

CHAPTER IV

THE RESULTS OF RESEARCH AND DEVELOPMENT

A. The Implementation of Development

Procedural models developed for this product is the adaptation model by Alessi and Trollip. There are 10 stages 1) determine objectives and needs, 2) collect reference materials, 3) learns content, 4) brainstorming, 5) design learning, 6) creates a flowchart, 7) create storyboards, 8) program material, 9) creates support material, and 10) evaluation and revision.

1. Determine Objectives and Needs

Learning materials in this product are the thematic learning themes energy saving. The goal is that students can be easier to understand the concept of a material. In addition, students can also apply materials to save energy, according the example given in the media and can take advantage of useless things.

At this stage the researcher determines needs in the implementation of the development. Needs is theoretical study, study materials, books on I-spring, and media development as well as the computer/laptop.

2. Collect Reference Materials

Reference materials collected include thematic lesson books for students and teachers, the manual use of I-spring, and books supporting material. The developer is looking for reference material as much as possible to strengthen and simplify the concept that will be given to students.

3. Learn Content

An activity at this stage is the learn reference materials have been collected in the previous stage. The developer does not wait until all the reference material collected. In the stage of studying the content, developer learns the existing reference materials and gradual.

4. Brainstorming

Developer develops media from reference material that has been studied before. Developer determined that interactive media have the following characteristics 1) use color to make students interested in media, 2) there are reading about prayer before and after study 3) using the display menu that is easily chosen 4) using the animation on concept of material 5) use different colors in any material.

5. Design Learning

Material themes saving energy have a good design to make it easy for students. At the beginning of the study, students will see the opening menu display afterward students are invited to pray before the study. Students click on the material to be studied. In each view, there are many symbols that instruction, evaluation, home, and exit. Instructions symbol to inform the function of each symbol to students. Evaluation symbol, to start the test. Home Symbol to return to the main menu to select material and cross symbol used to exit the interactive media.

Students choose the material to be learned, but the teacher directs students to choose the material sequentially. The first material which prime numbers, developer uses number tables to facilitate students in finding prime numbers.

Students will be involved directly in the game and match the answers. Not only that, but the students are also invited to prove a prime number and not the Prime or composite. After that, students will conclude the definition of primes and gives examples of prime numbers.

The second factor is the material, at the beginning of the developer gives the definition of the factor and prime factors along with examples. Then students are invited to conclude the difference between factors and prime factors. The last, students were invited to work on an example of the question.

The third material is prime factorization. The developer gives definitions and examples of prime factorization to students. The developer also provided the material factor tree interactively.

The fourth material is a multiple of the least common multiple. The developer gives the concept of multiples of numbers. Then invite students to observe the multiple number. Afterward, students concluded the definition of multiples of numbers. Similarly, multiple numbers and least common multiple, the developer creates the concept of the animation so easy to understand. After students understand about the least common multiple then students are invited to determine the least common multiple. Students are told how to determine least common multiple and give an exam to practice.

The fifth material solves the problem of least common multiple. Students are given examples of questions that relate to their daily activities. The developer also relates the material with the theme about saving energy. In the example question, students can match with the existing answers.

Sixth material is chained. Students are invited to take advantage of useless objects. Students create a necklace from the materials according to the instructions given.

All the material has been studied by students. It's time to student working on evaluation. There are 15 multiple choice questions. The developer determines the score standard amounted to 75. If the student scores less than 75, students have not mastered the material. After the students answering all the questions, the display will show the score and a review of each question. Students can learn and know the explanation of each question.

End of learning, studentsis invittedd to pray after the study. Students can return to the main menu or choose the cross symbol to get out of the media. This interactive media provided the voice to support the material studied. This Design, Interactive Media as in Figure 4.1 below.

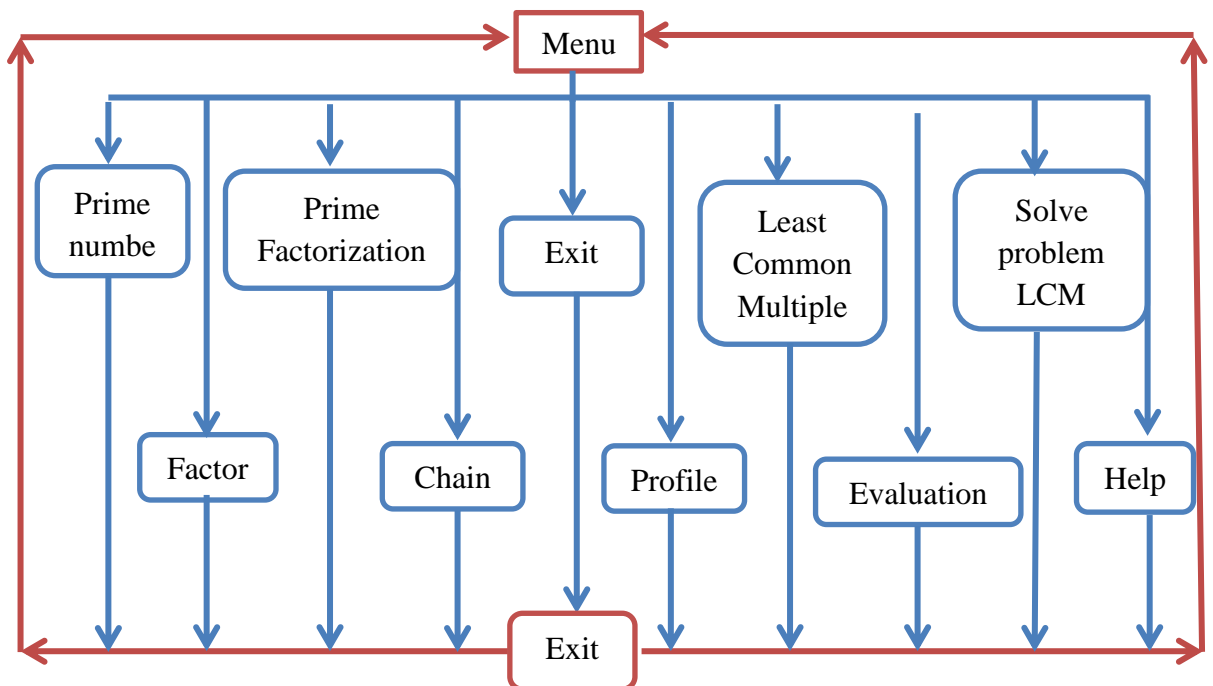


Figure 4.1 Design Interactive Media

6. Create A Flowchart

A flowchart of interactive media is not made in detail. Flowchart in this interactive media only made in outline. Flowchart does not detail from a program called pseudo flowchart. This media pseudo flowchart arranged as in Figure 4.2 below.

