CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Method

This research is undertaken to develop bloodventure game. To gain the purpose, it is needed a research approach that highlight an effort to produce the media. Therefore, in this research was conducted using developmental research method. Developmental research facilitates the study of new models, tools, and procedures.

Multimedia development used the Decide, Design, Develop, Evaluate (DDD-E) model. This model is a learning design model that is used in developing multimedia learning (Ivers & Barron, 2002). The selection of this model is also based on the development model procedure that is designed simply on another development model. Multimedia development using DDD-E consists of 4 stages as follows, (1) Decide, this stage consists of setting project objectives, developing project guidelines, including initial planning in developing a product. (2) Design, this stage determines program structure and details of the contents. (3) Develop, this stage consists of producing media elements and project programming. (4) Evaluate, stage it looks at the whole process that occurs in multimedia development.

3.2 Research Design

The researcher created bloodventure game in the form of EXE application in the computer that develops on Construct 2. It can be accessed from personal computer or laptop. Final paper supervisors then supervised the bloodventure game before the experts that expertise in the biology content, and media. After getting suggestions and revisions until the final assessment, the game will be brought to science and media teachers and students to be reviewed.

3.3 Population and Sample

The subject for this research consists of experts and students. The experts in this research are one science field expert, one media field trip expert, and three science teachers. The expert on science had an educational background until doctoral and has experience in teaching science. The expert on media had experience in being a lecturer for subject media and computer. Two teachers on this research had a background of science and one of teacher is had background of media in junior high school. One of the teachers is a science teacher from private school in Bandung and graduated from university from turkey. Two of teachers from Sukabumi district in junior high school.

The number of students in this research are twenty-five. That consist of 11 male students and 14 female students in 9 and 8 grades in one of junior high school. The location of research is public school in Sukabumi districts. Data was taken in a computer laboratory in school which had 10 laptops available and can be normally operated. The sampling technique used is purposive sampling technique because this test is only used to see the application performance.

3.4 Operational Definition

In order to avoid misconceptions about this research, operational definitions are explained in this research. Those terminologies are explained as follow:

1) Bloodventure game create using software name construct 2. Besides that, Software that support for making bloodventure games include Corel draw, Adobe Photoshop CS6, Chrome, Audacity, and Microsoft word. Bloodventure game using computer for run the application.

2) Gamification is the use of game mechanics and experience design to digitally engage and motivate people and highlights the importance of engagement and driving motivation. In gamification the developers can input fun elements into applications and system that might otherwise lack immediacy or relevance for users. Gamification also focuses on enabling

people to achieve their goals.

3) Computer-assisted instruction (CAI) refers to specific computer applications or supplemental activities to enhance the teacher's instruction. Using computer programs to assisted instruction are interactive and can illustrate a concept through attractive animation, sound, and demonstration. They allow people to progress at their own pace and work individually or problem solve in a group.

4) Circulatory system Circulatory system concept in this study is about Circulatory system organ, Mechanism of blood circulation, and Circulatory disease in junior high school material based on Indonesia curriculum 2013.

3.5 Research Instrument

The data is collected in the form of rubrics from expert and a survey from the students. The rubrics and survey have a scale, rating, and written review. The rubrics have one until four scales with each specific description on the scale. The survey was given both yes or no choice and level of agreement scale 1-5. The written review contains a form to put feedback, comment, opinion, and suggestion. In order to collect the data, the detail process is described as follow:

3.5.1 Experts

The instrument that consist of game, rubrics, were directly given to experts of science, media, and teacher directly after the game was created. The game was in the form of EXE type so the experts can try it directly. The game and rubrics send by email to expert. All of the expert was asked to play the game from laptop, depend on condition. Then, after trying one game, experts filled the rubrics given. Expert gave feedback and opinion written to the researcher. The data collected from experts were in the form of scale and suggestion or comments regarding the aspects and general feedback towards the game.

