CHAPTER 3
RESEARCH METHODOLOGY

3.1 Research design

The ADDIE (Analyze, Design, Develop, Implement, and Evaluate) research method was used in this research. ADDIE was ideal for creating and developing learning products (Branch, 2009). In this research, the learning products made were IoT32 training kit and tutorial module. the learning product was used as a learning media in embedded systems and IoT courses.

3.2 Research Procedures

The researched procedure in this research could be seen in Figure 3.1.

![Figure 3.1 Research Procedures](image-url)
Based on Figure 3.1, in the analyze stage, the researcher observes and collects information and analyzes the need for learning media in the embedded systems and IoT courses. At the design stage, researchers design learning media products according to the needed results obtained from the analysis in the first stage. At the development stage, researcher were comparing the learning products had been made with planning in in the previous stage, then training kit was tested functional, and instruments tested as validity. The implementation stage consists of two stages, there were limited testing and participants response testing. Limited testing were conducted online with participants selected and approval from participants. At this stage, the participants was given socialization regarding the technical flow of data collection. The next step was to provided training kits and the accessibility schedule remotely with 5 participantss each day. After the accessibility of the training kit was finished, the participants were asked to fill out the evaluation form that the researchers had prepared. A participants response and cognitive assessment test was done by filling the online questionnaire after accessing the training kit. Whereas researchers made assessments of affective and psychomotor by observing participants behavior during practiced. In the final stage, researcher conducted an analysis of the studied instrument and described the researched results.

3.3 Participants

The technique used to select participants is purposive sampling. The participants involved in this research were 31 students of the Electrical Engineering Education which taking embedded systems and IoT courses. The participants consists of 17 male and 14 female students in the age of 20-22.

3.4 Data Collection

3.4.1 Literature Review

The first data-collecting technique was a literature review. It did by reading, understanding books, and some literature relating to this research. This technique
was used in collecting data from references related to researched objects to determine conclusions from the research being done.

3.4.2 Observation

At the observation stage, researcher observe the environment and the availability of learning infrastructure at industrial electrical engineering laboratory. Researcher found that there was no learning media for IoT material in embedded systems and IoT courses.

3.4.3 Questionnaire

This research used closeted questionnaires because the approach used was quantitative. The distribution of questionnaires was done online use a google form platform. The questionnaire was used to measure participants response, cognitive assessment, affective and psychomotor. The participants response questionnaire consists of three aspects covering material quality, media used, and learning.

3.5 Research Instruments

The questionnaire of participants response was made with five scales on a Likert scale of 1 - 5 with predicates "bad", “fair", "good," "very good," and "excellent". The questionnaire of assessment was made in three aspects there were cognitive, affective, and psychomotor based on the basic competencies of the IoT system.

The aspect of cognitive assessment was made in multiple-choice which participants would did with a maximum score of 100 points. The aspect of affective assessment was made with five scales on the Likert scale same as the participants response questionnaire. The aspect of psychomotor assessment was made with five scales on a Likert scale of 1 - 5 with predicates “Not Skilled”, “Less Skilled”, “Sufficiently Skilled”, “Skilled” and “Very Skilled”. the affective and psychomotor aspects were filled in by the researcher with reference to the indicators contained in Appendix 2.
3.6 Data Analysis

In this research, the data analysis technique that the researcher used was the Mann-Whitney's u test, also known as the Wilcoxon rank-sum test, and was a non-parametric version of the t-test (Yantai, 2014). Mann-Whitney's u test was used when:

a. The dependent variable was ordinal;
b. The dependent variable was a ratio or interval, but it could not be assumed that the population forms a normal distribution.

In this research, Mann-Whitney's u test was used to compare the responses' trend and measured how significant the difference in responses between male and female participants was to this learning media.