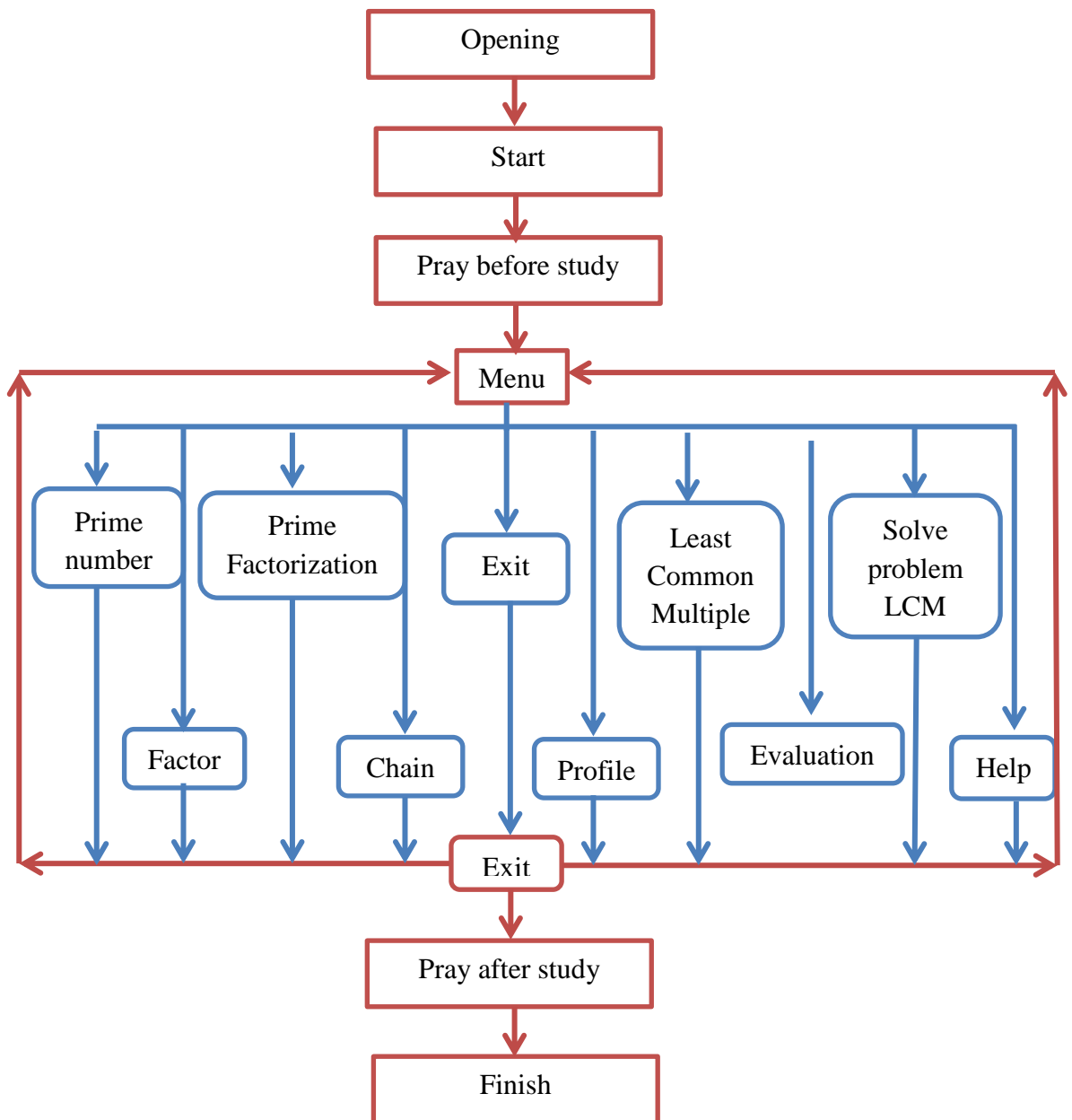


Figure 4.2 Flowchart interactive media

7. Create A storyboard

Create a storyboard is the process of creating the appearance of the paper to be "transferred" to the computer screen. Storyboard contains material that will be presented, questions, feedback, instructions, pictures, and animations. Storyboards are often called a worksheet. This time, the developer does not create storyboards for all display. Sometimes developers designed a display directly on a computer screen. However, for a complex display developer have to create storyboards.

The developer will be easier in designing a display with storyboards. A single sheet of storyboards, contains a display will be shown on a computer screen. The developer creates storyboard example can be seen in Figure 4.3 here.

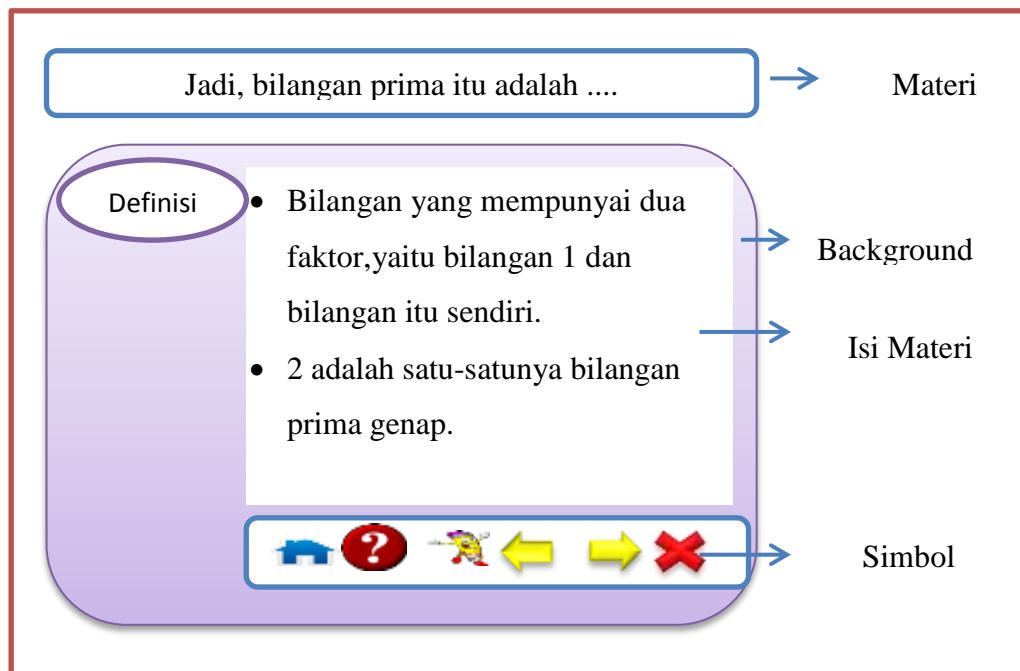


Figure 4.3 Storyboard interactive media

8. Program Material

The developer uses the power point program that was changed to flash player through the software I-spring. I-spring is one of the tools that changes the presentation file into flash and SCORM/AICC. It is the form commonly used in learning with e-learning LMS (Learning Management System). The application I-spring can be used to make the evaluation questions and change the PowerPoint files to flash quickly and easily.

The first step is to program the display design and menu system. After all display programmed, it's time to process of moving the display from storyboards to the computer screen. Figure 4.4 is an example of the results of the moving storyboards of the computer screen in Figure 4.3.