Table 3.1. Expert Judgement Rubric Scale

No	Aspect	Criteria	1	2	3	4	Remark
1	Mechanical	Technical	The game is not going well. There are many technical errors when playing.	The game runs at a less than optimal level. There are still many technical errors when playing.	The game runs smoothly with few technical errors at play.	The game runs perfectly without technical problems. For example, no sound, video or other file errors were found.	
2		Navigation	Navigation buttons and tools not found. There are no buttons and navigation tools that function when played.	There is little difficulty when pressing buttons and navigation tools. There are still errors on the buttons and navigation tools when playing.	Most of the buttons and navigation tools work. There are still a few errors on the buttons and navigation tools when played.	All buttons and navigation tools are functioning properly. There were no errors when playing.	
3		Spelling	The use of language is incompatible with EYD and gives rise to multiple interpretations.	Most languages are in accordance with EYD and still cause multiple interpretations.	The use of language is in accordance with EYD and does not lead to multiple interpretations.	The use of language is very communicative, according to EYD and does not lead to multiple interpretations.	
4		Completion	The game is not finished and there are many elements that are incomplete.	The game is not finished and there are still some incomplete elements.	The game is almost complete and there are still a few incomplete elements.	Game completely finished.	

No	Aspect	Criteria	1	2	3	4	Remark
5		Screen design and audio	Audio and visual display (background, image, color, type & size of letters, and music are not interesting.	A small portion of audio and visual display (background, image, color, type & size of letters, and music are suitable and quite interesting.	Most audio and visual displays (background, images, colors, font type & size, and music are suitable and attractive).	All audio and visual displays (background, images, colors, type & size of letters, and music are very suitable and very interesting.	
6	Multimedia	use of enhancement	There are no images, videos, audio or other enhancements that support the delivery of material in this game.	There are images, videos, audio, or other enhancements but do not support the delivery of material in this game.	Most of the images, videos, audio, or other enhancements are used correctly to support the delivery of material in this game.	All images, videos, audio or other enhancements are used effectively to support the delivery of material in this game. Enhancements contribute significantly to conveying all learning material.	
7		Game Instruction	There are no instructions or tutorials for using the game, so users feel confused when playing the game.	There are instructions or tutorials for using the game, but the delivery is unclear and makes users feel confused.	There are instructions or tutorials for using the game. The delivery is quite clear and allows users to play the game.	Every instruction or tutorial on using the game is delivered very clearly so that the user can play the game correctly and not feel confused.	

No	Aspect	Criteria	1	2	3	4	Remark
8	Information Structure	Information sequence	The order of information is irregular. The menu and flow of information delivery is not clear.	The order of information is a bit understandable. Menus and flow of information delivery are still confusing and there are errors	The order of information is quite understandable. Menus and flow of information delivered directly and clearly.	The order of information is very clear and intuitive. The menu and all information is clear and delivered in person.	
9		Information attractiveness	Display information conveyed in this game is not interesting and makes students not want to read it.	The information display delivered in this game is quite interesting but students tend not to want to read it.	Display information conveyed in this game is quite interesting and makes students want to read it.	Display information conveyed in this game is very interesting and interactive. Make students who read it understand and not get bored.	
10	Motivation	Attractiveness and motivation engagement	This game cannot motivate and attract students' attention to study.	This game can attract the attention of students but cannot cause student motivation to learn.	This game is able to attract the attention of students and increase student motivation to learn.	Students are very interested and motivated to learn after playing this game.	
11		Permission to use game elements	There is no permission to use text, graphics, audio, video, and other elements in this game.	A small portion of the use of text, graphics, audio, and other elements has received permission.	Most uses of text, graphics, audio, and other elements have been granted permission.	All uses of text, graphics, audio, video and other elements have been granted permission.	
12	Documentation	Originality	This game mimics ideas from other people's work. All elements in the game have already	This game is a repetition of ideas, products, and images from other people. There are a few	This game shows authenticity and creativity. But there are still aspects that are used from other	This game shows evidence of authenticity and significant creativity. Most of the content is new, original,	

No	Aspect	Criteria	1	2	3	4	Remark
			been made by someone.	updates that were created in this game.	people's work.	and inventive ideas.	
13		Linkage of curriculum to the games	There is no link between games and curriculum. Students cannot learn from this game.	There are several aspects that have a link between curriculum and games. Students can learn from this game.	Aspects of the relationship between curriculum and games are sufficient. students tend to learn from this game.	The aspects of the relationship between the curriculum and the game are very clear and adequate.	
14		Learning objective	Explanation of the material presented is not in accordance with the learning objectives	A small portion of the material presented is in accordance with the learning objectives.	Most of the material delivered is in accordance with the learning objectives.	All the material conveyed is in accordance with the learning objectives.	
15	Quality of Content	Material depth	The description of the material presented is not in accordance with the ability level of junior high school students.	A small portion of the material presented is in accordance with the ability level of junior high school students.	Most of the material delivered is in accordance with the ability level of junior high school students.	All the material descriptions were in accordance with the ability level of junior high school students.	
16		The use of scientific terms	The use of terms in every element and learning material in the game is not in accordance with the scientific field.	A small portion of the use of the term in each element and learning material is in accordance with the scientific field.	Most of the use of the term in each element and learning material is in accordance with the scientific field.	All the use of terms in each element and learning material is in accordance with the scientific field.	
17		Clarity of learning material	Learning material in the game is not clear. The information	A small portion of learning material in the game is clear enough. Some	Most of the learning material in the game is clear, some information is	All learning materials in the game are very clear. All information is correct and correct.	

