



CONSTRUCT 2 INTERACTIVE MULTIMEDIA FOR TEMPERATURE AND HEAT TOPIC: A MULTIMEDIA DEVELOPMENT FOR SENIOR HIGH SCHOOL LEARNING

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Article Info

Article history:

Received: October 28, 2020

Accepted: November 28,
2020

Published: November 30,
2020

Keywords:

Construct 2
High school learning
Interactive multimedia
Temperature and heat

ABSTRACT

This study aimed to develop interactive multimedia using construct 2 on the topic of temperature and heat. The research method used is Research and Development (R&D) which adopted the development of Borg & Gall. Based on the results of the validation from the content experts, the results obtained were 81% in the very good category, and the media experts gave a score of 94% for the very good category, and the results of the teacher's response obtained a percentage score of 77% in the good category. Then interactive multimedia was tested through two stages, small group trials and field trials. The average results obtained were 83.6% for small group trials, and the results of field trials in three schools were 85%, 84%, and 84%, and the average was 85.7% in the very good category. So, it can be concluded that interactive multimedia is feasible and good for use in learning.

MULTIMEDIA INTERAKTIF DENGAN CONSTRUCT 2 PADA MATERI SUHU DAN KALOR: PENGEMBANGAN MULTIMEDIA UNTUK PEMBELAJARAN TINGKAT SMA

Kata Kunci:

Construct 2
Pembelajaran di SMA
Multimedia interaktif
Suhu dan kalor

ABSTRAK

Penelitian ini bertujuan untuk mengembangkan multimedia interaktif menggunakan construct 2 pada topik suhu dan kalor. Metode penelitian yang digunakan adalah Research and Development (R&D) yang mengadopsi pengembangan dari Borg & Gall. Berdasarkan hasil validasi dari ahli materi, didapatkan hasil dengan presentase 81% kategori sangat layak, dan ahli media memberikan nilai dengan presentase 94% kategori sangat layak, serta hasil respon guru memperoleh presentase skor 77% dalam kategori sangat menarik. Kemudian multimedia interaktif di uji coba melalui dua tahap yaitu uji coba kelompok kecil dan uji coba lapangan. Hasil rata-rata yang diperoleh yaitu 83,6% untuk uji coba kelompok kecil, dan hasil uji coba lapangan di tiga sekolah yaitu 85%, 84%, dan 84%, dan rata-rata 85,7% dengan kategori sangat baik. Maka dapat disimpulkan bahwa multimedia interaktif ini layak dan baik untuk digunakan dalam pembelajaran.

1. INTRODUCTION

The learning process can be said to be going well if there is an interaction between teachers and students, between students and students, or students with other learning sources. [1], [2]. The success in achieving learning objectives is strongly influenced by several factors, for example, teaching and learning strategies, learning methods and approaches, and learning resources used in the form of books, modules, worksheets, media, etc [3]–[5]. Learning media is a tool or object that can be used as an intermediary for distributing lesson content so that students are more interested and easier to understand the information conveyed by the teacher [6]–[10]. The media serves as a source of information on learning and a source of exercises [11]–[13]. The use of media in learning can cover the limitations of teachers in conveying information and learning time in class [14]–[16].

Based on the results of Preliminary Research at SMAN 13 Bandar Lampung through an interview with one of the physics teachers, it was found that most of the physics learning process is still teacher-centered. Students only act as recipients of information, therefore, students' understanding is limited to information from the teacher and they do not understand the meaning and purpose of the concept. Moreover, teachers also only use printed books and worksheets in the learning process. Although LCD facilities are available in each class, they are only used occasionally due to the lack of time to make or copy material to PowerPoint. Thus, to streamline time, teachers prefer to use the lecture method and students only accept the material delivered by the teacher. So, the use of learning media is still not optimal according to the needs of students.

Researchers try to develop learning media to be a solution to the problem. By using learning media that can stimulate students' thinking skills and combine various media in one unit, researchers develop interactive multimedia. Interactive multimedia is multimedia that is equipped with a controller that can be operated by the user so that the user can choose what he wants for the next process [17]–[21]. Interactive learning media makes it easier for educators to teach abstract material. With interactive multimedia, the teaching and learning process of physics becomes easier and teaching and learning activities become more interesting and less monotonous.

Interactive multimedia development can be done using a variety of software, one of which is Construct 2 software. Construct 2 is software for creating game applications, especially for 2D HTML5-based games, which allows creating games without coding. Construct 2 is a product made by Scirra, a company based in London, England [22]–[24]. Construct 2 software is software to make games, but many studies have also used this software for making learning media [24]. For this reason, researchers developed Interactive Multimedia Using Construct 2 on the Subject of Temperature and Heat for Class X SMA Students.

