CHAPTER 3
RESEARCH METHODOLOGY

3.1 Research Methods

This study adopts the ADDIE instructional design model as a framework for designing a web-based learning medium called Nutriolic. The ADDIE model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Nugraha & Setiyawan, 2025). This model was developed in the 1970s by the Center for Educational Technology at Florida State University and has been widely applied in instructional design and training development in various environments, both academic and corporate (Ranuharja et al., 2021). Various studies have explored the effectiveness of the ADDIE model in different contexts, including in the fields of health, business, and education.

3.1.1 Research Design

The ADDIE development model consists of five gradual steps: analysis, design, development, implementation, and evaluation, which must be carried out sequentially. This research uses interviews and questionnaires to collect data from education experts, science teachers, and students. The data collected includes qualitative and quantitative information. The data is then analyzed qualitatively to obtain comments and quantitatively to determine the percentage of feasibility of using the product. The ADDIE development research steps in this study are displayed in the form of the following diagram on figure 3.1.

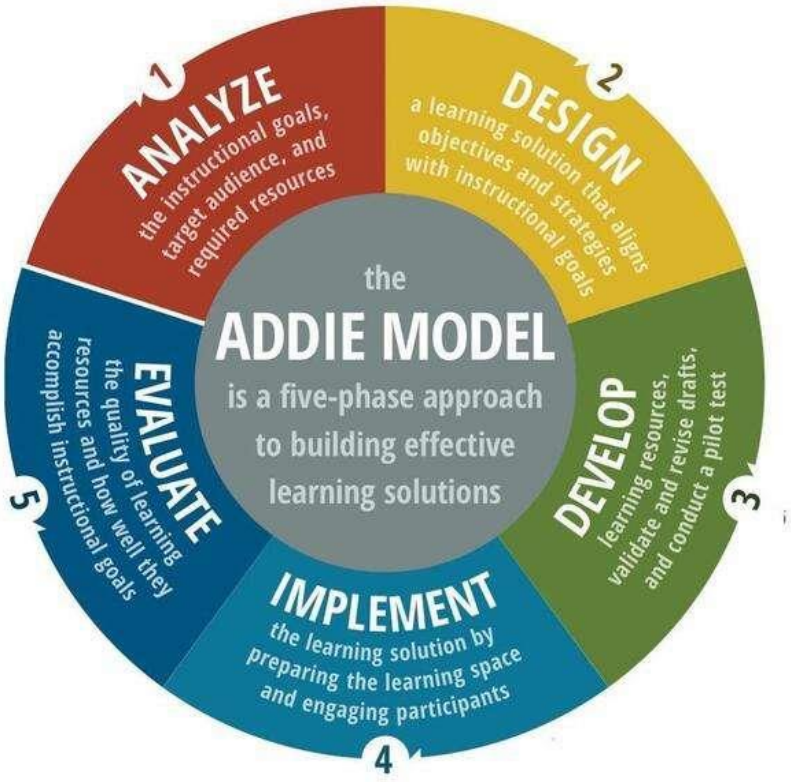

Figure 3. 1: ADDIE MODEL

Based on Figure 3.1, the diagram shows the stages of ADDIE model development, which consists of five main steps, namely analysis, design, development, implementation, and evaluation. Each stage is interconnected and carried out sequentially to ensure that the developed product is of optimal quality. According to (Amaliyah, 2023), this model helps researchers systematically design, develop, and evaluate learning products, from initial planning to final assessment.

3.2 Population and Sample

The population in this study were all 8th grade students in one of the Junior High Schools in Bandung. The selection of this research location was carried out because the school had implemented the National Independent Curriculum, so it was in accordance with the context of developing Nutriolic learning. Sampling in this study using Convenience sampling technique or chance sample, Convenience sampling is a sampling technique that is carried out subjectively based on convenience, location and number of samples that are easily accessible to researchers (Ahmed, 2024).

