

Developing Content for 4-Side Hologram Media: E-Book and Hologram Video on Sound Material for Junior High School Students

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Abstract

From the result of literature review, hologram as learning media is able to attract student interest and learning, and it is suitable to use in various disciplines and levels of education. In other hand, the observational result in the field, teachers rarely used an innovative media and student learning outcomes are low in sound material. Therefore, the authors are interested in developing hologram media content forms as e-books and hologram videos on sound material. This research is using R&D method with the ADDIE model (Analysis, Design, Development, Implementation and Evaluate). Based on our result, it can be concluded that the development of e-books and hologram videos on sound material are valid with a percentage 88.5% and are suitable to use in the classroom with a percentage 89.4%. Likewise, from the result of the reliability test for pre-test and post-test questions has a value of 0.882, so that these questions are reliable. After these products are used in the classroom, the effectivity test with *N-gain* experienced value in a moderate category. Thus, it can be concluded that the development of hologram media content for sound material, such as e-book and hologram videos, are effective to use in junior high school.

Keywords: *Hologram media; Sound; and Junior high school.*

I. Introduction

The development of hologram-based learning media has its own interest for researchers. Besides its innovative shape, this media is able to attract students' attention. In addition, hologram-based learning media is also effectively used in several levels of education and disciplines. For example, in Greece, the research from Fokides-Bampoukli [1] found that students in elementary schools were more happier and motivated to learn when using hologram-based learning media. Even Fokides-Bampoukli

[1] suggesting that this media can be continued because it offers a positive learning experience to students. In Indonesia, relevant results were also obtained by Sulton-Prihatmoko [2]. Then in the junior high school level, Fauzan-Syamsurijal [3] got the result that the development of hologram media in the field of science is effectively used and comfortable used by students. In other fields of science, for example, Aditia *et al.* [4] developed a hologram media on historical heritage material with the name 'Histogram', and they combined the media with student gadgets in learning.

Some of the researchs above have shown the superiority of hologram as a learning media. So that further research related to this media is feasible to continue. However, from the previous research, the development of hologram-based learning media has never been developed on sound material. Therefore, we are interested to conduct the research with title "Developing content for 4-side hologram media: e-book and hologram video on sound material for junior high school students". We developed this content because we had previously made 4-sided hologram media or hologram pyramids.

II. Method

In this study, we used Research & Development (R&D) type to develop e-book and hologram video on sound material. Generally, the procedure consisted of three stages such as a) product development, b) product validation, and c) product effectivity [5]. Through these steps, qualitative and quantitative data were taken by the author with mixed method research [6]. Then for data analysis, we used the statistics of non-parametric. The research location was held in a state junior high school 1 (coordinate: -7.971001, 112.623801) in Malang city, province of East Java, Indonesia. A more detailed explanation of the three stages will be described as follows.

a. Product Development

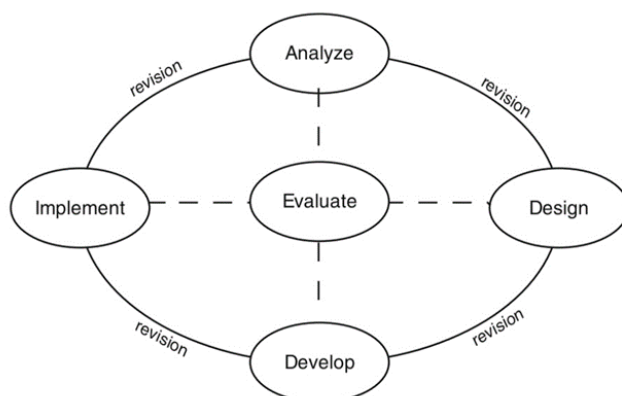


Figure 1. The ADDIE model by Branch

Product development is carried out systematically with the ADDIE model adapted from Branch [7]. This model was chosen because each stage in the product development process is more structured in

detail, and it is programmed to solve learning problems related to learning resources according to the needs and characteristics of products [8]. The ADDIE model diagram can be seen in figure 1. While the activities carried out by researchers from each stage are described in table 1 below.