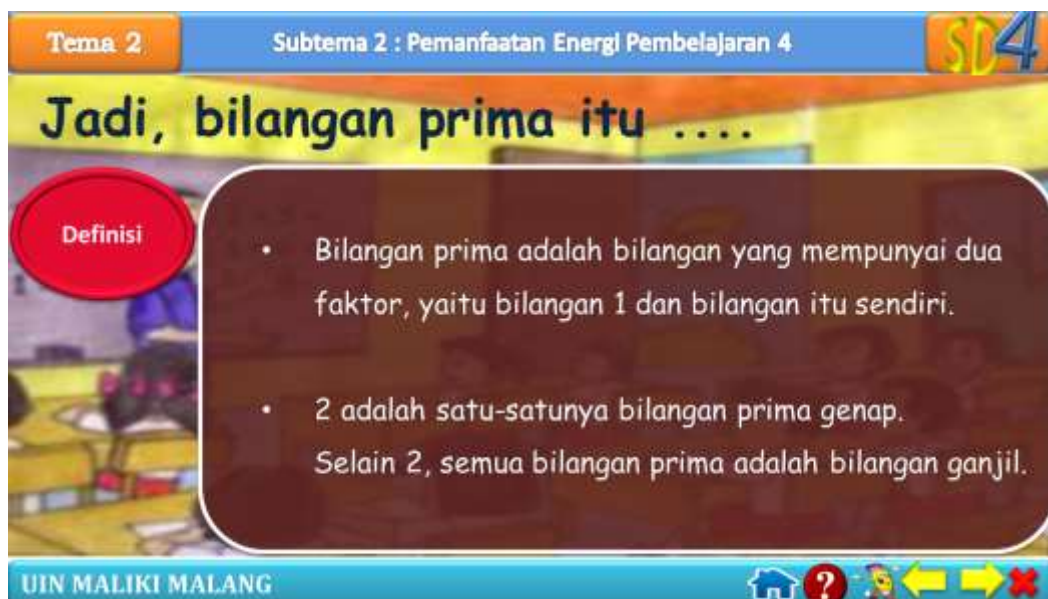


Figure 4.4 Program material interactive media

After the slide power point that developer creates has been filled with content. The final step is to publish it to convert to android. The developer does

the steps below for publications. Developer clicks the tab I-spring and select Publish. The developer clicks the tab I-spring and select Publish. Then, the developer clicks publish and wait a while. Interactive media is ready to use.

The developer is not only develops on your computer or laptop, but also on smartphones. The developer will convert flash swf file to android apk file. To create android applications, the first step is to prepare the needed materials. Materials needed include file results publish i-spring, andraided, adobe air SDK, Java 5.0 and Java 7.0.

All materials should be installed in the computer. The developer creates one folder. The folder's name is android. There are files AIR_SDK.rar and Andaired.rar. Andaired is software used to convert files results publish I-spring into the application android. To run the Andaired, developer follows these steps. Developer opens file Andaired.exe in the folder C:\android\Andaired. The display will appear as shown below as in Figure 4.5.

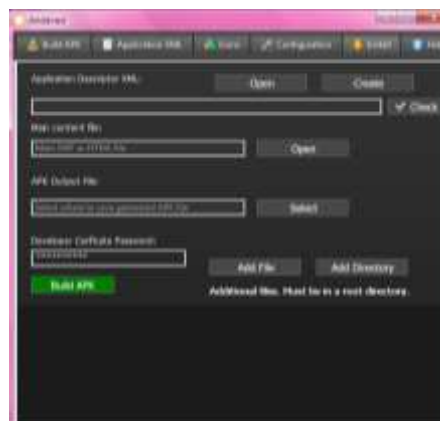


Figure 4.5 Andaired

The developer clicks the tab Configuration. This section is used to set the program Andaired. This is the display tab Configuration as in Figure 4.6.

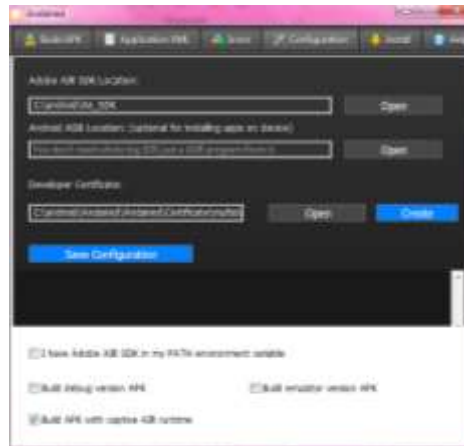


Figure 4.6 Tab Configuration

The next step is to find the location of the folder is Air_SDK. Click Open in the Adobe AIR SDK Location. The developer is looking for a folder AIR_SDK in C:\android\AIR_SDK. The developer has already found the folder AIR_SDK the display will appear as in Figure 4.7.

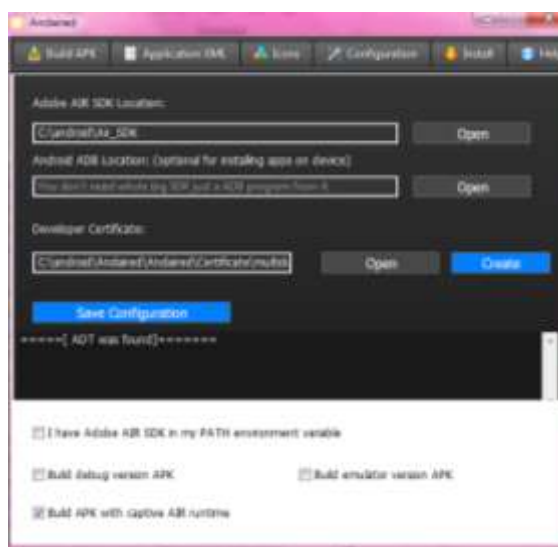


Figure 4.7 AIR_SDK

The next step is to find the certificate ' APK ' in the folder andaired. Click open in the Developer Certificate. Developer search file multidukasi. p12 in folder C:\android\Andaired\Certificate. The developer has already found the certificate, click Save Configuration to the new configuration. If it has been stored, the notification will appear New Configuration Saved. As in Figure 4.8 below.

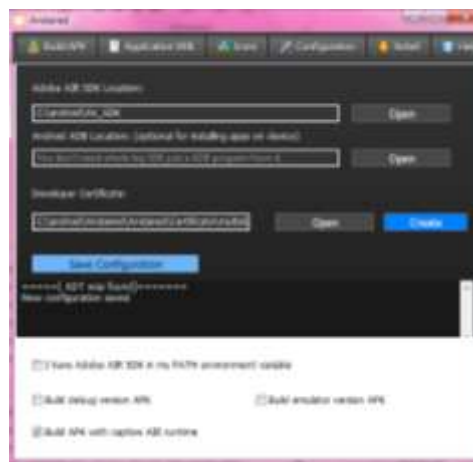


Figure 4.8 Save Configuration

The next step is making the Application Descriptor XML. The application is a file used to configure, manage and describe how a component, module or application to work. Application Descriptor XML has a role to set the file name, icon, and version, publish, display settings, etc.

To create the file, the developer performs the following steps. The developer chooses the Unique Application Identifier and rename them with Interactive Media energy saving. Developer selects the Require AIR SDK Version 3.5. Developer fills the file name with the Interactive Media energy saving. The developer changed the name in the Name displayed to Interactive Media energy saving. Afterward select the Main Content file. Developer clicks Open to find swf

application files results publish I-spring. The developer chooses the Optional advanced parameters and Select the full screen. By pressing the button Generate Application Descriptor, save screen will appear. Developer keeps files in C:\android\interaktif with the name of Interactive Media energy saving.xml. After pressing the button Save will appear icon builder. Click Open to open the browser to look for the icon. The developer uses saving energy icon as this interactive media identity. Click the create button to create the icon. Icons successfully created in various sizes.

Build applications to process applications for Android. Select the Application Descriptor XML. Click the Open button. Search the location of Interactive Media saving energy.xml in C:\android\interaktif. Click check to validate the application.xml.

The developer chooses APK File Output. Click Select button, choose a location in the C:\android\Aplikasiku. Developers give the name of Interactive Media saving energy.apk. Click Save button, publish location APK has been determined. Click the Build button APK to start the process create APK. The application has been successfully created.

9. Create Support Material

Supporting material includes the operating instructions and specifications of computers and smartphones. The operating instructions can be read when students are already running this interactive media. Students get information such as a description of the symbols contained in the media.