In this study, the samples used were 8th grade students at the specified junior high school, with a total of 35 students who had studied nutrition material. Determination of the number and location of samples was chosen based on the availability of students and ease of access in data collection by researchers. Convenience sampling was chosen because this method allows researchers to select samples efficiently, save time, and reduce the costs involved in data collection. Although convenience sampling has the potential for bias, control measures were taken, such as ensuring diversity of student representation and collecting data from students with different classes to increase the reliability of the study.

3.3 Research Instrument

To obtain the data and information needed in this research, the researcher created a set of research instruments. The instruments that will be used in this research consist of:

3.3.1 Preliminary Study Instrument

Preliminary study instruments were carried out on teachers and students. The instruments used were questionnaires and semi-structured interviews. Interviews are conducted with subject teachers to find out the condition of Nutrition learning. The interviewer can ask about the teaching methods used, the obstacles faced, and the effectiveness of existing teaching materials. Meanwhile, questionnaires are given to students to obtain an overview of learning and students' responses to the use of multimedia in learning. about the material taught, and their opinions about the effectiveness of multimedia in helping them understand the lesson material.

3.3.2 Multimedia Validation Instrument

The instrument in this research uses expert validation for media validation. Media expert validation was carried out by referring to media characteristics based on the LORI (Learning Objects Review Instrument) v2.0 assessment instrument (Nesbit, et al, 2009). Based on the LORI instrument, there are eight aspects measured, namely:

a. Presentation Design: Design visual and auditive information to promote learning and efficient mental processing.
b. Interaction Usability: Ease of navigation, Predictability of the user interface, Quality of the interface help features
c. Ease of Interaction: Ease of navigation, predictability of the user interface, and quality of the interface's help features.
d. Accessibility: Design controls and presentation formats to accommodate students with disabilities and mobile users.
e. Standards Compliance: Compliance with international standards and operability on commonly used technical platforms.

Based on the aspects of the LORI Rubric instrument used in this study, the questionnaire covers two aspects, namely multimedia and its characteristics. These characteristics include content, both nutritional material and language. The multimedia aspects assessed include the design of Nutriolic. Scale of 1 to 5 is used to determine whether the points in Nutriolic align with the objectives, targets, and expectations. The Likert scale and evaluation are also used for the student and teacher questionnaires. There are five evaluation scales to determine whether Nutriolic is compatible and suitable for the junior high school level or not. The multimedia aspects evaluated, along with Description of each aspect based on the LORI Instrument, can be seen in Table 3.1.

Table 3. 1 Description Aspects of Multimedia Assessment Based on Learning Object Review Instrument (LORI) v2.0

Indicator	Description
Presentation Design	Desain visual (Design of visual) Audio untuk meningkatkan pembelajaran (Auditory information for enhanced learning)
Interaction Usability	Ease of navigation, Predictability of the user interface, Quality of the interface help features

Accessibility	Desain of controls, Presentation formats to accommodate mobile learners
Reusability	Ability to use in varying learning contexts and with learners from differing backgrounds
Standard Compliance	Adherence to international standards and specifications

(Nesbit, et al, 2009)

Based on Table 3.1 Criteria used to evaluate the quality of multimedia learning. Starting with the presentation design, the assessment looks at how audio and visual elements are designed to enhance understanding of the material. In addition, ease of user navigation, interface consistency, and the presence of adequate help features are the focus of ease of interaction. Accessibility ensures that the media can be easily accessed, including on mobile devices, through appropriate control settings and presentation formats. Reusability measures how flexible the media is in terms of being reused in various learning contexts and with students from diverse backgrounds. Finally, Compliance Standards measure how well the media adheres to international standards and specifications to maintain quality and compatibility.

The next assessment instrument that will used by media expert and subject matter exprets to provide numerical assessments of Nutriolic media. Assessments are made using a Likert scale (1-5), where 1 indicates “very poor” and 5 indicates “very good.”. Expert Assessment of multimedia Instrument Based on Learning Object Review Instrument (LORI) v2.0 can be seen on tabel 3.2. Meanwhile, a comprehensive multimedia validity tool based on the Learning Object Rating Instrument (LORI) version 2.0 can be found in Appendix A.1.