2. METHOD

The research and development procedure was based on the Borg and Gall design. Interactive multimedia products use construct 2 on the subject of temperature and heat. The Borg n Gall development model includes: 1) Need analysis, 2) Collecting data, 3) Product Design, 4) Design Validation, 5) Design Revision, 6) Product Trial, 7) Product Revision, 8) Field Trial, 9) Final Product Revision, 10) Desimination [25]–[30]. In this study, the research and development steps were limited from ten steps to seven steps because the seven steps had answered the research question. The development procedure in this study is presented in Figure 1.

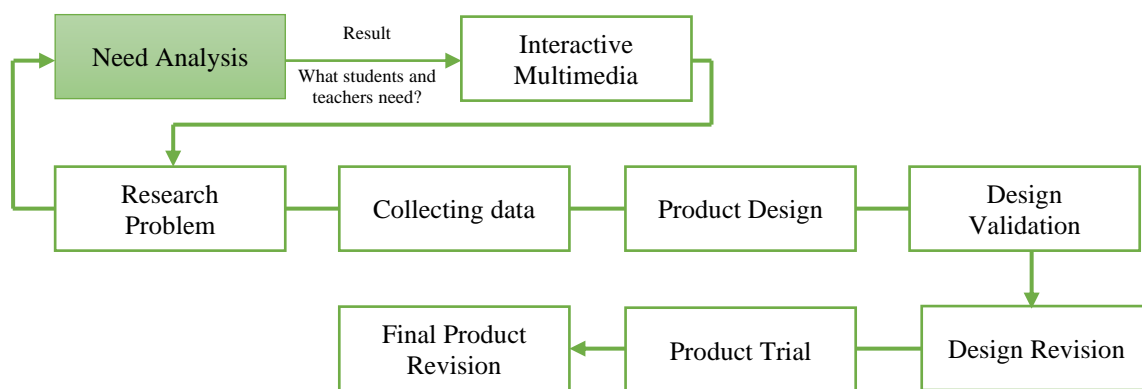


Figure 1. Research Procedure

The research subjects were students of class X at SMAN 13 Bandar Lampung, SMA Al-Azhar 3 Bandar Lampung and MAN 1 Lampung Tengah. Research data were collected using student response sheets, and data analysis using a Likert scale.

The response questionnaire to the use of interactive multimedia products using the construct 2 application on the subject of heat and temperature is made in the form of a question. Interpretation of the results of the assessment of media experts, content experts, and physics teachers into a score of 1-5 following the rules in Table 1.

Table 1. Scoring Rules

| Category | Score |
|------------|-------|
| Very Good | 5 |
| Good | 4 |
| Acceptable | 3 |
| Poor | 2 |
| Very poor | 1 |

To determine the level of attractiveness of interactive multimedia, respondents were given a questionnaire. The final score is calculated using the average item analysis based on the questions in the questionnaire. The result of the percentage score obtained is interpreted by the criteria in Table 2.

Table 2. Interactive Multimedia Feasibility Scale

| Feasibility score | Criteria |
|-------------------|------------|
| 0 % - 20 % | Very Good |
| 20,01 % - 40 % | Good |
| 40,01 % - 60 % | Acceptable |
| 60,01 % - 80 % | Poor |
| 80,01 % - 100 % | Very poor |

The overall value of interactive multimedia using construct 2 was determined by calculating the average score of all assessment criteria, then the data obtained was converted into qualitative data in accordance with the assessment criteria table 2. The data that has been obtained was then calculated to obtain the final value using the formula:

$$x_i = \frac{\sum s}{s_{max}} \times 100\% \tag{1}$$

With:

s_{max} = Maximum Score

$\sum S$ = Total Score

x_i = Feasibility score

3. RESULTS AND DISCUSSION

The initial stage in the initial product planning is to make observations to analyze the need for interactive multimedia in schools. The results of the observations stated that the use of learning media in accordance with the needs of students was still not optimal, even interactive multimedia was not available, so interactive multimedia learning media was needed.

The first step to creating interactive multimedia is choosing the software to be used. The software chosen was construct 2. The process of making interactive multimedia going through two general stages, the media design stage and the content design stage. At the design stage, the researcher selected the background, created a topic title, created a loading animation, created symbols to be included in the instructions for using the media and created buttons for the topic (temperature, heat, expansion, competency standards and basic competencies, sample questions and evaluation) which then it will be designed to be an interactive multimedia. Figure 2 is a visualization of the interactive multimedia cover page:



Figure 2. Interactive Multimedia Display

The product that has been developed is then validated by several experts before being tested. Validation was carried out by 3 content experts and 3 media experts.