Minimum computer specifications are used to create android applications from Microsoft Power Point is an Intel core 2 duo, 1 Giga memory, Windows vista up with infrastructure 32 bits, Microsoft Office 2007 full installation, and flash player 11 upwards. Minimum smartphone specifications are ARMv7 Processor, OpenGL, 550MHz, Android 2.3 (Gingerbread) upwards, and 256 MB of RAM Memory.

10. Evaluation and revision

At this stage the media have been developed. The result of this development was named as the drafts I. Final development activities are evaluation and revision of the media. There are four stages include stage I, stage II, stage III, and stage IV in evaluation and revision. Developer consults the media to material expert, design experts, linguists about the draft I in phase I. The consultation results are analyzed for basis implementation of revised drafts I. The result revised draft I called draft II.

In phase II, draft II media have feedback and assessed by teachers in fourth grade Islamic Global School Malang. Based on feedback and the assessment of teacher, all components are appropriate. Teacher's class said interactive media is quite good and doesn't need to be revised.

In phase III, draft III media tested to 3 students from fourth grade of Islamic Global School Malang. The three students use draft III media in learning. The results of observation and interviews showed that media can be operated easily. Based on the analysis of the results of observation and interviews, drafts III was changed to draft IV.

In stage IV, draft IV media tested to 6 students from fourth grade of Islamic Global School Malang. The six students use draft IV media in learning. The results of observation and interview shows drafts IV has been able to run successfully and the learning material can be understood by students. Draft IV media is set as the end product and not revised again.

B. Development Results

There are four stages include 1) the development of phase I, 2) the development of phase II, 3) the development of phase III, 4) the development of phase IV. Each stage can be explained as follows.

1. Result of Development of Phase I

a. Data and data analysis

Developer consults the media to material expert, design experts, linguists about the draft I in phase I. Data validation is obtained from results of the evaluation carried out by three validators. They are three educational lecturers as a materials expert, design experts, and linguists. The identity of this validator can be seen in the attachment.

Data are quantitative data and qualitative data. Quantitative data is the assessment of the scale of Linkert. Qualitative data is assessment or advice from the validator as in Table 4.1 below

Table 4.1
Criteria for Validation Assessment by Material Experts, Design Experts, and Linguist

Description	Score
Very Nice	5
Nice	4
Less Good	2
No Good	1

Table 4.2
Criteria for Validation Assessment by Students

Description	Score
A	5
B	4
C	2
D	1

Data and data analysis of this stage is the result of consultation with material expert, experts design, and linguist.

- 1) Material expert validation phase I
 - a) Data and data analysis consultancy

Quantitative data from the results of validation from material experts can be seen in Table 4.3

Table 4.3
Interactive Media Assessment Data by Material Expert Phase I

No	Statement	Σx	Σxi	Percent (%)	Valid Criteria	Description
1.	Material according to subject character	4	5	80%	Valid	No revision
2.	Development of the conceptual material	5	5	100%	Valid	No revision
3.	Material completes	4	5	80%	Valid	No revision
4.	Material regularly	4	5	80%	Valid	No revision
5.	Acceptable with the development of the students	4	5	80%	Valid	No revision

6.	The logical connection between the facts, concepts and theories	4	5	80%	Valid	No revision
7.	The concept suitable with core competence and basic competence in curriculum 2013	4	5	80%	Valid	No revision
8.	Outlining the concept of material and activities in accordance with grade 4.	4	5	80%	Valid	No revision
9.	Emphasize the skills of the process.	4	5	80%	Valid	No revision
10.	There are questions that are able to measure the results of student learning.	4	5	80%	Valid	No revision
11.	There are questions that guide students to make conclusions.	2	5	40%	Less valid	Need revision
12.	There are questions that emphasize the skills of the process.	4	5	80%	Valid	No revision
13.	Evaluation instructions easy to understand	2	5	40%	less valid	Need revision
14.	Delivery of materials and instructions are easy to understand for students	4	5	80%	Valid	No revision
15.	The delivery of the material is interesting.	4	5	80%	Valid	No revision
16.	Volume synchronization backsound on media with other audio	4	5	80%	Valid	No revision
TOTAL		61	80	76,25%	Valid	No revision

Description:

ΣX : score the answers by the validator

Σx_i : score the highest answer

P : percentage rate valid

$$P = \frac{\Sigma x}{\Sigma x_i} \times 100\%$$

Table 4.3 showed that the results of assessment of material experts to the interactive media is good, with the percentage of valid 76, 25 %. The following is an analysis of each question.

- (1) According to material experts about number 1 on material according to subject character with a valid percentage of 80%.
- (2) According to material experts about number 2 on development of the concept of matter with a valid percentage of 100%.
- (3) According to material experts about number 3 on material complete with a valid percentage of 80%.
- (4) According to material experts about number 4 on material regularly with a valid percentage of 80%.
- (5) According to material experts about number 5 on acceptable with the development of the students with a valid percentage of 80%.
- (6) According to material experts about number 6 on the logical connection between the facts, concepts and theories with a valid percentage of 80%.
- (7) According to material experts about number 7 on the concept suitable with core competence and basic competence in curriculum 2013 with a valid percentage of 80%.

- (8) According to material experts about number 8 on outlining the concept of material and activities in accordance with grade 4 with a valid percentage of 80%.
- (9) According to material experts about number 9 on emphasize the skills of the process with a valid percentage of 80%.
- (10) According to material experts about number 10 on there are questions that are able to measure the results of student learning with a valid percentage of 80%.
- (11) According to material experts about number 11 on there are questions that guide students to make conclusions with a valid percentage of 40%.
- (12) According to material experts about number 12 on there are questions that emphasize the skills of the process with a valid percentage of 80%.
- (13) According to material experts about number 13 on evaluation instructions easy to understand with a valid percentage of 40%.
- (14) According to material experts about number 14 on the delivery of materials and instructions are easy to understand for students with a valid percentage of 80%.

(15) According to material experts about number 15 on the delivery of the material is interesting with a valid percentage of 80%.

(16) According to material experts about number 16 on Volume synchronization back sound on media with other audio with a valid percentage of 80%.

Although in general the interactive media is valid and not revised, but in the analysis of each question show that there are two numbers that are less valid namely number 11 and 13. Validation statement number 11 is there are questions that guide students to make conclusions and validation statement number 13 is evaluation instructions easy to understand. A material expert does not agree with the statement.

b) Qualitative data

Qualitative data from the results of validation from material experts can be seen in Table 4.4

Table 4.4
Criticism and Suggestions by Material Expert of Interactive Media







Name of material experts	Criticism and suggestions
Yeni Tri Asmaningtias, M.Pd	<ol style="list-style-type: none"> 1. Font and color is still too stiff 2. There is no relationship least common multiple and saving energy 3. The image is not one theme, it's best made in a theme 4. Slide 33 need explanation in detail 5. Slide the 21 largest communion multiples? Or least common multiple? Or greatest common factor?









Based on feedback as indicated in table 4.4 that many aspects still need to be improved. The researcher has to do revisions as the developer of the product.

c) Product revision

Based on analyses, revision of interactive media is as follows.