No	Aspect	Criteria	1	2	3	4	Remark
			conveyed is confusing and incorrect.	information is still confusing and incorrect.	correct, and correct.		
18		User survey	The items in the Instrument are not clear enough to retrieve data from the user.	The items in the instrument are clear enough to retrieve data from the user.	The items in the instrument are quite clear and have clear aspects for retrieving data from the user.	The items in the instrument are clear enough to take data from the user and have a measurable aspect.	

(Source: McCullen, et al., 2015)

3.5.2 Students

The output data collected from students are the percentage of yes/no, level of agreement, and written comment or feedbacks. The first process took the data that, the game was copied and tried one by one to fourteen laptops in the school. Students were being separated into two batches to collect twenty-five data because of WFH condition in Indonesia. Students got into the class, and the worksheet was given to each of the students. The worksheet consists of the manual to play the game and questionnaire. Then, the researcher explained how to play the game each of the processes one by one using oral explanation. Students were also explained how to fill the questions. After that, students played the game by themselves. There were time differences in each student to finished the game. Some of the students asked so many things in the middle of playing the game to the researcher. Then after all of the students finished the game., in around 1 hours, the filled questionnaire was given back to the researcher. Data collected in form of scale, ratings, and quiz in the game for each student. Students will be given a questionnaire 1 on Media and Gamification Availability shown in table 3.2.

Table 3.2. Student Questionnaire 1

No.	Question	Answer	
1	Do you find difficulties when playing bloodventure games?	Yes	No
2	Does the button on the bloodventure game work well?	Yes	No
3	Is the language and writing used in bloodventure games easy to understand?	Yes	No
4	Does bloodventure game have an attractive color and appearance?	Yes	No
5	Does each level in the Bloodventure game have different levels of difficulty?	Yes	No
6	Is there a circulatory system material in humans in the Bloodventure game?	Yes	No
7	Does the bloodventure game increase understanding of the material in the circulatory system in humans?	Yes	No
8	Can the biological terms in the Bloodventure game be understood?	Yes	No

No.	Question	Answer	
9	Is the delivery of the material of the circulatory system to humans in a bloodventure game clearly delivered?	Yes	No
10	Are the questions on bloodventure this game understandable?	Yes	No

Student is also given a Student Questionnaire 2 on Media and Gamification Availability shown in table 3.3.

Table 3.3. Student Questionnaire 2

Aspect	Pernyataan	1	2	3	4	5
Motivation	I am increasingly excited to study biology after playing bloodventure games					
Challenge	I got a challenge while playing bloodventure games					
Joyness	Bloodventure games don't bore me					
Goal and mission	The goals and missions at each bloodventure game level are quite clear					
Convenience	Bloodventure game is easy to play					
Addiction	I want to play bloodventure again					
Learning Environment	I would rather study biology in games than study in class					
Content Understanding	Explanation of material on the circulatory system in humans in a bloodventure game is easy to understand					
Improve Understanding	Playing a bloodventure game can improve understanding of the material in the circulatory system in humans					
Attractiveness	Bloodventure game is very interesting to play					
Interactiveness	Bloodventure game is very interactive to play					

3.6 Analysis

The instrument used to obtain data in this research to gather opinion, feedback, and satisfaction with using gamification aspect in learning human

circulatory system. The instrument that used are the experts' judgment rubric and questionnaire for students.