Table 3. 2 Multimedia Expert Assessment Instrument Based on Learning Object Review Instrument (LORI) v2.0

No	Assessment Criteria	Assessment				
Presentation Design						
	Multimedia design (visual and audio) can help improve learning.	**1**	**2**	**3**	**4**	**5**
Ease of Interaction (Interaction Usability)						
	Ease of navigation.	**1**	**2**	**3**	**4**	**5**
	The interface is predictable.	**1**	**2**	**3**	**4**	**5**
	Helpful interface quality.	**1**	**2**	**3**	**4**	**5**
Accessibility						
	Ease of access.	**1**	**2**	**3**	**4**	**5**
Interaction Usability						
	Multimedia design accommodates learning.	**1**	**2**	**3**	**4**	**5**
Reusability						
	Ability to be used in various learning variations and with different learning	**1**	**2**	**3**	**4**	**5**
Standards Compliance						
	Comply with international standard specifications	**1**	**2**	**3**	**4**	**5**

(Nesbit, et al, 2009)

Table 3.2 contains the assessment tools used to evaluate the quality of Nutriolic. The presentation design aspect determines the extent to which visual and audio design can improve understanding of the material. Ease of Interaction (Interaction Usability) covers the quality of features that facilitate user experience, interface consistency, and ease of navigation. Our focus is to ensure that everyone, including those in various learning situations, can access it. Reusability assesses how well the media can be reused for students with diverse backgrounds and learning variations. Compliance Standards monitor the media's conformity with international specification standards to ensure its quality and compatibility.

3.3.3 Material Validation Instrument

The validation of materials intended for subject matter experts (lecturers) and science teachers was carried out by referring to the core competencies and basic competencies of Natural Sciences for Grade 8 Junior High School to evaluate whether the materials contained in the nutrition learning media in the Nutrolic application were appropriate and could be used for junior high school students in accordance with the objectives. The assessment used adapts the LORI assessment instrument. In the LORI instrument, aspects that can be categorized in evaluating the material include:

Content Quality: Accuracy, balanced presentation of ideas, appropriate level of detail, and ease of use in various contexts.

1. Alignment with Learning Objectives: Alignment between learning objectives, activities, assessment, and student characteristics.
2. Feedback and Adaptation: Adaptive content or feedback influenced by student input or student learning models.
3. Motivation: The ability to motivate and engage the identified group of students.

The material aspects evaluated, along with Description of each aspect based on the LORI Instrument, can be seen in Table 3.3.

Table 3. 3 Description Material validation instrument Based on LORI Learning Objects Review Instrument v2.0

Indicator	Description
Content Quality	Veracity, Accuracy, Balanced presentation of ideas, Appropriate level of detail.
Learning Goal Alignment	Alignment among learning goals, Activities, Assessments, Learner Characteristics.
Feedback and Adaptation	Adaptive content of feedback driven by differential learner input or modeling
Motivation	Ability to motivate and interest an identified population of learners

(Nesbit, et al, 2009)

Table 3.3 describes the elements needed to assess the suitability of learning materials. Content qualifications include accuracy, precision, balance in the presentation of concepts, and level of detail in the material. Alignment Learning Goals observes the suitability between learning objectives, activities, assessments, and student characteristics. Feedback and Adaptation assesses the material's ability to provide adaptive feedback based on differences in student input or characteristics. However, motivation is a measure of how strongly the material can motivate and engage the target students.

Assessment by subject matter experts was conducted using a Likert scale (1–5), where 1 indicates a ‘very poor’ rating and 5 indicates a ‘very good’ rating. The aspects assessed include the quality, accuracy, and depth of the material in supporting student learning and the development of science

literacy. This assessment instrument is based on the Learning Object Review Instrument (LORI) version 2.0. Table 3.4 presents the material assessment instrument by experts based on LORI, and the complete material validity instrument can be found in Appendix A.2.