Table 4.5
Revision of Interactive Media Based on Validation of Material Expert

No	Revised overview	Before revision	After revision
1	Color display is less attractive		
2	Background with color of writing more clarified		
3	The writings of greatest common multiple changed to the least common multiple		

4	The calendar view is more attractive and descriptive writings are summarized		
5	The background is made in one theme in schools. Not the children who are waking up		
6	Need guidance about evaluation		
7	The images are not only small but also magnified into the background		

2) Material expert validation phase II

a) Data and data analysis consultancy

Quantitative data from the results of validation from material experts can be seen in Table 4.6

Table 4.6
Interactive Media Assessment data by Material Expert phase II

No	Statement	Σx	Σxi	Percent (%)	Validity criteria	Description
1.	Material according to subject character	4	5	80%	Valid	No revision
2.	Development of the concept of matter	5	5	100%	Valid	No revision
3.	Material completes	4	5	80%	Valid	No revision
4.	Material regularly	4	5	80%	Valid	No revision
5.	Acceptable with the development of the students.	4	5	80%	Valid	No revision
6.	The logical connection between the facts, concepts and theories.	4	5	80%	Valid	No revision
7.	The concept suitable with core competence and basic competence in curriculum 2013	4	5	80%	Valid	No revision
8.	Outlining the concept of material and activities in accordance with grade 4.	4	5	80%	Valid	No revision
9.	Emphasize the skills of the process.	4	5	80%	Valid	No revision
10.	There are questions that are able to measure the results of student learning.	4	5	80%	Valid	No revision
11.	There are questions that guide students to make conclusions.	4	5	80%	Valid	No revision
12.	There are questions that emphasize the skills of the process.	4	5	80%	Valid	No revision
13.	Evaluation instructions easy to understand	4	5	80%	Valid	No revision
14.	Delivery of materials and instructions are easy to understand for students	4	5	80%	Valid	No revision
15.	The delivery of the material is interesting.	4	5	80%	Valid	No revision
16.	Volume synchronization backsound on media with other audio	4	5	80%	Valid	No revision
TOTAL		65	80	81,25%	Valid	No revision

Description:

ΣX : score the answers by the validator

Σx_i : score the highest answer

P : percentage rate valid

$$P = \frac{\Sigma x}{\Sigma x_i} \times 100\%$$

After some revisions based on assessment by material expert on phase I, researcher asks validation again to find out if there are still parts that are less valid and needs to be revised again. Results of second validation of material experts can be seen in table 4.6 above. It appears that after doing some revision, interactive media have been good with the percentage of valid 81, 25%. There are no criticism and advice from the material experts. Based on an analysis of each question there is no revision again.

- (1) According to material experts about number 1 on material according to subject character with a valid percentage of 80%.
- (2) According to material experts about number 2 on development of the concept of matter with a valid percentage of 100%.
- (3) According to material experts about number 3 on material complete with a valid percentage of 80%.

- (4) According to material experts about number 4 on materials regularly with a valid percentage of 80%.
- (5) According to material experts about number 5 on acceptable with the development of the students with a valid percentage of 80%.
- (6) According to material experts about number 6 on the logical connection between the facts, concepts and theories with a valid percentage of 80%.
- (7) According to material experts about number 7 on the concept suitable with core competence and basic competence in curriculum 2013 with a valid percentage of 80%.
- (8) According to material experts about number 8 on outlining the concept of material and activities in accordance with grade 4 with a valid percentage of 80%.
- (9) According to material experts about number 9 on emphasize the skills of the process with a valid percentage of 80%.
- (10) According to material experts about number 10 on there are questions that are able to measure the results of student learning with a valid percentage of 80%.

- (11) According to material experts about number 11 on there are questions that guide students to make conclusions with a valid percentage of 80%.
- (12) According to material experts about number 12 on there are questions that emphasize the skills of the process with a valid percentage of 80%.
- (13) According to material experts about number 13 on Evaluation instructions easy to understand with a valid percentage of 80%.
- (14) According to material experts about number 14 on the Delivery of materials and instructions are easy to understand for students with a valid percentage of 80%.
- (15) According to material experts about number 15 on the delivery of the material is interesting with a valid percentage of 80%.
- (16) According to material experts about number 16 on volume synchronization back sound on media with other audio with a valid percentage of 80%.

3) Design expert validation phase I

a) Data and data analysis consultancy

Quantitative data from the results of validation from design experts can be seen in Table 4.7

Table 4.7
Interactive Media Assessment Data by Design Expert Phase I

No	Statement	Σx	Σxi	Percent (%)	Validity criteria	Description
1.	An interesting media packaging	5	5	100%	Valid	No Revision
2.	Use appropriate typeface in the media	5	5	100%	Valid	No Revision
3.	Precision is typing layout	5	5	100%	Valid	No Revision
4.	Typing is clear	5	5	100%	Valid	No Revision
5.	Exact image position	5	5	100%	Valid	No Revision
6.	Use good illustrations	5	5	100%	Valid	No Revision
7.	Consistent use of the system	2	5	40%	Less Valid	Need revision
8.	Suitability organizing media content	5	5	100%	Valid	No Revision
9.	Kind of a nice assessment	4	5	80%	Valid	No Revision
10.	The ease of language used in interactive media	5	5	100%	Valid	No Revision
TOTAL		46	50	92,00%	Valid	No Revision

Description:

ΣX : score the answers by the validator

Σxi : score the highest answer

P : percentage rate valid

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

Table 4.7 showed that the results of assessment by design experts to the interactive media is good, with the percentage of valid 92, 00 %. The following is an analysis of each question.

- (1) According to design experts about number 1 on an interesting media packaging with a valid percentage of 100%.
- (2) According to design experts about number 2 on use appropriate typeface in the media with a valid percentage of 100%.
- (3) According to design experts about number 3 on precision typing layout with a valid percentage of 100%.
- (4) According to the design experts about number 4 on typing is clear with a valid percentage of 100%.
- (5) According to design experts about number 5 on exact image position with a valid percentage of 100%.
- (6) According to design experts about number 6 on Use good illustrations with a valid percentage of 100%.
- (7) According to design experts about number 7 on Consistent use of the system with a valid percentage of 40%.
- (8) According to design experts about number 8 on Suitability organizing media content with a valid percentage of 100%.
- (9) According to design experts about number 9 on kind of a nice assessment with a valid percentage of 80%.

(10) According to the design experts about number 10 on the ease of language used in interactive media with a valid percentage of 100%.

Although in general the interactive media are valid and not revised, but in the analysis of each question show that there is one number that is less valid namely number 7. Validation statement number 7 is consistent use of the system. Design expert does not agree with the statement.

b) Qualitative data

Qualitative data from the results of validation from design experts can be seen in Table 4.8

Table 4.8
Criticism and Suggestions by Design Expert of Interactive Media





Name of Design Expert	Criticism and suggestions
Dr. Muhammad Walid, M.A	The developer should be more complete instructions for easier use

Based on feedback, as indicated in table 4.8 that many aspects still need to be improved. The researcher has to do revisions as the developer of the product.

c) Product revision

Based on analyses, revision of interactive media is as follows.

