CHAPTER III
RESEARCH METHODOLOGY

3.1 Research Method

The research method used in this study is development. This method was chosen because this research aims to produce and evaluate the effectiveness of systematically designed learning media. The ADDIE model is used as the development model for the learning media in this study which consists of 5 stages, namely Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model is currently used by many companies dealing with individual training to achieve educational goals, especially as the e-learning option is adopted and distance learning via the Internet becomes more popular worldwide (Branch, 2009). Meanwhile, according to Hannum, (2005), this model is considered important in the development of education and training programs.

3.2 Research Design

In order to make this research more systematic and organized, this research follows 5 stages in the ADDIE development model which stands for Analysis, Design, Development, Implementation, and Evaluation. Each process and result are explained descriptively with reference to each variable and research procedure in this study. According to Branch (2009) the application of ADDIE to instructional system design facilitates the complexity of purposeful learning settings. To construct tools and infrastructure for electronic learning media application programs that are successful and efficient in raising student understanding of current student subjects, this model is highly useful to employ as a guideline (Prasetyo et al., 2020). The steps of the ADDIE model can be seen in Figure 3.1 The five stages in ADDIE includes:

1) Analysis Stage, is the phase before planning by clarifying the suitability of the audience's needs. Includes analysis of need, analysis of student characteristics, and analysis of topic.
2) Design Stage, is the phase of making a blueprint which includes setting goals, developing strategies, designing flowchart, and making Storyboards to help the developer visualize big ideas.
3) Development Stage, is the phase of realizing content ideas from the design

stage and creating the actual product by arranging content visually, creating animation, arranging topic material, and all the aspects needed to create learning media.

4) The Implementation Stage, includes the distribution of access to media use to students and teacher after the evaluated by the experts.
5) Evaluation Stage, includes calculating data from questionnaire and expert judgment on the quality of media features and components.

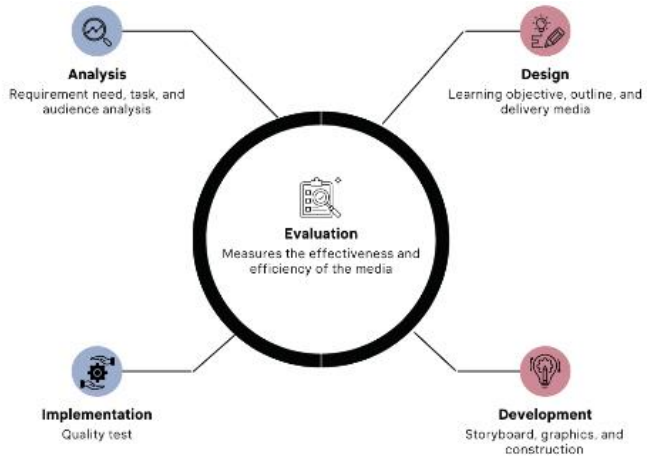

Figure 3. 1 ADDIE Concept

3.3 Population and Sample

a. Population

Participants in this study involved grade 7 and 8 students at Junior High School in Bandung, West Java, Indonesia. The schools use English as the main or second language of instruction.

b. Sample

The sample in this study were 42 students from international junior high school which specifically consist of 17 students from grade 7 and 25 students from grade 8 who studied the earthquakes and mitigation topic. The sample are selected through purposive sampling with certain consideration: (1) students from 7 and 8 grade at Junior High School in Bandung; (2) School use English as the main language or second language of instruction. and (3) School that facilitate the technology for learning or support the use of technology for learning so that students already have basic knowledge regarding the use of mobile phones or computers.

3.4 Research Instrument

The data in this study were collected in the form of rubrics for experts and also student and teacher questionnaires. Chavabot learning media access links are offered, together with a guidebook, as supporting tools for accessibility. The expert rubric contains assessment indicators, assessment scales and written reviews. The expert rubric has an assessment gradient with a scale of 1-4 with each criterion for each scale. Student and teacher questionnaires also contain statement sentences regarding the quality of Chavabot learning media and also a scale of 1-4 (strongly disagree-agree). The written reviews on student and teacher questionnaires are in the form of blank columns to enter feedback and suggestions. The instrument and guidebook of this research can be seen in Appendix A. Detailed explanation is described as follows:

3.4.1 Expert Judgment

The expert judgment for the data collection in this study is in the form of a rating scale. The rubric includes category or aspect, assessment gradient, score, and comment space for suggestions or recommendations regarding the learning media. This rubric was used to validate the quality of content, design, and critical thinking indicators of the Chavabot learning media. This rubric was adapted from the Learning Object Review Instrument (LORI) v2.0 (Nesbit & Leacock, 2009). The adaptation mapping of this rubric can be seen in Appendix A. The comments and assessments are given for revision of the learning media by the developer. Table 3.1, Table 3.2, and Table 3.3 show the expert judgment rubric respectively.

