy literacy skills include the ability to read or solve mathematical numbers and reasoning skills, which include activities to analyze and understand implicit concepts and use mathematical information found through graphs, tables or diagrams. Based on the understanding of numeracy literacy skills, it can be concluded that they are the abilities a person has to use mathematics in everyday life.
According to [17] in the book Gerakan Literasi Numerasi (GLN), the indicators of numeracy literacy skills include the ability to use symbols and numbers in social arithmetic material, (2) the ability to analyze information from tables and, for example, (3) the ability to analyze and make decisions by explaining the results of the analysis. According to [18], numeracy literacy skills consist of three indicators: 1. Having skills related to numbers and symbols in mathematics. 2. Analyzing information presented in various forms (graphs, tables, charts). 3. Solving problems.

3. Methods

Research stages of developing integrated audiovisual digital handouts assisted by flipbook applications based on Realistic Mathematic Education using the modified Borg and Gall model. This type of research is applied research with research and development methods or Research and Development (R&D). [19] stated that Research and Development (R&D) is a method used to produce specific products, and its effectiveness can be tested.

3.1. Research Design

The research location was at State Middle Schools throughout Dewantara District. The model used in this study is the Borg and Gall model, which has been modified with the following steps.

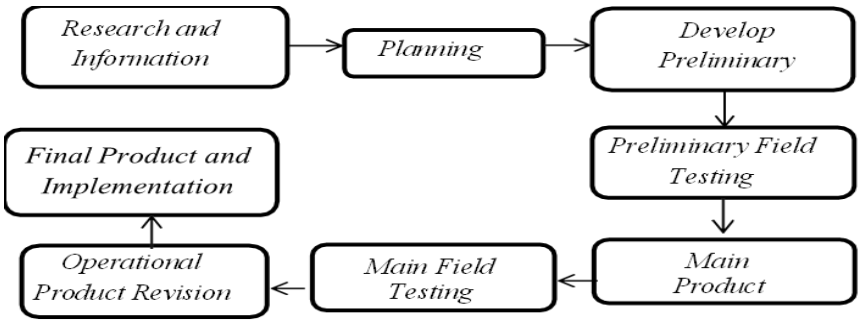

Fig 1. Stages of digital handout development research using the Borg and Gall model

3.2. Data Analysis Technique

The developed handout was tested for its validity by providing validation sheets to experts consisting of media experts and material experts. To clarify the learning level of validity of media, the researcher used a Likert scale. The validity weight can be seen in Table 1, and the validity criteria can be seen in Table 2. The product quality criteria in this study are determined as follows:

1. Validity Analysis

Table 1. Validity Assessment Weight

Category	Score
Very Good	4
Good	3
Less Good	2
Very Less	1

Source :[19]

Validity level criteria:

Table 2. Validity Level Criteria

No	Validity Value (%)	Validity Criteria
1	85-100	Very valid, or can be used without revision
2	70-85	Valid or usable but requires minor revisions
3	50-70	Less valid, recommended not to use because it needs major revision
4	0-50	Invalid, or may not be used

Modified from: [20]

Determine (%) the validity criteria are:

$$\text{Validitas} = \frac{\text{TSe}}{\text{TSh}} \times 100\% \quad (1)$$

Where is

TSe (Total Empirical Score) = total Value of questionnaire validation results.
TSh (Total Maximum Score) = total maximum Value of questionnaire validation.

2. Practical Data Analysis

Table 3. Practicality Assessment Weight

Category	Score
Category	4
Very Good	3
Good	2
Less Good	1

Source : [19]

Table 1. Practicality Level Criteria

No	Practical Value (%)	Level of Practicality
1	85-100	Very practical or can be used without revision
2	70-85	Practical or usable but needs minor revisions
3	50-70	Less practical, it is recommended not to use it because it requires major revision.
4	0-50	Not practical or should not be used

Modified from: [20]

Determine (%) the validity criteria are: =

$$\text{Practicality} = \frac{\text{SRe}}{\text{SRh}} \times 100\% \quad (2)$$

Where: SRe (Empirical Average Score) = average Value of the results of the practicality questionnaire
SRh (Maximum Average Score) = total average of the results of the practicality questionnaire.

3. Data Effectiveness Analysis
The effectiveness of the developed handouts can be seen from the data on measuring student learning outcomes. Integrated audiovisual digital handouts assisted by flipbook applications through the Realistic Mathematic Education approach are effective if students have met the KKM as in the effectiveness criteria (Akbar, 2017).