3.1 Content Expert Validation

Validation from content experts was carried out by filling out an assessment questionnaire sheet for each aspect of the assessment consisting of 2 aspects: (1) quality of content and learning objectives; (2) instruction quality; and there are 18 questions in total. The results of the material expert validation are shown in Table 3.

Table 3. Content Expert Validation Results

| Aspect | V ₁ | V ₂ | V ₃ | ΣV | Average | Criteria |
|---|----------------|----------------|----------------|------|---------|-----------|
| Content Quality and Learning Objectives | 30 | 34 | 32 | 96 | 4.0 | Good |
| Instruction Quality | 42 | 42 | 39 | 123 | 4.1 | Very Good |
| Total | 72 | 76 | 71 | 219 | 8.1 | - |
| Average | 4 | 4.2 | 3.9 | 12.2 | 4.05 | Very Good |

The percentage of the average aspect of content quality and interactive multimedia objectives using construct 2 is 80%. The average percentage of the quality aspects of interactive multimedia instructional using construct 2 with a score of 4.2 is 84%. The results of the assessment in the form of a percentage per aspect are depicted in the diagram in Figure 3 below.

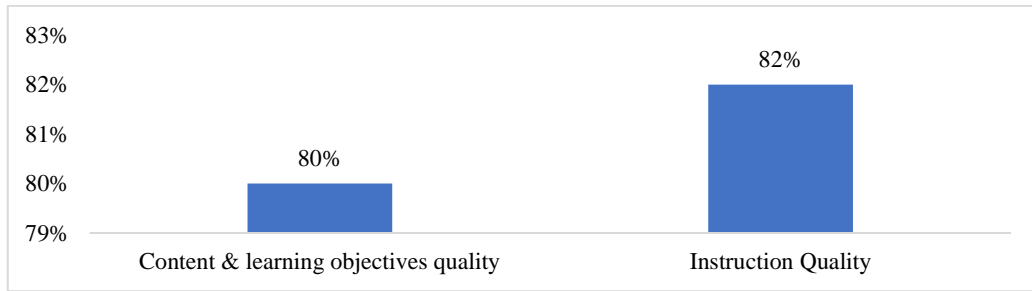


Figure 3. Material Validation Assessment Diagram

Figure 2 shows the results of the evaluation of material expert validation. The average of the two aspects of interactive multimedia using construct 2 is 81% with the very good category.

3.2 Media Expert Validation

Media validation with indicators of design aspects, readability aspects, and interactive aspects. Media validation aims to see the feasibility of media developed from learning media in the form of interactive multimedia using construct 2 on the subject of temperature and heat. Table 4 shows the result of media validation:

Table 4. Material Expert Validation Results

| Aspect | Average | Categori |
|---------------|---------|-----------|
| Design | 4.9 | Very Good |
| Legibility | 4.5 | Very Good |
| Interactivity | 4.8 | Very Good |
| Total | 14.1 | - |
| Average | 4.7 | Very Good |

The percentage of the average aspect of interactive multimedia design is 97%. The percentage of the average aspect of interactive multimedia readability is 90%. The average percentage of interactive multimedia interactive aspects is 96%. The assessment results table in the form of percentages per aspect is illustrated in Figure 4.

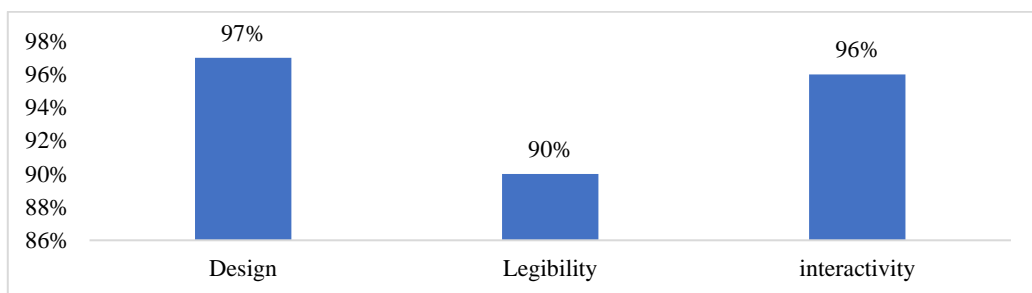


Figure 4. Media Validation Results Diagram

Figure 4 shows a diagram of the results of the media expert’s validation. The average of the three aspects of interactive multimedia is 94% with a very decent category.