Table 3. 1 Media Expert Validation Instrument for Content

No	Indicator	Assessment Gradient 1 (Need Improvement)	2 (Fair)	3 (Good)	4 (Excellent)
1	Accuracy	The content is inaccurate or overly general. Students are unlikely to learn anything or may be misled.	Some content is inaccurate or incomplete. Students may learn some isolated facts, but they are unlikely to gain new insights about the topic.	The content is generally accurate and reasonably complete. Students may develop a few insights about the topic.	The content is accurate and comprehensive. Students are likely to gain new insights about the topic.
2	Veracity	There are several errors in the content of the learning media, or many criteria have not been encountered.	Almost all information on the learning media is reliable, and almost all criteria have been encountered.	Almost all the information provided on the learning media is reliable, and all material delivery standards have been encountered.	All information given on the application is reliable, and all material delivery standards have been encountered.

Table 3. 2 Media Expert Validation Instrument for Design

No	**Indicator**	**Assessment Gradient 1 (Need Improvement)**	**2 (Fair)**	**3 (Good)**	**4 (Excellent)**
1.	Audio	The sound is unclear, the narration is not in accordance with the text/image/animation being presented, sound effects and back sound interfere with students' understanding.	A small portion of the sound is clear, the narration is in accordance with the text/image/animation being presented, sound effects and back sound do not interfere with	Most of the sound is clear, the narration is in accordance with the text/image/animation being presented, sound effects and back sound do not interfere with students'	The sound is clear, the narration is in accordance with the text/image/animation being presented, sound effects and back sound do not interfere with students' understanding.

No	Indicator	Assessment Gradient			
		1 (Need Improvement)	2 (Fair)	3 (Good)	4 (Excellent)
			students' understanding.	understanding .	
2.	Animation	The animation displayed in this learning media is not in accordance with the learning topic, the images are unclear, unattractive, and do not enhancing students' understanding.	A small portion of the animation displayed in this learning media is in accordance with the learning topic, using clear, attractive images, and enhancing student understanding	Most of the animation displayed in this learning media is in accordance with the learning topic, using clear, attractive images, and enhancing student understanding .	All of the animation displayed in this learning media is in accordance with the learning topic, using clear, attractive images, and enhancing student understanding.
3.	Color matching	Color matching does not help readers increase their attention levels on certain information.	Color matching quite helps readers increase their attention levels on certain information.	Almost all Color matching helps readers increase their attention levels on certain information.	All color matching help readers increase their attention levels on certain information.
4.	Content and Media Placement	The placement of titles, subtitles and illustrations is unbalanced, the size of the images and animations are inappropriate, and interfere with understanding.	The placement of titles, subtitles and illustrations is balanced, the size of the images and animations are appropriate, but interfere with understanding.	The placement of titles, subtitles and illustrations is balanced, some of the size of the images and animations are inappropriate, but do not interfere with understanding	The placement of titles, subtitles and illustrations is balanced, the size of the images and animations are appropriate, and do not interfere with understanding.

No	Indicator	Assessment Gradient 1 (Need Improvement)	2 (Fair)	3 (Good)	4 (Excellent)
5.	Font type	The font is not easy to read and can't direct the reader's attention.	The font is quite easy to read and a little bit directs the reader's attention.	The font is easy to read but a little bit directs the reader's attention.	The font is easy to read and can direct the reader's attention.
6.	Font size	The font size is not clear and not readable.	The font is quite clear but does not really readable.	The font is clear but does not really readable.	The font size is clear and readable.
7.	Navigation	There are no buttons or navigation tools in the learning media that are made.	There is a little difficulty with pressing buttons or navigation tools. There are still errors/out-of-sync with the buttons and navigation tools when played.	There is a little difficulty with pressing buttons or navigation tools. There are still errors/out-of-sync with the buttons or navigation tools when clicked.	All the buttons and navigation tools are functioning correctly. There is no mistake when it is clicked.
8.	Information Structure	The order of information is not understandable. The menu and flow of information delivery are not clear.	The order of information is quite understandable. The menu and flow of information delivery were confusing and contained errors.	Most of the order of information is quite understandable. The menu and flow of information are directly delivered and clear.	All of the order of information is clear and understandable. The menu and all information are directly delivered and clear.