Table 2. Effectiveness Level Criteria

No	Practical Value (%)	Level of Effectiveness
1	81-100	Very practical or can be used without revision
2	61-80	Effective or usable but needs minor revisions
3	41-60	Less effective, it recommended not to use
4	21-40	Ineffective, or should not be used
5	0-20	Very ineffective, or should not be used

Modified from: [20]

Determine (%) the effectiveness criteria is

$$\text{Effectiveness} = \frac{\sum \text{Subject achieved KKM}}{\text{Subject}} \times 100\% \quad (3)$$

4. Results and Discussion

4.1. Research Results

The development of digital handouts conducted in this study used a modified Borg and Gall model development model. However, in this report, the research results only reached the development stage, namely the initial field trial or Preliminary Field Testing. The following is a description of the stages in the development of integrated audiovisual digital handouts assisted by flipbook applications based on Realistic Mathematic Education.

1. This Research and Information Collection
At this stage, the research conducted observations in several public junior high schools in Dewantara District, namely Public Junior High School 1 Dewantara, Public Junior High School 2 Dewantara, and Public Junior High School 3 Dewantara. In addition to observations, a needs analysis was also conducted using the interview method with mathematics teachers at the junior high schools. Based on the initial analysis conducted, it was found that the learning resources that had been used in learning were only textbooks and printed LKPD.
2. Planning
At this stage, an analysis of learning outcomes was carried out which was continued with material analysis. The selection of materials was carried out so that they were relevant to learning outcomes, material needs for junior high school level. At this stage, the instruments to be used were also planned, namely expert validation sheets, student response questionnaire sheets, and test instruments that measure student abilities.
3. Preparing the initial form of the product
The initial product development stage includes the product creation stage, namely digital handouts and validation assessments by experts, namely media experts and material experts. At this stage, validation sheets and response questionnaire sheets and ready-to-use student ability test instruments were also prepared.
   a. Product creation (Digital Handout)
   The first stage carried out in the context of product creation is the creation of a cover design as the initial display of the handout and also the contents of the handout which include materials, learning videos and evaluation questions. The creation of this digital handout product consists of several stages. First, the handout is designed and developed using the Canva application, then the handout that has been developed is imported in PDF format. Furthermore, the Flipbook application re-evaluates the PDF file until

it becomes a digital handout integrated with audiovisuals and contains materials equipped with learning videos and evaluation questions.

b. Expert Validation

After the digital handout is created, the next step is to carry out an assessment by the validator. The media expert validators are two lecturers of Mathematics Education IAIN Lhokseumawe. At the same time, the material expert validators consist of one lecturer of Mathematics Education, IAIN Lhokseumawe, who is also a facilitator for the Driving course teacher, and one SMA Negeri 1 Dewantara Aceh Utara mathematics teacher—validation results from 2 media experts.

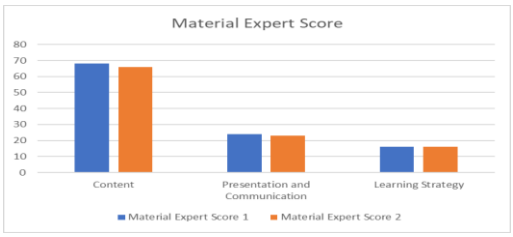

Fig 3. Material Expert Assessment Aspects

The figure 3 shows the Percentage of validity of the digital handout obtained from material expert 1 of 96.42% with the category "Very Valid" and material expert 2 of 93.75% with the category "Very Valid". Based on the results of the validation test by material expert 1 and material expert 2, it can be said that the validity of the digital handout developed is in the very valid category when viewed from the material side.

4. Preliminary Field Testing

This stage is a trial of the digital handout that has been developed in a small group consisting of 10 students of class VIII of SMP Negeri 3 Dewantara. This test was conducted to determine the readability and practicality of the digital handout developed on a small scale.