Table 4.9
Revision of Interactive Media Based on Validation of Design Expert

No	Revised overview	Before revision	After revision
1	There should be a symbol for the return or exit. The symbol should be more complete		
2	When it comes out there is a choice between continued or not		

4) Design expert validation phase II

a) Data and data analysis consultancy

Quantitative data from the results of validation from design experts can be seen in Table 4.10

Table 4.10
Interactive Media Assessment data by Design Expert phase II

No	Statement	Σx	Σxi	Percent (%)	Validity criteria	Description
1.	An interesting media packaging	5	5	100%	Valid	No Revision
2.	Use appropriate typeface in the media	5	5	100%	Valid	No Revision
3.	Precision is typing layout	5	5	100%	Valid	No Revision
4.	Typing is clear	5	5	100%	Valid	No Revision
5.	Exact image position	5	5	100%	Valid	No Revision
6.	Use good illustrations	5	5	100%	Valid	No Revision
7.	Consistent use of the system	4	5	80%	Valid	No revision

8.	Suitability organizing media content	5	5	100%	Valid	No Revision
9.	kind of a nice assessment	5	5	100%	Valid	No Revision
10.	The ease of language used in interactive media	5	5	100%	Valid	No Revision
TOTAL		49	50	98,00%	Valid	No Revision

Description:

ΣX : score the answers by the validator

Σx_i : score the highest answer

P : percentage rate valid

$$P = \frac{\Sigma x}{\Sigma x_i} \times 100\%$$

After some revisions based on assessment by design expert on phase I, researcher asks validation again to find out if there are still parts that are less valid and needs to be revised again. Results of second validation of design experts can be seen in table 4.10 above. It appears that after doing some revision, interactive media have been good with the percentage of valid 98, 00%. There are no criticism and advice from the design experts. Based on an analysis of each question there is no revision again.

- (1) According to design experts about number 1 on an interesting media packaging with a valid percentage of 100%.

- (2) According to design experts about number 2 on use appropriate typeface in the media with a valid percentage of 100%.
- (3) According to the design experts about number 3 on precision typing layouts with a valid percentage of 100%.
- (4) According to the design experts about number 4 on typing is clear with a valid percentage of 100%.
- (5) According to design experts about number 5 on exact image position with a valid percentage of 100%.
- (6) According to design experts about number 6 on Use good illustrations with a valid percentage of 100%.
- (7) According to design experts about number 7 on Consistent use of the system with a valid percentage of 80 %.
- (8) According to design experts about number 8 on suitability organizing media content with a valid percentage of 100%.
- (9) According to design experts about number 9 on kind of a nice assessment with a valid percentage of 100%.
- (10) According to the design experts about number 10 on the ease of language used in interactive media with a valid percentage of 100%.

5) Linguist validation

- a) Data and data analysis consultancy

Quantitative data from the results of validation by linguist can be seen in Table 4.11

Table 4.11
Interactive Media Assessment data by Linguist

No	Statement	Σx	Σxi	Percent (%)	Validity criteria	Description
1.	Word choice in material	5	5	100%	Valid	No Revision
2.	The language is easy to understand by users	5	5	100%	Valid	No Revision
3.	Interactive media is a pleasure to read and understood	5	5	100%	Valid	No Revision
4.	The language used in accordance with the EYD	5	5	100%	Valid	No Revision
5.	The language used is suitable for fourth grade	5	5	100%	Valid	No Revision
6.	The phrase used is not ambiguous.	5	5	100%	Valid	No Revision
TOTAL		30	30	100%	Valid	No Revision

Description:

ΣX : score the answers by the validator

Σxi : score the highest answer

P : percentage rate valid

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

Table 4.11 showed that the results of the assessment by linguist to the interactive media are good, with the percentage of valid 100, 00 %. The following is an analysis of each question.

- (1) According to linguist about number 1 on word choice in material with a valid percentage of 100%.

- (2) According to linguist about number 2 on the language is easy to understand by users with a valid percentage of 100%.
- (3) According to linguist about number 3 on interactive media is a pleasure to read and understood by a valid percentage of 100%.
- (4) According to linguist about number 4 on the language used in accordance with the EYD with a valid percentage of 100%.
- (5) According to linguist about number 5 on the language used is suitable for fourth grade with a valid percentage of 100%.
- (6) According to linguist about number 6 on the phrase used is not ambiguous with a valid percentage of 100%.

b) Qualitative data

Qualitative data from the results of validation by linguist can be seen in Table 4.12

Table 4.12

Criticism and Suggestions by Linguist of Interactive Media

Name of Linguist	Criticism and suggestions
Hj. Siti Annijat Maimunah, M.Pd	1. Please edit the votes pile up 2. The Narrator can be filled with different voices

Based on feedback, as indicated in Table 4.12 that many aspects still need to be improved. Researcher has to do revisions as the developer of the product.

c) Product revision

Based on the analysis, developer revises product with improved sound filler material as back sound for pile up again. The developer did not revise the product with a different sound because the developer had trouble finding someone willing to be voiced.

On the development of phase I, the resulting drafts II interactive media. Draft II interactive media is the result of the revision of the drafts I interactive media based on consultation with material experts, design experts, and linguists. Thus, it is expected that a draft II interactive media will be more effective, efficient and more attractive compared to the drafts I interactive media.

2. Result of Development of Phase II

a. Validation teacher class

1) Data and data analysis consultancy

Quantitative data from the results of validation by teacher class can be seen in Table 4.13

Table 4.13
Interactive Media Assessment data by teacher

No	Statement	Σx	Σxi	Percent (%)	Validity criteria	Description
1.	The concept suitable with core competence and basic competence in curriculum 2013	5	5	100%	Valid	No Revision
2.	Outlining the concept of material and activities in accordance with grade 4.	5	5	100%	Valid	No Revision
3.	A clear theme of identity	5	5	100%	Valid	No Revision
4.	The completeness of components in the student guide	4	5	80%	Valid	No Revision
5.	Clarity in a characteristic theme	4	5	80%	Valid	No Revision
6.	Development of the concept of matter	5	5	100%	Valid	No Revision
7.	Material completes	5	5	100%	Valid	No Revision
8.	Material regularly	5	5	100%	Valid	No Revision
9.	Acceptable with the development of the students.	4	5	80%	Valid	No Revision
10.	Appropriate learning strategies	4	5	80%	Valid	No Revision
11.	Ease to use student	5	5	100%	Valid	No Revision
12.	Organizing the material interested	4	5	80%	Valid	No Revision
13.	Evaluation of results study clearly	5	5	100%	Valid	No Revision
14.	Emphasize the skills of the process.	4	5	80%	Valid	No Revision
15.	There are questions that are able to measure the results of student learning.	4	5	80%	Valid	No Revision
16.	There are questions that guide students to make conclusions.	5	5	100%	Valid	No Revision
17.	There are questions that emphasize the skills of the process.	4	5	80%	Valid	No Revision
18.	Evaluation instructions	4	5	80%	Valid	No Revision

	easy to understand					
19.	Delivery of materials and instructions are easy to understand for students	4	5	80%	Valid	No Revision
20.	The delivery of the material is interesting.	4	5	80%	Valid	No Revision
21.	Volume synchronization back sounds on media with other audio	4	5	80%	Valid	No Revision
22.	The right layout	5	5	100%	Valid	No Revision
23.	The consistency to use of space and typing	5	5	100%	Valid	No Revision
TOTAL		103	115	89,57%	Valid	No Revision

Description:

ΣX : score the answers by the validator

Σxi : score the highest answer

P : percentage rate valid

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

Table 4.13 showed that the results of the assessment by teacher class at fourth grade Islamic Global School Malang to the interactive media is good, with the percentage of valid 89, 57%. The following is an analysis of each question.

- a) According to teacher class about number 1 on the concept suitable with core competence and basic competence in curriculum 2013 with a valid percentage of 100%.
- b) According to teacher class about number 2 on outlining the concept of material and activities in accordance with fourth grade with a valid percentage of 100%.