Table 3. 3 Media Expert Validation Instrument for Critical Thinking

No	Indicator	Assessment Gradient 1 (Need Improvement)	2 (Fair)	3 (Good)	4 (Excellent)
1	Basic Clarification (Asking and answering the question with clarification about earthquake and mitigation)	There is no content in this learning media that can facilitate students' to asking and answering the question with clarification.	There is small portion of content in this learning media is enough to facilitate students' to asking and answering the question with clarification.	There is content in this learning media is appropriate to facilitate students' to asking and answering the question with clarification.	The content in this learning media is very suitable and facilitates students' to asking and answering the question with clarification.
	Basic Clarification (Analyzing argument about earthquake reports)	There is no content in this learning media that can facilitate students' to analyzing argument.	There is small portion of content in this learning media is enough to facilitate students' to analyzing argument.	There is content in this learning media is appropriate to facilitate students' to analyzing argument.	The content in this learning media is very suitable and facilitates students' to analyzing argument.
2	Basic Support (Observing and judging observations report about earthquakes)	There is no content in this learning media that can facilitate students' to observing and judging observations report.	There is small portion of content in this learning media is enough to facilitate students' to observing and judging observations report.	There is content in this learning media is appropriate to facilitate students' to observing and judging observations report.	The content in this learning media is very suitable and facilitates students' to observing and judging observations report.
3	Inference (Making and judging value judgements about certain situations problems	There is no content in this learning media that can facilitate students' to making and judging value judgements.	There is small portion of content in this learning media is enough to facilitate students' to making and	There is content in this learning media is appropriate to facilitate students' to making and	The content in this learning media is very suitable and facilitates students' to making and judging value judgements.

No	Indicator	Assessment Gradient 1 (Need Improvement)	2 (Fair)	3 (Good)	4 (Excellent)
	during an earthquake)		judging value judgements.	judging value judgements.	
4.	Advanced Clarifications (Identifying assumptions about certain situations problems of earthquakes)	There is no content in this learning media that can facilitate students' to identifying assumptions.	There is small portion of content in this learning media is enough to facilitate students' to identifying assumptions.	There is content in this learning media is appropriate to facilitate students' to identifying assumptions.	The content in this learning media is very suitable and facilitates students' to identifying assumptions.
5.	Strategy and Tactics (Deciding on action for earthquake mitigation)	There is no content in this learning media that can facilitate students' to deciding on action.	There is small portion of content in this learning media is enough to facilitate students' to deciding on action.	There is content in this learning media is appropriate to facilitate students' to deciding on action.	The content in this learning media is very suitable and facilitates students' to deciding on action.

3.4.2 Teacher and Student Questionnaire

The teacher and student questionnaire also use a rating scale of 1 to 4 (strongly disagree - strongly agree). Data from this questionnaire is used to validate the quality of Chavabot Learning media. This questionnaire was adapted from the Learning Object Review Instrument (LORI) v2.0 (Nesbit & Leacock, 2009) which is broken down into five measurement categories includes mobile connectivity, materials, user interface, learning experience, and critical thinking. The adaptation mapping of this rubric can be seen in Appendix A. There are also columns that allow teachers and students to make suggestions or enter according to certain categories and statements. Teacher questionnaire can be seen in the Table 3.4.

Table 3. 4 Teacher Questionnaire for Chavabot Learning Media

Category	Statement
Mobile Connectivity	The learning media is easy to access
	The learning media is easy to connect
	The learning media is flexible to interact with
Materials	Materials are understandable and clear
	Materials are accessible
	The question can enhance the comprehension
User Interface	The color matching is attractive
	All text can be seen and readable
	All picture can be seen clearly
	All animation suitable and clear
	All video suitable and clear
	All audio suitable and clear
	All content placement suitable and not interfere students understanding.
Learning Experience	The learning media is fun for students and increases motivation to learn.
	The learning media allows students to learn independently.
	The learning media is helpful for students in learning activity.
	The learning media facilitates students critical thinking.