3.3 Teacher Response

Aspects of the response of the teaching staff include the quality of content and learning objectives, instruction, design, readability, and interactivity. The questionnaire consisted of 30 statements using a Likert scale with a scale of 1 to 5. A physics teacher at SMA Al-Azhar 3 Bandar Lampung as the respondent 1, a physics teacher at SMA Negeri

13 Bandar Lampung as the respondent 2, physics teacher at MAN 1 Lampung Tengah as the respondent 3. The results of the assessment of the response of the teaching staff are shown in the following table.

Table 5. Results of Teacher Responses to interactive multimedia

| Aspect | Average | Categori |
|---------------------------------------|---------|----------|
| Content & Learning Objectives Quality | 3.8 | Good |
| Quality of Instruction | 3.9 | Good |
| Design | 3.8 | Good |
| Legibility | 4.0 | Good |
| Interactivity | 3.8 | Good |
| Total | 19.3 | - |
| Average | 3.9 | Good |

The percentage of content quality aspects is 76%. The average percentage for quality aspects of instruction was 79%. The average percentage of design aspects is 75%. The average percentage of the readability aspect of the media is 80%. The average percentage of the interactive aspect is 76%. The assessment results table in the form of percentages per aspect is illustrated in the following diagram.

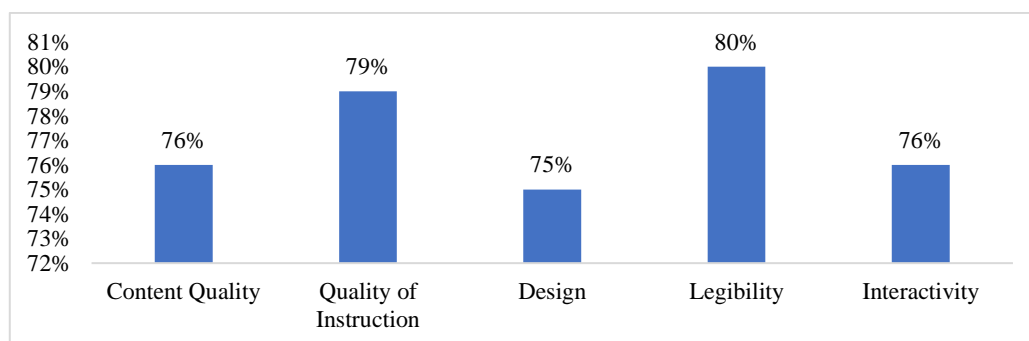


Figure 5. Teacher Response Diagram

Figure 5 shows a diagram of the teacher’s response to interactive multimedia with software construct 2. The average rating of the four aspects was 77% in the “Good” category and received a positive response.

3.4 Small Group Trial

Small group trials were carried out on 15 students who had studied the topic of temperature and heat at SMA Al-Azhar 3 Bandar Lampung, SMA Negeri 13 Bandar Lampung, and MAN 1 Lampung Tengah. The results of the recapitulation of the small group trial questionnaire can be seen in the Table 6.

Table 6. Small Group Trial Results

| Aspect | Σ |
|------------------|-----------|
| Learning Process | 380 |
| Content | 124 |
| Media | 186 |
| Total score | 690 |
| Maximum score | 825 |
| Percentage | 83,6% |
| Criteria | Very Good |

Based on the results of small group trials at SMA Al-Azhar 3 Bandar Lampung, SMA Negeri 13 Bandar Lampung, and MAN 1 Lampung Tengah with 15 students, the results showed 690 out of a maximum score of 825, so the percentage was 83.6%. So interactive multimedia with software construct 2 meets the criteria “very good or very interesting” and does not need any revision.

3.5 Field Trial

Field trials were tested on 75 students who had studied the topic of temperature and heat at SMA Al-Azhar 3 Bandar Lampung, SMA Negeri 13 Bandar Lampung, and MAN 1 Lampung Tengah. The results of the field trial questionnaire can be seen in Table 7.

Table 7. Field Trial Results

| Aspect | Σ |
|------------------|-----------|
| Learning Process | 1920 |
| Content | 634 |
| Media | 982 |
| Total score | 3536 |
| Maximum score | 4125 |
| Percentage | 85,7% |
| Criteria | Very Good |

Based on the results of field trials conducted at SMA Al-Azhar 3 Bandar Lampung, SMA Negeri 13 Bandar Lampung and MAN 1 Lampung Tengah, with 75 students the results obtained from the field trial were 3536 from a maximum score of 4125 so the percentage was 85, 7%. So that interactive multimedia media using construct 2 meets the criteria “very good or very interesting” to be used as a learning medium, and no revision needed.