Table 1. Details of activities in the ADDIE stage

Stage	Activity
Analyze	<ul style="list-style-type: none"> • Interviewing science teachers at junior high school • Distributing the questionnaires to students at junior high school • Doing the need analysis based on the condition at school
Design	<ul style="list-style-type: none"> • Designing the objects to be displayed in hologram videos • Designing the materials for e-book • Designing the questions for pre-test and post-test
Develop	<ul style="list-style-type: none"> • Developing the hologram videos • Developing the materials and layouts for e-book • Developing the questions for pre-test and post-test for students
Implement	<ul style="list-style-type: none"> • Validity test by Expert • Readability test by students at junior high school • Feasibility test by science teacher • Teaching students with media, and giving pre-test and post-test
Evaluate	<ul style="list-style-type: none"> • Effectivity test after using media in classroom

b. Product Validation

The products is validated through several tests to determine the validity of the product. The tests consisted of expert validity tests, readability tests, and feasibility tests. The types of data obtained in this study are quantitative data and qualitative data. The data collection instruments in this study were interview sheets, expert validation test sheets, teacher feasibility test sheets, and student readability test sheets as learning media users. The expert validation test consisted of concept, media and language. The Guttman scale was used in the concepts with a choices of yes (score 1) and no (score 0). While the measuring scale of media and language, teacher's feasibility test and the student's readability test are Likert scale, with a choice of scores of 1 for the "strongly disagree" category, 2 for the "disagree" category, 3 for "agree", and 4 for the "strongly agree" category [9].

$$P = \frac{\sum xi}{\sum x} \times 100\%$$

The data analysis technique for all product validations were analysed descriptively [10] by using equation below, where P is the percentage, $\sum xi$ is the real score and $\sum x$ is the maximum score.

With the descriptive analysis results, the percentages of the product's feasibility level now can be identified as valid, moderately valid, less valid, and invalid criteria. Table 2 below is the format of product eligibility criteria as learning media (Arikunto, 2010).

Table 2. Criteria of validity and eligibility of media

Percentage (%)	Criteria
76-100	Valid
51-75	Moderately Valid
26-50	Less Valid
0-25	Invalid

c. Product Effectivity

At this stage, the products were applied directly in learning. The sample was chosen randomly with a total of 28 students at a junior high school in Malang city. The type of research design used in this research is a pre-experimental one group pre-test and post-test design. The effectiveness test was carried out by comparing the students' pre-test and post-test scores after using our media. In this effectiveness test, the questions used for the pre-test and post-test are the same as 10 items which are adjusted to the indicators of competency achievement and learning objectives [12]. The questions that we have created then it tested to the empirical validity and reliability before being used in class.

The requirement for decision-making of validity test is if the significant value of the r_{count} is less than 0,05 ($r_{count} < 0,05$), then the questions are valid, and vice versa. In addition, decision-making can also be done by comparing the calculated r_{values} and r_{tables} . If $r_{count} > r_{table}$, then the questions were valid. The percentage of r_{table} used in this study was r_{table} 5% of 0,374. After the questions were declared valid, the reliability tests carried out to determine their consistency as a measuring instrument. Questions were said to be reliable if the same results had obtained many times in the measurement. The reliability test used in this study was the split-half method because the data had one correct answer, with a decision that is when $r_{count} > 0,70$ [13].

After using media in the classroom and getting student pre-test and post-test data, the normality test now can be done. The normality test was carried out to know whether the data is normally distributed or not. Because the statistics were non-parametric, the expectation data does not have to be normally distributed. The normality test that we choose was Shapiro-Wilk, because the number of samples were less than 50 data. Decision-making theory in the Shapiro-Wilk normality test was the data normally distributed if the significance value is more than 0,05 ($sig > 0,05$). If it is less than 0,05 ($sig < 0,05$) then the data is not normally distributed [14].