3.6.1 Expert rubric

The rubric has adapted from rubrics created by Multimedia Team at North Carolina State University In order to check the development of learning, media created based on gamification aspect a multimedia rubric consist of the indicator, criteria, and aspects for scale one until four. The scale one until four has its category and definition for each criterion. Thus, the expert can choose the most suitable point based on the condition of the game and their perspective. The detail rubrics is shown in table 3.1 Expert's Rubric Scale. The resulting score is taken from average for each scale that the result given by all of the experts. The average got from the total of the score given by all experts in each aspect and divided by three as number total of the experts by formula shown below.

$$\bar{X} = \frac{\Sigma x}{n}$$

(Minium, King, & Bear, 1992)

That defined by, is mean of the sample. X is the score given by experts or sum of scores. N is total of the sample which is experts' number. Validation Criteria which used in the program validation are shown in the table 3.4.

Table 3.4. Program Validation Criteria

Score (1-4)	Validation Criteria
4	Valid
3	Valid Enough
2	Last valid
1	Invalid

3.6.2 Scale for Students' Questionnaire

The rubric that used in this research is scale and ratings. The questionnaire is consisting of eight aspects, and it has one question each, students need to answer yes if they found the aspect asked and answered no if they did not find it in game. The first questionnaire is to check the availability of gamification and media aspects of the aspects mentioned to the students in Table 3.5.

Table 3.5. Students' Questionnaire on Media & Gamification Availability

No.		Question	Answer	
1	Difficulty level	Do you find difficulties when playing bloodventure games?	Yes	No
2	Error navigation	Does the button on the bloodventure game work well?	Yes	No
3	Language Error	Is the language and writing used in bloodventure games easy to understand?	Yes	No
4	Clear screen	Does bloodventure game have an attractive color and appearance?	Yes	No
5	Challenge	Does each level in the Bloodventure game have different levels of difficulty?	Yes	No
6	Contain material learning	Is there a circulatory system material in humans in the Bloodventure game?	Yes	No
7	Content Understanding	Does the bloodventure game increase understanding of the material in the circulatory system in humans?	Yes	No
8	Scientific term	Can the biological terms in the Bloodventure game be understood?	Yes	No
9	Delivery of Content	Is the delivery of the material of the circulatory system to humans in a bloodventure game clearly delivered?	Yes	No
10	Question of Material	Are the questions on bloodventure this game understandable?	Yes	No

the second questionnaire is to assess how much they see these aspects of gamification being used in the game. It has three aspects with three statement, the survey was asking student agreement from 1 – 5 by using a

Likert scale. Which the question and aspect are mentioned to the Gamification Aspects in Table 3.6.

Table 3.6. Gamification Aspects

Aspect	Statement
Challenging	I got a challenge while playing bloodventure games
Goal and mission	The goals and missions at each bloodventure game level are quite clear
Content Understanding	Explanation of material on the circulatory system in humans in a bloodventure game is easy to understand

The third questionnaire is to assess or see how gamification aspect effects motivation, joy, convenience, addiction, improve understanding, attractiveness, and interactiveness which has one question each. The scale used was Level on agreement in Likert Scale from 1-5. Which the question and aspect are mentioned to the students in Table 3.7.

Table 4 Gamification Effects to Motivate & Behavior

Aspect	Statement
Motivation	I am increasingly excited to study biology after playing bloodventure games
Joyness	Bloodventure games don't bore me
Convenience	Bloodventure game is easy to play
Addiction	I want to play bloodventure again
Improve Understanding	Playing a bloodventure game can improve understanding of the material in the circulatory system in humans
Learning Environment	I would rather study biology in games than study in class
Attractiveness	Bloodventure game is very interesting to play
Interactiveness	Bloodventure game is very interactive to play

For both scales by student's questionnaire, the data was judge by

using a Likert scale for student' Level of Agreements, and it shows in the table 3.8.

Table 3.8. Likert Scale for Students' Level of Agreement

Scale Creation	Point
Strongly Disagree	1
Disagree	2
Neither agree or disagree	3
Agree	4
Strongly Agree	5

The data were collected for each of the aspects by the point that is given by the students and counted for each scale criterion for how many students agree with each scale by using simple addition. After that, the expert" judgment rubric was analyzed by a quantitative measurement, adapted from (Riduwan & Akdon, 2010). Then, comparing the result with the total amount of highest score and result is converted to a percentage where Na is total of score given from all the students, Nx is the number sample which is a number of students.

$$\% = \left(\frac{Na}{Nx} \right) \times 100\%$$

(Ridwan & Akdon, 2010)

3.7 Research Procedure

As described in the research and development model in research methodology, research using the DDD-E model contains 4 steps of the development procedure as follows:

1) Deciding stage

a) Formulating Research Objectives

b) Brainstorm Content

c) Literature review of CAI, Gamification, and Content

d) Decide Software used to develop game

2) Designing Stage

a) Designing Flowchart

b) Designing Story Board

3) Development Stage

a) Developing Bloodventure Game

b) Developing Instrument consist of experts and users (students)

4) Evaluation Stage

a) Testing Readability to experts and students

b) Collecting data from experts and Students

c) Analysis and Evaluate Data

d) Making Result and discussion from the analysis data

e) Reporting result

The scheme of research procedure stages is shown in figure 3.1.

