CHAPTER 3

RESEARCH METHOD

3.1 Stages of Research

The following are the steps of the research stages carried out in figure 3.1. The stages of the research are as follows:

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┌─────────────────────────┐
│     Data Collection     │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ Validity & Reliability  │
│          Test           │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ Implementing Algorithm  │
│           C4.5          │
└─────────────────────────┘
            │
            ▼
┌─────────────────────────┐
│ Performance Evaluation  │
└─────────────────────────┘
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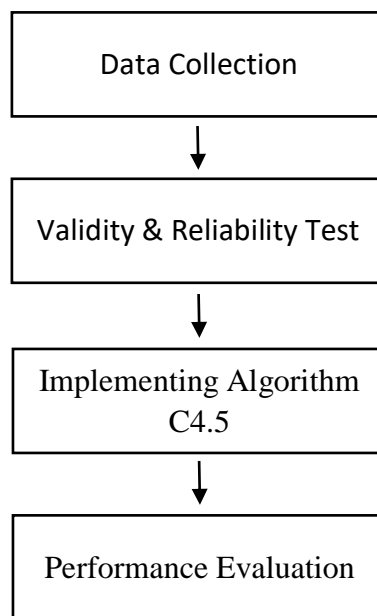
Figure 3.1 Stages of research

3.2 Data Collection

The data collection was carried out by distributing questionnaires, the variable of the questionnaire can be seen in Table 3.1. The sample of this study is active students in the Department of In Mechanical Engineering at Muhammadiyah Kalimantan Timur University class 2019. In this study, the data was used to make several questions related to the offline learning system process. As many as 20 questions were then compiled and created using Google Form. Students in the Mechanical Engineering class of 2019 fill out each question according to what they want to feel during the offline learning process. each question has 5 dimensions consisting of tangible, reliability, responsiveness,

assurance, and empathy. An example of a question data set that will be created in the google form can be seen in table 3.1.

Table 3.1 Question

Nu	Question	Dimension
1.	Learning facilities (lecture materials) are well prepared	Tangible
2.	Lecturers are consistent with a predetermined schedule	
3.	Using an LCD projector in learning makes it easier for me to understand what is being taught	
4.	The curriculum provided is in accordance with the competencies, needs, and developments of the times	
5.	The material presented by the lecturer is easy to understand	Reliability
6.	Lecturers start and end lectures on time according to the schedule	
7.	Lecturers give group assignments as effectiveness in learning	
8.	Give assignments according to what has been taught by the lecturer	
9.	Provided time for discussion and question and answer	Responsiveness
10.	Responsiveness of lecturers in answering questions from students	
11.	Students who have difficulty in the subject being taught	
12.	Lecturers have mastered the subjects that have been taught	

Table 3.2 Question (Continue)

Nu	Question	Dimension
13.	Lecturers deliver lectures according to the lesson plan	Assurance
14.	Lecturer's ability in presentation	
15.	Evaluation is given after each lecture delivery	
16.	The appearance of the lecturer seen from the attitude, behavior, and speech has met the standard of politeness	
17.	Lecturers are easy to contact either via Whatsapp, SMS, phone, email, or others	Empathy
18.	Understanding student interests and needs	
19.	Lecturers are open and discuss with students	
20.	Lecturers give tolerance or any opportunity	

To measure the level of satisfaction of the offline learning process in students using a questionnaire by providing a score for the answers to the questionnaire that was filled in by the respondents, then the level of satisfaction depends If you choose number 1 then the answer is (Very Not Satisfied), If you choose number 2 then the answer is (Not Satisfied),If you choose number 3 then the answer is (Satisfied), and If you choose number 4 then the answer is (Very Satisfied)

3.3 Validity and reliability test

In the data process, there will be validity and reliability tests. A validity test is used to measure whether the questionnaire is valid or not, while the reliability test is used to measure the same symptoms and if the measurement results obtained are relatively consistent, then the measuring instrument is reliable. Questionnaire items are said to be valid if the value of "$rhitung$" is higher than "$rtabel$". The formula for the validity and reliability test is below:

a) Validity test formula

Validity test is used to measure whether or not the used variable is valid. To measure the validity of a variable using formula 3.1. After getting the rxy value for each item, then rxy compared to the r table. If rxy is smaller than r table

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then thr variable item is stated invalid and if rxy is greater than r table then the variable is stated valid.

$$r_{xy} = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)}}$$ (3.1)

Where r_{xy} is correlation coeffition X and Y, N is number of subjects, $\sum XY$ is X and Y multiplication score, $\sum X$ is amount of X, $\sum X^2$ is sum of X squares, $\sum Y$ is amount Y, and $\sum Y^2$ is sum of Y squares.

b) Reliability test formula

Reliability test is used to shows the measuring instrument can be trusted or reliable. To measure a questionnaire is reliable or not using, calculating the reliability using Equation 3.2. To determine the level of reliability of the questionnaire using Guilford Reliability Coefficient Category Table 3.2.

$$r_{11} = \left(\frac{K}{k-1}\right)\left(1 - \frac{\sum \sigma_b^2}{\sigma_1^2}\right)$$ (3.2)

Where r_{11} is instrument reliability, K is many questions, $\sum \sigma_b^2$ is varians items summary, and σ_1^2 is total varians.

Table 3.3 Guilford Reliability Coefficient Category

Scale	Description
0,80 ≤ r11 ≤ 1,00	Very High
0,60 ≤ r11 ≤ 0,80	High
0,40 ≤ r11 ≤ 0.60	Medium
0,20 ≤ r11 ≤ 0,40	Low
0,00 ≤ r11 ≤ 0,20	Very Low

3.4 Implementing the C4.5 Algorithm

The C4.5 algorithm uses entropy and gain for the selection of attributes to generate the decision tree. The root node or the first node will have the greatest gain value. The decision tree participation process stops when all the branches in node N are in the same class, there are no attributes in the branch that can be subdivided and there are no empty branches. To calculate the entropy using Equation 3.3 and to calculate gain using Equation 3.4.

a) Entropy value formula

$$Enthropy(S) = \sum - pi * log_2\, pi \qquad (3.3)$$

S denotes the case set, A denotes the feature, N denotes the number of partitions, and Pi denotes the ratio of Si to S.

b) Gain value formula

$$Gain(S,A) = Enthropy(S) - \sum_{i=l}^{n} \frac{|Si|}{|S} * Enthopy(Si)(2) \qquad (3.4)$$

S is the Case set, A is an attribute, n is the number of attribute partitions, |Si| is the number of cases on partition I, and |S| is the number of cases in S.

3.5 Performance Evaluation

in the final stage, the evaluation is carried out to analyze and measure the accuracy of the C4.5 algorithm model using Split Validation. Split Validation is a technique that divides two parts of the data randomly, partly as training data and partly as test data with a ratio of 7:3