Table 3. 4 Material Expert Assessment Instrument Based on Learning Object Review Instrument (LORI) v2.0

No	Assessment Criteria	Assessment				
Content Quality						
	Veracity	**1**	**2**	**3**	**4**	**5**
	Accuracy	**1**	**2**	**3**	**4**	**5**
	Balanced presentation of ideas	**1**	**2**	**3**	**4**	**5**
	Appropriate level of detail	**1**	**2**	**3**	**4**	**5**
Learning Goal Alignment						
	Alignment among learning goals	**1**	**2**	**3**	**4**	**5**
	Activities, clarity of description, discussion, examples, simulations, exercises (Activities)	**1**	**2**	**3**	**4**	**5**
	Learner Characteristics	**1**	**2**	**3**	**4**	**5**
	Assessments	**1**	**2**	**3**	**4**	**5**
Feedback and Adaption						
	Adaptive content of feedback driven by differential learner input or modeling	**1**	**2**	**3**	**4**	**5**
Motivasi (Motivation)						

No	Assessment Criteria	Assessment				
	Ability to motivate and interest an identified population of learners	**1**	**2**	**3**	**4**	**5**

(Nesbit, et al, 2009)

Table 3.4 contains assessment tools used by subject matter experts to evaluate the quality of learning content. Accuracy of facts, precision, balance of ideas, and depth of material are components of content quality. Learning Goal Alignment assesses the alignment between learning objectives and activities, assessments, and student characteristics. This includes clear descriptions, illustrations, discussions, simulations, and exercises. The focus of Feedback and Adaptation is the ability of the material to provide feedback that is appropriate to the differences in input or needs of learners. Finally, motivation is a measure of the extent to which the material can attract the attention and motivate the targeted students to learn.

3.3.4 Student Assesment Instrument for Multimedia

The student assessment instrument for multimedia is used to determine student responses to web-based interactive learning multimedia using the Guided Inquiry model. The instrument used is a rating scale, the same as the instrument used in media validation by experts. The instrument is a questionnaire assessing the interactive learning multimedia can be seen on table 3.5.

Table 3. 5 Student Responses Instrument to Multimedia

No	Aspects Assesment	Assessment				
Software Aspects						
	Ease of Use	**1**	**2**	**3**	**4**	**5**
	comfort of interaction	**1**	**2**	**3**	**4**	**5**

System Stability and Reliability	**1**	**2**	**3**	**4**	**5**
Learning Aspects					
Clarity of Learning Content Presentation	**1**	**2**	**3**	**4**	**5**
Stimulation of Learning Motivation	**1**	**2**	**3**	**4**	**5**
Creating an engaging learning environment	**1**	**2**	**3**	**4**	**5**
Increased Understanding and Knowledge	**1**	**2**	**3**	**4**	**5**
Suitability of activities to materials	**1**	**2**	**3**	**4**	**5**
Aspects of Visual Communication					
Attractive Visual Design Quality	**1**	**2**	**3**	**4**	**5**
Clarity and Readability of Text.	**1**	**2**	**3**	**4**	**5**
Clarity of Function and Navigation on Buttons	**1**	**2**	**3**	**4**	**5**

Table 3.5 contains assessment tools used to evaluate student responses to learning media. The software is assessed based on ease of use, ease of interaction, and system stability and reliability. The learning aspect examines whether the material is presented clearly, whether the media can motivate students to learn, whether the learning atmosphere is engaging, whether the activities are appropriate for the material, and whether the material is easier to understand and comprehend. The visual communication aspect, on the other hand, focuses on the quality of visual design, text readability, clarity of functions, and button navigation.

3.3.5 Assessment Instrument Science Literacy

The science literacy measurement tool in this study was designed to measure the extent to which the Nutriolic application can facilitate the development of students' science literacy in nutrition learning. This instrument is in the form of a questionnaire using a 1-5 Likert scale, with ratings ranging from “very poor” to “very good.” The indicators in this questionnaire were designed based on the characteristics of science literacy as defined by the (OECD, 2025). The indicators of science literacy aspects in this study include: Explaining Phenomena Scientifically, Designing and Evaluating Scientific Investigation Designs and Interpreting Data, Researching, Evaluating, and Using Scientific Information for Decision-Making and Action. The assessment instrument science literacy can be seen in Table 3.6. Meanwhile, a comprehensive material validity tool based on the Learning Object Rating Instrument (LORI) version 2.0 can be found in Appendix A.2.