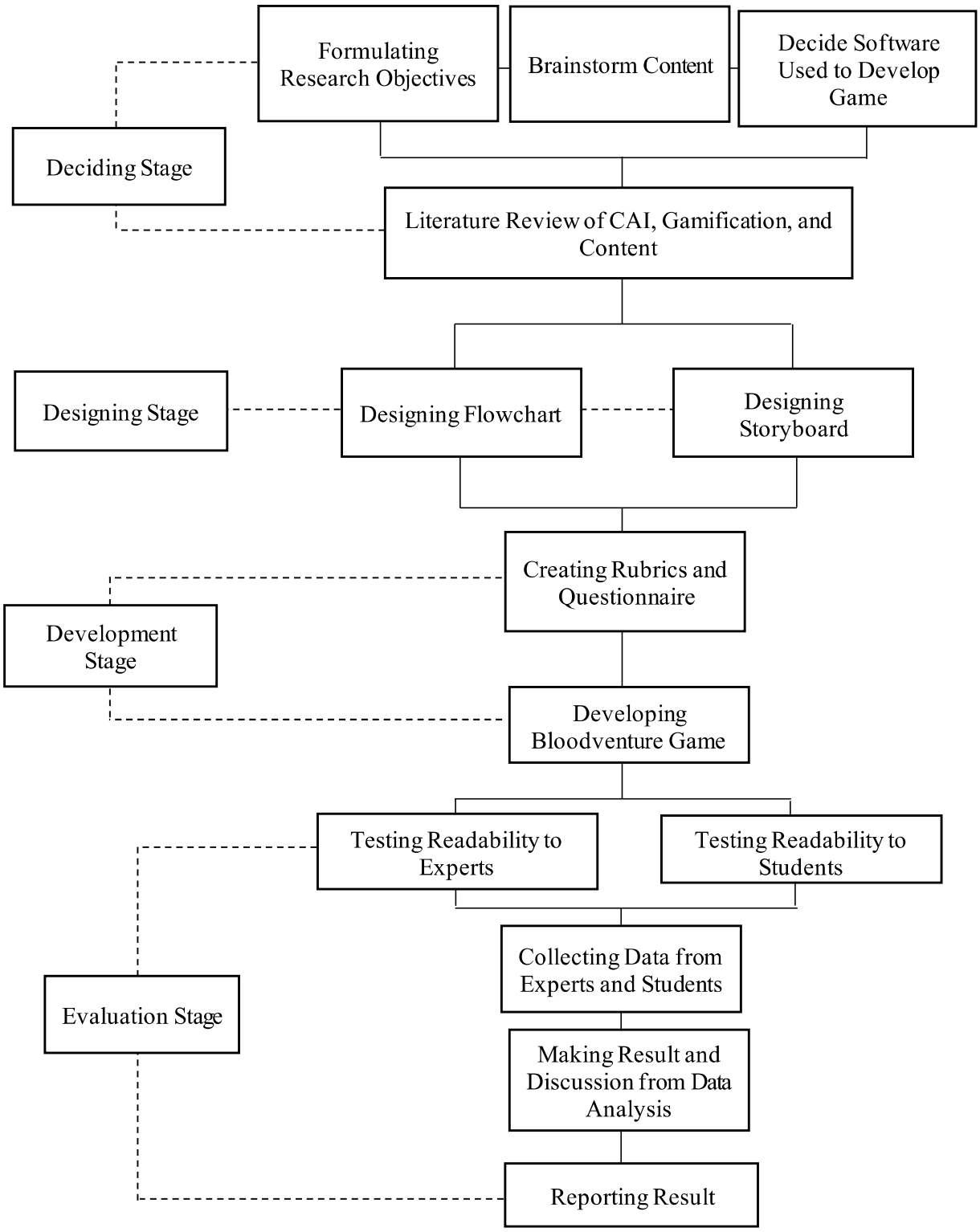

Figure 3.1. Research Procedure Scheme