Furthermore, for data analysis we used the Wilcoxon test. We set a hypothesis (H_a) where there is a difference between the results of the pre-test and post-test scores. For decision-making on the Wilcoxon test, if the significance value (*2-tailed*) was less than 0,05 (*Asymp. Sig* < 0,05), H_a is accepted. If the significance value (*2-tailed*) was greater than 0,05 (*Asymp. Sig* > 0,05), H_a is rejected. The last step was determined the Normalized-gain (*N-gain*) which aims to determine the effectiveness of using media in classroom. The *N-gain* test formula can be seen in this equation below.

$$Ngain = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

The maximum score on the *N-gain* test was the highest score that can be obtained on the data. As for calculating the *N-gain*, the categorization of scores can be analyzed using table 3 below [13].

Table 3. The value of *N-gain* for each category

<i>N-Gain</i> Value	Category
$g > 0,7$	High
$0,3 < g < 0,7$	Moderate
$g < 0,3$	Low

III. Results and Discussion

a. Product Development

The development of e-book and hologram video through the ADDIE model has been carried out systematically. In the ‘Analysis (A)’ stage, we distributed the questionnaires to students and interviewed the science teachers. Based on the results of questionnaire, it found that 82,1% of students at junior high school 1 Malang preferred learn science by watching videos rather than reading books. In addition, 96,4% of students are more enthusiastic in class when using learning media like videos. Then based on the results of interview, the teacher has been used the media in the classroom, and the media were visual and audio-visual. For visual media used in the classroom were varies such as printed books, pictures and simple tools, while for audio-visual such as YouTube videos. Furthermore, based on the student questionnaire, 82,1% of students stated that it was difficult to understand the concept of sound material. Specifically, students are still experienced difficulties, such as 50% in the sound formation’s process, 53,6% in the high and low sound’s factor, 82,1% in the resonance process and 60,7% in the process of sound reflection.

At the ‘Design (D)’ stage, we had determined the objects that will be displayed in the hologram video and the e-book. We made an icon with the name 'Mr. Bun' as the main character both in the e-book and the hologram video, so that the communication can be funny. The appearance of the e-books were developed, can be seen in the Figure 2. Based on its components, this e-book consists of a title or cover, back cover, introduction, table of contents, list of pictures, basic competencies, competency of achievement indicators, learning objectives, introduction to holograms, instructions for using the book, sound material, sample of questions, exercise, bibliography, answer key, author profile and glossary.



Figure 2. The examples of e-book, hologram videos, and how they appear in the hologram media.

This e-book is also equipped with a barcode and a link of hologram video, so that it can be projected on 4-side hologram media. In the link, there are four videos that we have developed. The first video is a video about the process of sound formation. In this video, there is a picture of a drum beaten then a vibration appears to travel through the air, and it finally reaches the human ear. The second video is high and low of sound, such as the effect of string length, cross-sectional area and the amount of string tension that affects frequency. The third video is the process of resonance that occurs in guitars and

tuning forks, while the fourth video is the process of sound reflected in the form of echolocation's abilities in bats. These hologram videos aim to help students how to visualize and understand concepts in sound material.

b. Product Validation

The results of the 'Develop (D)' stage, then are proceed to the 'Implementation (I)' stage. The results of this stage consisted of the expert validity stage, feasibility test and readability tests. The results of expert validity were carried out by experts in their expertise. The results of feasibility test were carried out by science teachers at junior high school 1 Malang, and the readability test done by students who had or were currently studying sound material. The results of the validation test can be seen in the table 4.