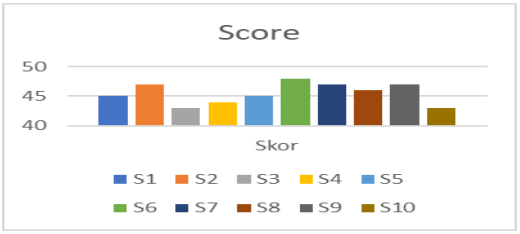

Fig 4. Small group trial scores

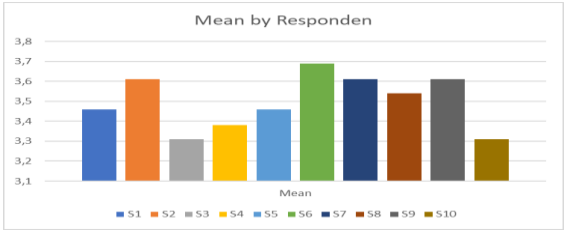

Fig 5. Small group trial average

The results of the practicality trial in small groups with 10 students as research subjects obtained an average score of 3.49. The percentage of the practicality level of the handout is 87.25%. It can be said that the handout developed is in the "Very Practical" category.

5. Main Product Revision

The validation results from media and material experts as well as the initial field trial obtained several suggestions that became revisions for the media being developed. However, the revisions made were only minor revisions. Suggestions from material experts to replace some questions with literacy and numeracy questions have been carried out. Likewise with suggestions from students who stated that the music in the video was too loud so that the conversation in the video was not heard. This section has also been revised by the research team so that the media is worthy of being continued with the main product field test.

6. Main Field Testing At this stage, the results of the learning evaluation and response questionnaires that have been worked on by students, the data is processed to obtain the results of the effectiveness and practicality of the media.

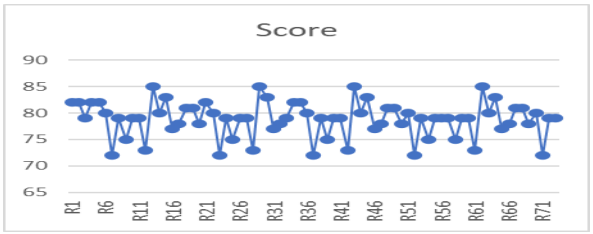

Fig 6. Product trial results scores by practitioners at SMPN 1

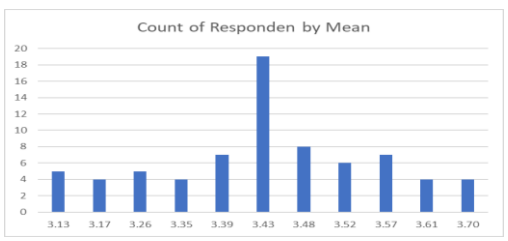

Fig 7. Practitioners' average scores at SMP N 1

The results obtained from the recapitulation of the results of the product trial on students of class VIII-D and VIII-E of SMP Negeri 1 Dewantara as many as 73 students, can be seen from graph 1, the average Value is 3.43, and the percentage of practicality level is 85.75%. The results of these calculations can be described as the media developed is "Very Practical". The following will present the results obtained from the product trial on students of class VIII-I of SMP Negeri 2 Dewantara.

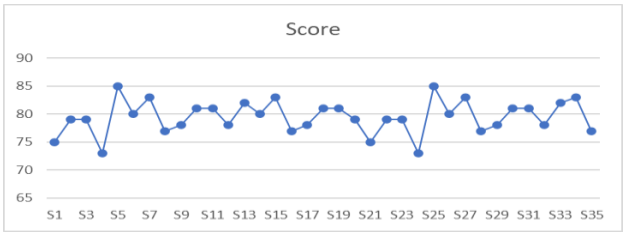

Fig 8. Product trial results scores by practitioners at SMP N 3

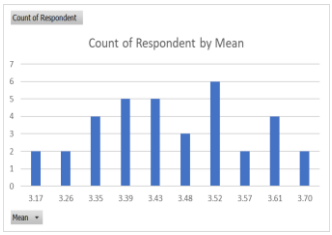

Fig 9. Practitioners' average scores at SMP N 3

The results of the practicality trial on a large group with 36 research subjects of class VIII-I SMP Negeri 3 Dewantara obtained an average score of 3.44. The percentage of the practicality level of the media is 86% so that the media developed can be categorized as "Very Practical".

Based on the calculation data at SMPN 1, SMPN 2 and SMPN 3 Dewantara, it was concluded that the integrated digital audiovisual handout learning media assisted by the Flipbook Application Based on Realistic Mathematic Education that had been developed was very practical to use as a learning medium.