Table 3. 5 Student Questionnaire for Chavabot Learning Media

Category	Statement
Mobile Connectivity	I find it is easy to access this learning media.
	I find it is easy to connect this learning media.
	I find this learning media are flexible to interact with.
Materials	I find it easy to understand earthquake and mitigation material through this learning media.
	I find it easy to access the material in this learning media.
	I feel the questions given can enhance to my understanding.
User Interface	I am interested in using this learning media because of the color matching is attractive.
	I can see and read all the texts in this learning media.
	I can see all the picture clearly in this learning media.
	I can see all the animation are attractive and clear.
	I can play and see all the video clearly in this learning media.
	I feel the placement of the animation is suitable.
Learning Experience	I feel motivated to learn about earthquake and mitigation through this learning media.
	This learning media allows me to study independently.
	This learning media is helpful for me in learning earthquake and mitigation materials.
Critical Thinking	This learning media facilitates me to ask and answer questions with clarification about earthquakes and mitigation.
	This learning media facilitates me to analyze arguments about earthquake reports.
	This learning media facilitates me to observe and judge observations and report about earthquakes.
	This learning media facilitates me to make and assess judgments about certain situations and problems during an earthquake.
	This learning media facilitates me to identify assumptions about certain situations and problems of earthquakes.
	This learning media facilitates me to decide on actions for earthquake mitigation.

3.5 Data Processing Technique

Rubrics of experts and teacher and student questionnaires using the different data processing techniques. After the media was developed, the researcher gave media access and rubrics to the experts. Experts are fill in a rubric to validate the media and provide feedback and suggestions for

improving the Chavabot learning media. After the media was revised according to the feedback and suggestions of the experts, the researchers distributed access and questionnaires to students and teachers. Students and teachers access Chavabot learning media and complete questionnaires. The results of the student and teacher questionnaires be processed by calculating the average of each aspect with the following formula:

$$\mathbf{X} = \frac{\sum \boldsymbol{x}}{\boldsymbol{n}}$$

(Wan et al., 2014)

Based on the calculation above, the average percentage is interpreted in the criteria served in Table 3.6.

Table 3. 6 Percentage Criteria for Likert Scale

Percentage	**Interpretation Score**
0 % - 20 %	**Very Poor**
21 % - 40 %	**Poor**
41 % - 60 %	**Acceptable**
61 % - 80 %	**Good**
81 % - 100 %	**Very Good**

Source: (Riduwan, 2008)

The results of the expert rubrics were analyzed using Aiken's Validity theory (Aiken's V). Aiken formulates the Aiken Validation formula to calculate the content-validity coefficient based on the results of a panel of experts as many as n people on an item in terms of the extent to which the item can represent the construct being measured. The Aiken formula used to assess the validity of the instrument is as follows.

$$\mathbf{V} = \frac{\boldsymbol{\Sigma s}}{\boldsymbol{n}(\boldsymbol{c}-\mathbf{1})}$$

(Aiken, 1980)

In this formula, V is a validity index; s is the score of each rater minus the lowest score used in the category, in this case it becomes (s = r-lo, r = given score from rater, and lo = lowest score); n is the number of validators; and c is the maximum score in the category or number of categories obtained from the

validator (Retnawati, 2016).

The validation value of the experts determines the level of validity of the learning media. the correlation category of learning media validity test can be seen in Table 3.7.

Table 3. 7 Validation Value Criteria

Interval Score	Criteria
> 0,80	**High**
0, 60 – 0,80	**Moderate**
0 < 0,60	**Low**

(Dr. Riduwan, M.B.A., 2019)

3.6 Research Procedure

This research uses the ADDIE development model which consists of analysis, design, development, implementation, and evaluation. Each stage in the ADDIE model is compiled in a research procedure which is divided into three stages, namely the planning stage, the implementation stage, and the final research stage. Each stage is described as follows:

1. Planning stage

   At this planning stage the researcher carried out the study literature and determining the problem by looking at existing phenomena or problems. Then the researcher submits a title, prepares a research proposal, and research questions.