Table 4. The results of validity test

No.	Validity	Average (%)	Category
1	Media in e-book	96.5	Valid
2	Language in e-book	81.3	Valid
3	Theory in e-book	83.4	Valid
4	Language in Hologram video	75	Quite valid
5	Theory in Hologram video	100	Valid
6	Utility as learning media	95	Valid
	Total	88.5	Valid

Table 5. The results of readability test and feasibility test

No.	Test	Average (%)	Category
1	Student's readability	83.9	Valid
2	Teacher's feasibility	94.9	Valid
	Total Average	89.4	Valid

Table 6. The results of question (Q) validity

No	Aspect	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1	Pearson correlation	0.431	0.422	0.854	0.854	0.614	0.424	0.394	0.796	0.625	0.614
2	Sig. (2-tailed)	0.022	0.025	0.000	0.000	0.001	0.025	0.038	0.000	0.000	0.001
	Category	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid	Valid

Based on the table 4, the e-book validity results all reach the valid category. While the results of the hologram video get a quite valid and valid categories. However, the utility of e-books and hologram videos as learning media is categorized as valid. Therefore, the total average by the expert in this study obtained a valid category. Next, the results of the readability test and feasibility test are displayed in the table 5. Based on table 5, the results of these test had valid categories. Therefore, the total results were valid also.

Before the pre-test and post-test questions are used as a measuring tool, the validity is also tested first as shown in the table 6. After that, a reliability test is performed using SPSS. Based on the results of validity calculation using SPSS, all questions (Q1 to Q10) are valid, it has known by the significant value of each item <0.05 and $r_{count} > r_{table}$ (r_{count} questions 1-10 > 0.374). In the reliability test, the split-half value was $0.882 > 0.70$, so that the items can be said to be 'reliable'.

c. Product Effectivity

Product effectivity is the 'Evaluate (E)' stage in the ADDIE model. At this stage, it is done by testing the normality of the data first. To test the normality of data, we used the Shapiro Wilk test. The results of the Shapiro Wilk test have shown in the table 7. In the table 7, the data are not normally distributed, because the significance value are $0.000 < 0.05$. Therefore, the next step is to do the Wilcoxon test.

Table 7. The results of Shapiro Wilk test

Type of Test	Statistics	df.	Sig.
Pre-test	0.265	28	0.000
Post-test	0.400	28	0.000

The Wilcoxon test is used to determine whether there are differences between the pre-test and post-test scores. The Wilcoxon test results are shown in the table 8. In the table 8, the value of *asym.sig* (2-tailed) is 0.000. Because the value of $0.000 < 0.05$, it means that there is a difference between the results of pre-test and post-test scores.

Table 9. The results of Wilcoxon test

Criteria	Post-test-Pre-test
Z	4.739
<i>Asymp. Sig. (2-tailed)</i>	0.000

The last step is to achieve the *N-gain* value. The results of *N-gain* test are shown in the table 10. The average value (mean) of *N-gain* is $0.7006 > 0.7$ with moderate category as in the table 10. This can be interpreted that hologram media in the form of e-book and hologram videos on sound material are effective to use in the classroom.

Table 10. The results of N-gain test

Category	N	Minimum	Maximum	Mean	Std. Deviation
<i>N-Gain</i> Score	28	0.50	0.000	0.7006	0.1108
<i>N-Gain</i> percentage	28	50.00	0.000	70.059	11.087
Valid N	28				

The results obtained in this study are relevant to other studies. For instance, Ali-Ramlie [15] in year 2021, analyze user experience with tutors in the form of 3D holograms. They found that hologram media is very positive and promising in the future [15]. Furthermore, Darmawan *et al.* [16] succeeded in developing hologram media for speed learning in primary school students, especially environmental education. Moreover, Hernawan *et al.* [17] stated that they managed to combine holograms and Kamishibai for environmental education. Therefore, the development of hologram media in classroom is feasible so much to continue in the future.

IV. Conclusion

Based on the research and development using the ADDIE model, it can be concluded that content development for hologram learning media as e-books and hologram videos on sound material have passed well and reached valid category with a percentage of 88.5% (validity) and a percentage of 89.4% (readability and feasibility). In the reliability test for pre-test and post-test questions, the split-half value was $0.882 > 0.70$, so the questions can be said reliable too. Moreover, the effectivity results with an average (mean) *N-gain* value obtained of $0.7006 > 0.7$ in the moderate category, so it can be concluded that hologram media content in the form of e-books and hologram videos is effective to use in the classroom. The suggestion from our results are further researchers can promote and continue in other scientific material.

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