The effectiveness value of the learning media will be calculated by looking at the achievement of the completion of the material taught through the assessment of student learning outcomes. The results of the assessment of student learning outcomes are as follows:

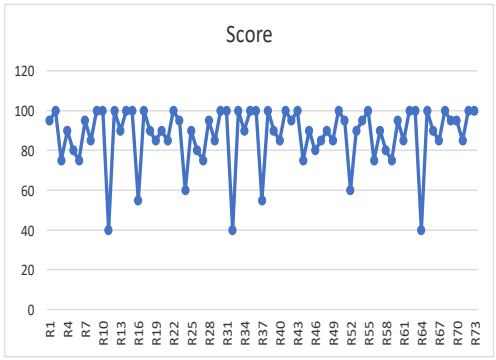

Fig 10. Effective result score

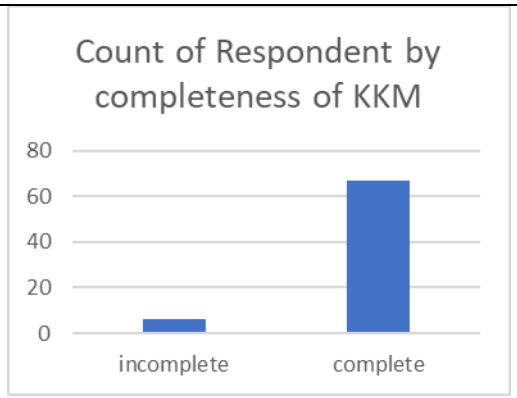

Fig 11. KKM completion

The learning completion achievement score at SMP N 1 Dewantara was 73 students, while 6 students did not reach the KKM, and the effectiveness score was 90.41% with the category of "very effective". The results obtained from the product effectiveness trial on class VIII-I students of SMP Negeri 3 Dewantara are as follows.

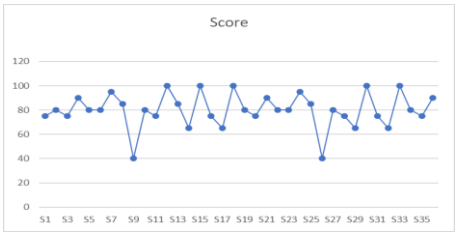

Fig 12. Score completion of learning at SMP N 3

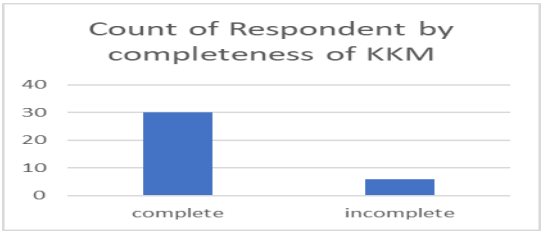

Fig 13. Completeness of KKM

Consisting of 30 students who achieved KKM, and 6 students who did not achieve KKM at SMP N 3, the effectiveness value can be calculated as 83.33% with a very effective category. Based on the results of the data, the learning media developed has very effective criteria for use. Integrated digital audiovisual handout learning media assisted by the Flipbook Application based on Realistic Mathematic Education that has been developed is very effective for use as a medium in learning Mathematics subjects at the junior high school level.

4.2. Final Product and Implementation

This stage is the implementation or application of the developed product. This activity aims to determine the difference in the increase in numeracy literacy skills between students who learn using the flipbook application and students who use regular textbooks. This implementation was carried out in class VIII of SMP Negeri 1 Dewantara involving two classes, namely class VIII-A as the experimental class and class VIII-B as the control class with the number of students in each class being 36 and 34 students. The experimental class was given treatment by implementing learning using the flipbook application and the control class using regular textbooks on the material of two-variable linear equation systems. The data analyzed at this stage were pretest data and N-gain data on the numeracy literacy skills of the two classes. N-gain data is data used to analyze the increase in numeracy literacy skills so that the difference in improvement in the two classes can be known.

5. Conclusion

Development of Digital Audiovisual Handout Learning Media on Two-Variable Linear Equation Systems. The preparation of research data collection instruments includes questionnaire validation and feasibility testing, as well as testing the effectiveness of the material in the media. The research has been conducted at SMPN 1 Dewantara, SMPN 2 Dewantara and SMPN 3 Dewantara. The subjects of this research were grade VIII students. The object of the study is the Integrated Digital Audio Visual Handout Assisted by Flipbook Applications Based on Realistic Mathematics Education. The results of the validity test by material experts and media experts indicate that the media that has been developed is feasible to be tested on students. From the small group trial results, it can be concluded that the press created is valid in appearance, ease of use, and usefulness so that it can be used in the media effectiveness test through evaluation. The next step in the research will be carried out in the implementation stage at SMP Negeri Dewantara.

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