The results of the material expert validation include 2 aspects of assessment: quality of content and quality of instruction. In the aspect of content quality and learning objectives, a percentage of 80% was obtained, and for the quality of instruction, it was 82%, so that the average result for all aspects was 81%. This shows that interactive multimedia is very suitable for use in learning. Interactive multimedia is very suitable for use because the presentation of the content is equipped with images, videos, and animations, and is presented attractively so that it indirectly invites students to engage auditorily and visually [11]. In addition, with pictures, animations, and videos, this media provides additional information for students on anything that cannot be visualized in books. The choice of musical instruments can also provide freedom for students to choose types of music that can provide more concentration for them to learn in understanding lessons [12]. Learning media is said to be appropriate if the presentation of images in learning media is easy to understand and can stimulate understanding in learning. [13].

The validation by media experts includes 3 aspects of assessment: design aspects, readability aspects, and interactive aspects. In the design aspect, the percentage was 97%, the legibility aspect was 90% and the interactive aspect was 96%. So that the average obtained for all aspects of interactive multimedia is 94%. This shows that this interactive multimedia fulfills the category “very good or very suitable for use in learning”. Interactive multimedia is categorized as very feasible because interactive multimedia is considered to be able to attract students to learn and try to understand the material because its presentation is supported by sound, animation, simulation, video, and attractive color contrast, moreover, interactive multimedia that is audiovisual and also interactive is also considered to be able to help students understand the concepts presented. This is in accordance with previous research statements regarding the benefit of learning media,

which is able to increase and direct student attention so that it can lead to student motivation and be able to overcome the limitations of senses, space, and time [14].

Aspects of teacher response assessment include the quality of content and learning objectives, instruction, design, readability, and interactivity. The result of the percentage of assessment from the aspect of content quality is 76%. The percentage for the quality aspect of instruction is 79%. Furthermore, the percentage of design aspects is 75%. The percentage for the readability aspect is 80% and the percentage for the interactive aspect is 76%. So that the average percentage of teacher validation is 77% with the category “good or feasible”. This multimedia was said to be feasible because it was able to make it easier for teachers to deliver material to students. Multimedia also provides opportunities for educators to further develop teaching techniques, so that they can get maximum results. Likewise with students, multimedia-based learning can make it easier for them to absorb and understand information [15]. The use of instructional media is not an additional function, but rather embodies its own function as a tool for effective learning [16]. Therefore, the use of instructional media will greatly assist the effectiveness of the learning process and assist in conveying messages and lesson content, thus helping students improve understanding because it presents information in an attractive and reliable way [17].

The trials include small group trials and field trials. This trial begins by explaining the instructions for using the media, then explaining the concepts of temperature and heat, then directing students to answer the quizzes contained in interactive multimedia. After the trial, students were asked to fill out a questionnaire for responses to interactive multimedia.

Small group trials were carried out on 15 students who had studied the topic of temperature and heat at SMA Al-Azhar 3 Bandar Lampung, SMA Negeri 13 Bandar Lampung, and MAN 1 Lampung Tengah. Students are given a questionnaire consisting of 11 questions that refer to 3 aspects of assessment, namely the learning aspect, the content standard aspect, and the media aspect.

Based on the results of small group trials conducted at SMA Al-Azhar 3 Bandar Lampung, SMA Negeri 13 Bandar Lampung, and MAN 1 Lampung Tengah, with a total of 15 students, the total score was 690 from a maximum score of 825, so the percentage was 83,6%. Therefore, interactive multimedia using construct 2 meets the criteria very well and does not need revision. This shows that interactive multimedia gets a positive response and can be used and utilized by teachers and students in learning. The factor of obtaining response results from students is very large because interactive multimedia is developed according to the needs of students. This makes learning more meaningful for students and more efficient, so that the learning process becomes more interesting and can increase students' interest in learning [18].

The product that was successfully developed is in the form of interactive multimedia using software construct 2 on the subject of temperature and heat to increase students' learning motivation on the topic of temperature and heat. This interactive multimedia is used to explain the concepts of temperature and heat. After going through the validation stage of several lecturers who are experts in their fields and conducting trials, this interactive multimedia is declared “very feasible” so it does not need to be revised.

4. CONCLUSION

Based on the research results, it can be concluded that interactive multimedia development using construct 2 is declared very feasible according to the validation results of content experts and media experts. Based on the responses of teachers and students to interactive multimedia, the teachers gave a score of 77% in the “good” category, and

students (in the small group trial) gave an average result of 83.6% with the “very good” category, and in the field trial, the students gave a score of 85.7% in the “very good” category. Both teachers and students give positive responses to interactive multimedia.

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