- c) According to teacher class about number 3 on a clear theme of identity with fourth grade with a valid percentage of 100%.
- d) According to teacher class about number 4 on the completeness of components in the student guide with a valid percentage of 80%.
- e) According to teacher class about number 5 on clarity in a characteristic theme with a valid percentage of 80%.
- f) According to teacher class about number 6 on development of the concept of material with a valid percentage of 100%.
- g) According to teacher class about number 7 on material complete with a valid percentage of 100%.
- h) According to teacher class about number 8 on material regularly with a valid percentage of 100%.
- i) According to teacher class about number 9 on acceptable with the development of the students with a valid percentage of 80%.
- j) According to teacher class about number 10 on appropriate learning strategies with a valid percentage of 80%.
- k) According to teacher class about number 11 on ease to use student with a valid percentage of 100%.
- l) According to teacher class about number 12 on organizing the material interested with a valid percentage of 80%.
- m) According to teacher class about number 13 on evaluation of results study clearly with a valid percentage of 100%.

- n) According to teacher class about number 14 on emphasize the skills of the process with a valid percentage of 80%.
- o) According to teacher class about number 15 on there are questions that are able to measure the results of student learning with a valid percentage of 80%.
- p) According to teacher class about number 16 on there are questions that guide students to make conclusions with a valid percentage of 100%.
- q) According to teacher class about number 17 on there are questions that emphasize the skills of the process with a valid percentage of 80%.
- r) According to teacher class about number 18 on evaluation instructions easy to understand with a valid percentage of 80%.
- s) According to teacher class about number 19 on the delivery of materials and instructions are easy to understand for students with a valid percentage of 80%.
- t) According to teacher class about number 20 on the delivery of the material is interesting with a valid percentage of 80%.
- u) According to teacher class about number 21 on Volume synchronization back sound on media with other audio with a valid percentage of 80%.
- v) According to teacher class about number 22 on the right layout with a valid percentage of 100%.

w) According to teacher class about number 23 on the consistency to use of space and typing with a valid percentage of 100%.

2) Qualitative data

Qualitative data from the results of validation by teacher class can be seen in Table 4.14

Table 4.14
Criticism and Suggestions by Teacher Class of Interactive Media

Name of teacher	Criticism and suggestions
Akhmad Susanto, S.S	Overall interactive media have been made quite representative in presenting material in fourth grade. It just needs to be maximized is standardizing curriculum 2013 to be complex.

Table 4.14 explained that interactive media is quite represented in the delivery of material in fourth grade. Teacher class said that interactive media is quite good and doesn't need to be revised.

On the development of phase II, the resulting draft III media. Draft III interactive media are the result of revisions to the draft II interactive media based on feedback and assessment of teacher class fourth grade Islamic Global School Malang.

3. Result of Development of Phase III

a. Data and data analysis

On the development of the phase III individual test was conducted in the first phase. The subject of trials consisted of 3 students, namely Adinda, Wildan, and Aldi that represents students who are well-capable,

medium, and low on the advice of teachers of fourth grade. Three students subject the test using draft III interactive media in learning the theme saving energy. Quantitative data from result of development of phase III as in Table 4.15.

Table 4.15
Interactive Media Assessment Data by Student at Fourth Grade Islamic Global School Malang

No	Statement	X ₁	X ₂	X ₃	Σ x	Σ xi	Percent (%)	Validity criteria	Description
1.	Interactive media can facilitate learning	4	4	4	12	15	80%	Valid	No Revision
2.	The use of interactive media can encourage learning	4	5	5	14	15	93%	Valid	No Revision
3.	Easy-to-understand material on interactive media	4	5	5	14	15	93%	Valid	No Revision
4.	The questions in this interactive media are easy	5	4	5	14	15	93%	Valid	No Revision
5.	Typeface and font size contained in interactive media is easy to read	5	5	5	15	15	100%	Valid	No Revision
6.	Students do not find difficult words when learning this interactive media	5	5	5	15	15	100%	Valid	No Revision
7.	The instructions in this interactive media are easy to understand.	4	4	5	13	15	87%	Valid	No Revision
8.	The language used in interactive media is easy to understand	4	5	4	13	15	87%	Valid	No Revision
9.	The questions are easy to understand	4	4	4	12	15	80%	Valid	No Revision
10.	This interactive media help to practice saving energy at home	5	5	5	15	15	100%	Valid	No Revision
TOTAL		44	46	47	137	150	91%	Valid	No Revision

Table 4.15 showed that the results of assessment of student at fourth grade Islamic Global School Malang to the interactive media are good, with the percentage of valid 91, 00%. Overall, this media do not need revision. The following is an analysis of each question.

- 1) According to students in fourth grade about number 1 on interactive media can facilitate learning with a valid percentage of 80 %.
- 2) According to students in fourth grade about number 2 on the use of interactive media can encourage in learning with a valid percentage of 93 %.
- 3) According to students in fourth grade about number 3 on easy-to-understand material on interactive media with a valid percentage of 93 %.
- 4) According to students in fourth grade about number 4 on the questions in this interactive media is easy with a valid percentage of 93 %.
- 5) According to students in fourth grade about number 5 on typeface and font size contained in interactive media is easy to read with a valid percentage of 100 %.
- 6) According to students in fourth grade about number 6 on students do not find difficult words when learning this interactive media with a valid percentage of 100 %.
- 7) According to students in fourth grade about number 7 on the instructions in this interactive media is easy to understand with a valid percentage of 87 %.

- 8) According to students in fourth grade about number 8 on the language used in interactive media is easy to understand with a valid percentage of 87 %.
- 9) According to students in fourth grade about number 9 on questions are easy to understand with a valid percentage of 80 %.
- 10) According to students in fourth grade about number 10 on this interactive media helps to practice saving energy at home with a valid percentage of 100 %.

b. Qualitative data

Qualitative data from the results of validation by the student can be seen in table 4.16

Table 4.16
Criticism and suggestions by student of interactive media

No	Name of student	Criticism and suggestions
1.	Adinda Azalea Firdaus	Quite Good. The color is good and colorful.
2.	Wildan Loanda Eldama	It is very interesting.
3.	Achmad Rifaldi Sonaini	I love it because make me interesting.

Interactive media are evaluated as quite well as the learning process using this interactive media. Students look very enthusiastic in learning process. Students seem more interested in learning. This is because students use media that has been close to them, namely the computer. But there has been no media that support learning and more centered on the teacher.

Based on observations and interviews of researchers, students looked enthusiastic and respond well to this interactive media. Students are more active in learning. They followed the instructions correctly. Teacher is more easily guiding students to explain the material.

c. Product revision

Based on the results of individual trials with percentage of 91, 00 %. Interactive media does not need to have a revision. However, the comments and suggestions of the respondents on the trials of individuals in open-ended question will be considered to refining the learning media. So the resulting interactive media will be getting better. On the development of phase III, the resulting draft IV media.

4. Result of development of phase IV

a. Data and data analysis

On the development of the phase IV individual test was conducted in the second phase. The subject of trials consisted of 6 students, namely Satrio, Dewa, Dea, Tri Nazwa, Rahma, and Sela that represent students who are well-capable, medium, and low on the advice of teachers of fourth grade. Quantitative data from result of development of phase IV as In table 4.17.