Table 3. 6 Assessment instrument scientific literacy

Explaining Phenomena Scientifically						
No	**Statement**	**1**	**2**	**3**	**4**	**5**
1	Understanding the function of nutrition through Nutriolic media					
2	The relationship between nutritional issues and scientific explanations					
3	Understanding the cause and effect of scientific phenomena from application content					

Developing and Evaluating Scientific Investigation Designs and Interpreting Data						
4	Preparation of scientific research steps.					
5	Identification of variables in experiments					
6	Understanding data through tables/graphs					
7	Drawing logical conclusions from data/graphs					
Researching, Evaluating, and Using Scientific Information for Decision Making and Action						
8	Formulating scientific arguments based on data					

Table 3.6 shows the assessment tools used to check how well students understand science. Understanding nutrition through nutriolic media, knowing how science explains nutrition issues, and understanding the cause-and-effect relationships of scientific phenomena are all part of explaining phenomena scientifically. Developing and evaluating scientific research designs and interpreting data include designing research procedures, identifying variables, understanding data in the form of tables or graphs, and drawing logical conclusions. However, students' ability to formulate scientific arguments based on data obtained is measured through research, evaluation, and the use of scientific information for decision-making and action.

3.4 Data Analysis

Data will be analyzed descriptively by looking at the results of assessments from expert questionnaires, science teachers and students. The data taken is in the form of scores on a scale of 1 to 5 and also a description of each assessment

3.4.1 Data Analysis of Field Study Instruments

Data analysis of field study instruments is carried out after conducting field studies study by formulating the results obtained through questionnaires and literature studies. literature study. The data is then processed and analyzed to see if multimedia needs to be developed.

3.4.2 Rating Scales

According to Sugiyono (2013, p. 141), a researcher must be able to interpret each number given in the answer choices for each instrument item when using a rating scale. Calculations using the rating scale can be done with the following formula:

$$P = \frac{Score\ obtained\ from\ data\ collection}{Ideal\ score} \times 100\%$$

Note: P= Percentage Number

Ideal Score: Highest Score per item x Number of respondents x Number of item.

the level of validation of learning media in this study is classified into five categories, can be seen in table 3.7

Table 3. 7 Categories Validation Learning Media

(Sugiyono, 2013, p 143)

Table 3.7 shows the categories of learning media feasibility assessment based on percentage scores. Categories with scores of 20 or less are considered highly unfit, categories 21 to 40 are unfit, categories 41 to 60 are moderately fit, categories 61 to 80 are moderately fit, and categories 81 to 100 are highly fit. The level of media suitability is measured using these categories.

3.5 Research Procedures

As mentioned in the research method, this research and development will use the ADDIE (Analysis Design Development Implementation Evaluations) model. The ADDIE development model has five development steps, namely: (1) Analysis Phase, (2) Design Phase, (3) Development Phase; (4) Implementation Phase, (5) Evaluation Phase, which is explained in the following syntax:

1 Analysis This stage aims to analyze the needs including analysis learning media and analysis content, and identify the problem.

2 Design The design stage is the stage where the verification of the problems that occur are in accordance with the proposed solutions. In this case the proposed solution is the development of web based learning. The design state includes verifying the material, writing the objective, creating

Grade %	category
$P \leq 20$	Very Inappropriate
$21 \leq P \leq 40$	Inappropriate
$41 \leq P \leq 60$	Feasible Enough
$61 \leq P \leq 80$	Feasible
$81 \leq P \leq 100$	Very feasible

nutriliotic using platform lavera and Canva website, and creating an

instrument which is expert judgement rubrics and questionnaire for student's feedback.

3 Development At this stage learning media products are made and validated. The validation is done by a media expert, material expert, and science teacher. After the product media validated, the next step is to revise the product.

4 Implementation At this stage, researchers collect the data from the student questionnaire. Researchers disseminate the revised nutriolic to the students then collect the feedback from the students.