2. Implementation stage

   At this stage the researcher started to carried out the stage of ADDIE model, namely design. The first stage in the ADDIE model, namely an analysis consisting of needs analysis, analysis of student characteristics, and topic analysis. At the design stage, the researcher determines the selected learning materials, determines the software to be used to develop media, compiles flowcharts and storyboards. The output from this stage becomes input for the development stage. This development stage makes the learning media design that has been planned become real, so that chatbots are made in accordance with the framework and structure, systematics, content, and presentation at the design stage.

The chatbot products that have been made are then assessed by six experts which include material experts and media experts through an assessment rubric. After receiving the results of the assessment from the experts, revisions were made to the learning media before it was implemented by distributing it to students and then measuring the responses to students' experiences when using their learning media through questionnaires. In addition to students, science teachers are also involved to see the experience of using learning media, the responses from teachers and students become input for the evaluation stage. At the evaluation stage, student and teacher responses are processed and sorted to then analyzed and interpreted for the research paper.

3. Completion stage

In this completion stage, the researcher carried out the last stage of the ADDIE development model, namely evaluation. At the evaluation stage, student and teacher responses are processed and sorted to then be used as suggestions for improving learning media. At this stage the researcher also draws conclusions by interpreting the data that has been processed, analyzed, and presented in graphical form and making conclusions from the research results related to the research variables. Then the results of this research are submitted in the form of a journal article in the Journal of Educational Science and Technology (EST). Evidence of submission can be seen in Appendix E. The scheme of research procedure stages is shown in Figure 3.2

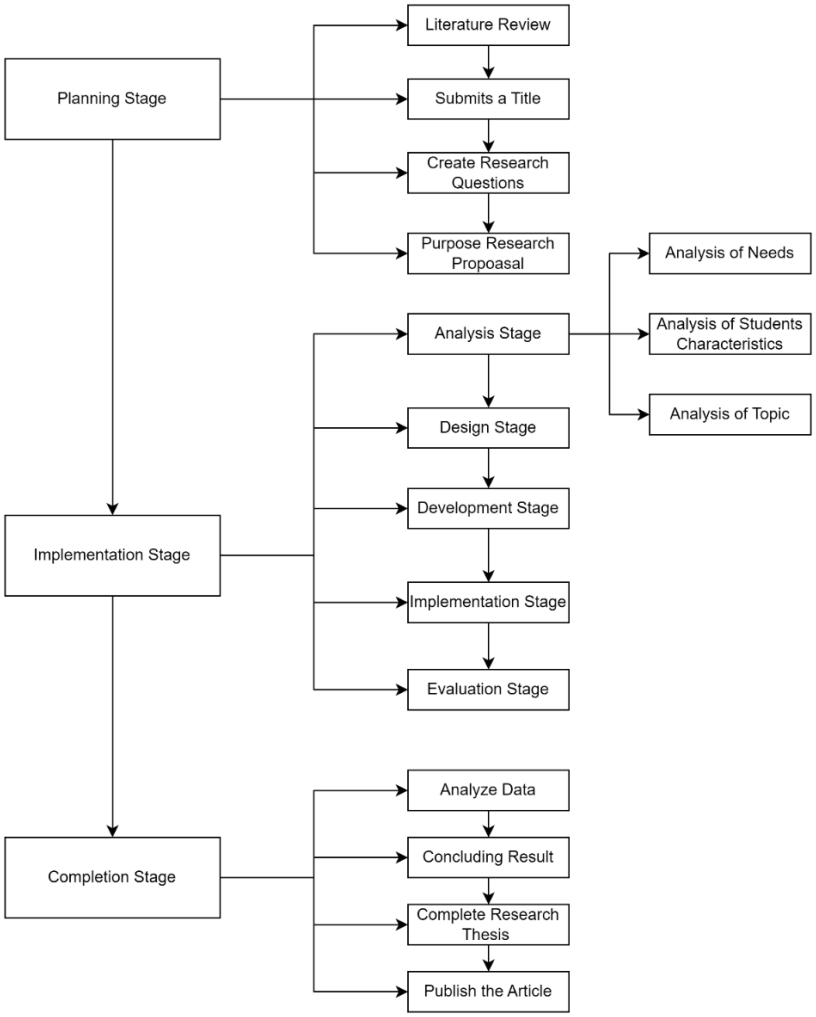

Figure 3. 2 Research Procedure Scheme