No	Statement	X₁	X₂	X₃	X₄	X₅	X₆	Σ x	Σxi	Percent (%)	Valid Criteria	Description
1.	Interactive media can facilitate learning	5	5	5	5	5	5	30	30	100%	Valid	No revision
2.	The use of interactive media can encourage learning	5	5	5	5	5	5	30	30	100%	Valid	No revision
3.	Easy-to-understand material on interactive media	5	5	5	5	5	5	30	30	100%	Valid	No revision
4.	The questions in this interactive media are easy	4	5	4	5	5	5	28	30	93%	Valid	No revision
5.	Typeface and font size contained in interactive media is easy to read	5	5	5	5	5	5	30	30	100%	Valid	No revision
6.	Students do not find difficult words when learning this interactive media	4	5	5	4	5	4	27	30	90%	Valid	No revision
7.	The instructions in this interactive media are easy to understand.	5	5	4	5	5	5	29	30	97%	Valid	No revision
8.	The language used in interactive media is easy to understand	5	5	5	5	5	5	30	30	100%	Valid	No revision
9.	The questions are easy to understand	5	5	5	5	5	5	30	30	100%	Valid	No revision
10.	This interactive media helps to practice saving energy at home	5	5	5	5	5	5	30	30	100%	Valid	No revision
TOTAL		48	50	48	49	50	49	294	300	98%	Valid	No Revision

Table 4.17
Interactive Media Assessment data by student in fourth grade Islamic Global School Malang

After getting quantitative data from the results of the assessment of individual trials second phase can be seen in table 4.17, the next step is to analyze the data. Table 4.17 showed that the results of assessment of student at fourth grade Islamic Global School Malang of the interactive media are good, with the percentage of valid 98, 00%. Overall, this media does not need revision. The following is an analysis of each question.

- 1) According to students in fourth grade about number 1 on interactive media can facilitate learning with a valid percentage of 100 %.
- 2) According to students in fourth grade about number 2 on the use of interactive media can encourage in learning with a valid percentage of 100 %.
- 3) According to students in fourth grade about number 3 on easy-to-understand material on interactive media with a valid percentage of 100 %.
- 4) According to students in fourth grade about number 4 on the questions in this interactive media is easy with a valid percentage of 93 %.
- 5) According to students in fourth grade about number 5 on typeface and font size contained in interactive media is easy to read with a valid percentage of 100 %.
- 6) According to students in fourth grade about number 6 on students do not find difficult words when learning this interactive media with a valid percentage of 90 %.

- 7) According to students in fourth grade about number 7 on the instructions in this interactive media is easy to understand with a valid percentage of 97 %.
- 8) According to students in fourth grade about number 8 on the language used in interactive media is easy to understand with a valid percentage of 100 %.
- 9) According to students in fourth grade about number 9 on questions are easy to understand with a valid percentage of 100 %.
- 10) According to students in fourth grade about number 10 on this interactive media helps to practice saving energy at home with a valid percentage of 100 %.

b. Qualitative data

Qualitative data from the results of validation by the student can be seen in Table 4.18

Table 4.18
Criticism and suggestions by student of interactive media

No	Name of student	Criticism and suggestions
1.	Satrio Bagus Setyawan	Help to study and I feel very easy to understand about the material
2.	Putra Rachel Dewa	The image is good, make me enthusiastic to study.
3.	Dea Ramadhany Putri	I know how to save energy
4.	Tri Nazwa Livia	I love this interactive media. The game is very good
5.	Rahmatul Istiqomah	It was very good. I love the color. It is colorful.
6.	Sela Garneta Iana	This interactive media is very help me to understand about least common multiple.

Based on the results of individual trials with percentage of 98, 00%. Interactive media does not need to have a revision. However, the comments and suggestions of the respondents on the trials of individuals in open-ended question will be considered to refining the learning media. So the resulting interactive media will be getting better.

c. Product revision

Based on the data analysis of individual trials second phase, then draft IV media does not need to be revised again. Draft IV media is the end product of this development.

C. Presenting data pre-test and post test

The table shows student's score from pre-test and post-test that obtained from students in fourth grade in Islamic Global School Malang when trial field.

Table 4.19
The result trial field from pre test and post test

No	Name	Pre-test	Post-test
1	Adinda Azalea Firdaus	90	100
2	Wildan Loanda Eldama	74	92
3	Achmad Rifaldi Sonaini	64	85
4	Satrio Bagus Setyawan	88	88
5	Putra Rachel Dewa	82	85
6	Dea Ramadhany Putri	78	95
7	Tri Nazwa Livia	76	92
8	Rahmatul Istiqomah	68	80
9	Sela Garneta Iana	64	90
Average		76	89,67

The table shows that the average pre-test score was 76 and the average post-test score was 89.67

It indicates that the average post-test (89,67) is larger than the average pre-test (76). The interactive media proved to be significantly effective to improve the understanding of the material on theme energy saving at fourth grade students in Islamic Global School Malang.

Data pre-test and post-test is analyzed by Paired Sample T Test. This analytical technique used to determine the effect on the object of research groups. It is an indicator of the influence, if there is a difference between cognitive understanding of learners before and after use the media.

Solution:

H_0 = There are no differences in cognitive understanding of learners before and after use the media.

H_a = There are differences in the cognitive understanding of learners before and after use media.

Table 4.19
Statistics on the results of the pre-test and post-test

No	Name	Score		$X_1 - X_2$	D	d^2
		Pre-test	Post-test			
1	Adinda Azalea Firdaus	90	100	-10	10	100
2	Wildan Loanda Eldama	74	92	-8	8	64
3	Achmad Rifaldi Sonaini	64	85	-21	21	441
4	Satrio Bagus Setyawan	88	88	0	0	0
5	Putra Rachel Dewa	82	85	-3	3	9
6	Dea Ramadhany Putri	78	95	-17	17	289
7	Tri Nazwa Livia	76	92	-16	16	256
8	Rahmatul Istiqomah	68	80	-12	12	144
9	Sela Garneta Iana	64	90	-26	26	676
$\sum n = 9$				$\sum d = 113$		$\sum d^2 = 1979$

$$d = \frac{\sum d}{n} = \frac{113}{9} = 12,5$$

$$t = \frac{\bar{d}}{\frac{S}{\sqrt{n}}}$$

$$S = \frac{\sqrt{n \sum d^2 - (\sum d)^2}}{n(n-1)}$$

$$= \frac{12,5}{\frac{8,37}{\sqrt{9}}}$$

$$= \frac{\sqrt{9 \times 1979 - (113)^2}}{9(9-1)}$$

$$= \frac{12,5 \times \sqrt{9}}{8,37}$$

$$= \frac{\sqrt{17811 - 12769}}{9 \times 8}$$

$$= 4,48$$

$$= \frac{\sqrt{5042}}{72}$$

$$= \sqrt{70,02}$$

$$= 8,37$$

T Test Criteria:

- a. If the value of count is greater than table, then a significant means H_0 is rejected and H_a is accepted.
- b. If the value of t_{count} is smaller than t_{table} , then a significant means H_0 is accepted and H_a is rejected.

$$T_{\text{table}} = t_{\alpha} : db$$

$$Db = n-1$$

$$= 9-1$$

$$= 8$$

$$\text{So, } t_{\text{table}} = t_{0,05} : 8 = 1,860 \quad t_{\text{count}} (4,48) > t_{\text{table}} (1,860)$$

It means significantly that H_a is accepted and H_0 is rejected.

Because t count $4,48 > t$ table $1,860$ then H_a is accepted and H_0 is rejected. The conclusion is that there are very significant differences between the value of the final (post-test) with the initial value (pre-test). Furthermore, from the average is known $X_2 89.67 > X_1 76$, means that the value of the post-test better than the pre-test. So there are significant differences in cognitive understanding of students on media development have been developed.