5 Evaluation Evaluate the students' questionnaire feedback to know how the web learning media can facilitate student scientific literacy in learning nutrition.

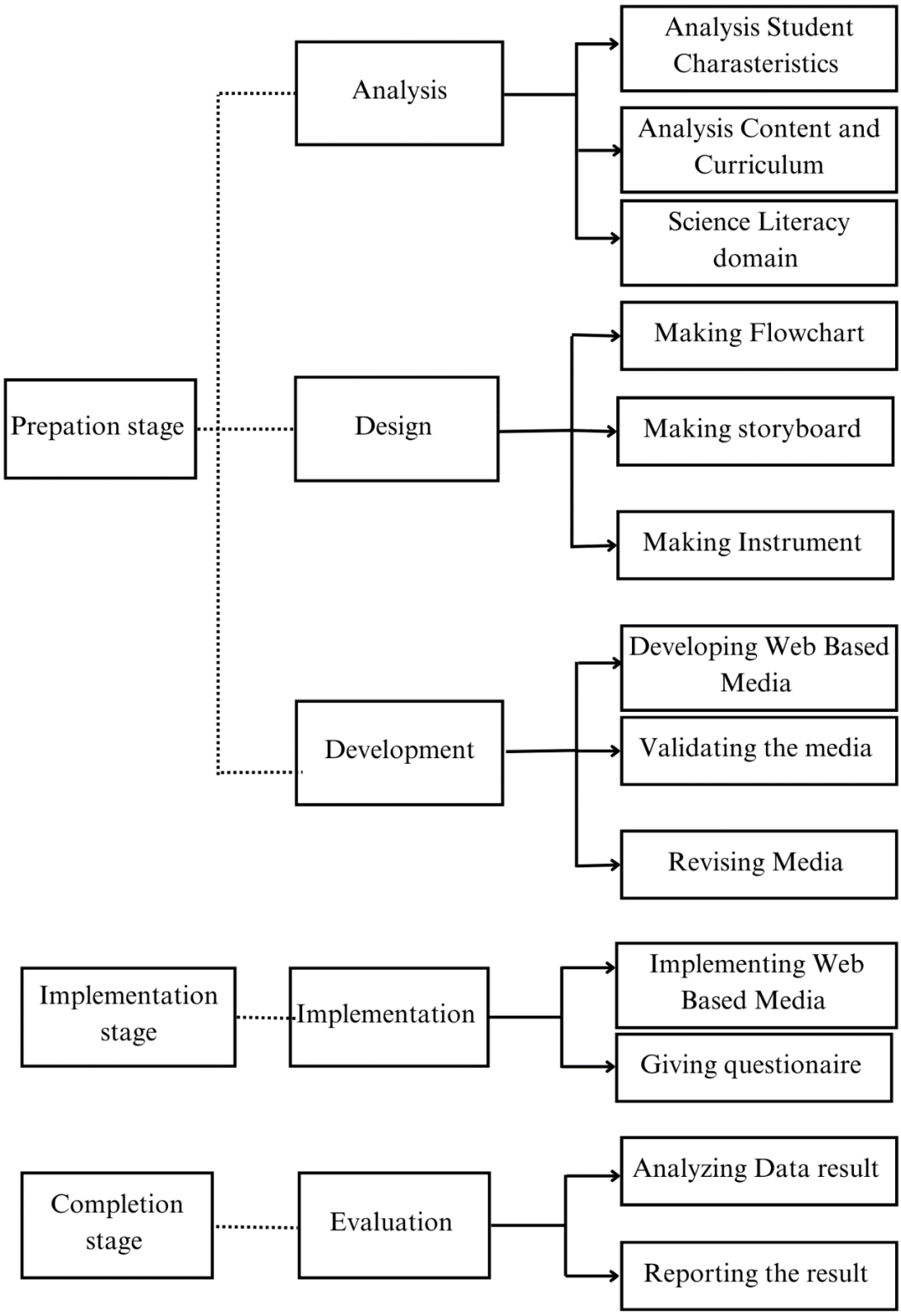

Figure 3. 2: Research Procedures