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Designing a Measurement Model for the Effectiveness of Online Learning Using C4.5 Algorithm

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Abstract— Technological developments in the world of education have led to many innovations to support education such as online learning in the learning process amid the Covid-19 pandemic. Changes in learning methods that occur suddenly from conventional learning methods or directly switch to distance learning methods or using online learning media greatly impact and affect students who come from underprivileged families and students who are in areas where internet access and infrastructure are lacking. support. This study aims to create a classification model for measuring the effectiveness of online learning in the Pringsewu area using the classification method. The classification method is used to classify data based on the nature of the data that has been recognized by each class. Various methods can be used to classify data, namely the C4.5 Algorithm method. The results of the research carried out are a design classification model for measuring the effectiveness of online learning in the Pringsewu area such as Internet Access, Network Infrastructure, Learning Media, Device Networks, Mastery of Technology Operations, School ICT Infrastructure, Learning Concepts, Motivation in Online Learning, Understanding of Learning Materials.

Keywords—Design, Effectiveness, Online Learning, C4.5 Algoritm

I. INTRODUCTION

The development of technology has many impacts and benefits on human life both positive and negative impacts both in work, interaction and socialization and in terms of education and learning. This proves that the development of technology greatly affects the progress of human civilization. Significant technological developments demand changes in the management of life and society including education. The development of technology in the world of education gave rise to many innovations to support education in the learning process during the Covid-19 pandemic.

Covid-19 is a virus that attacks the respiratory system and can cause death. Based on UNICEF data in 2020 more than 120 countries have imposed restrictions on social interaction through school closures that impacted 1.6 million students worldwide including Indonesia. The widespread spread of covid-19 in Indonesia forced the government to restrict social interactions including learning activities in schools. At least 60 million students in Indonesia have been affected by the covid-19 pandemic globally.[1]

With the Covid-19 pandemic, online learning has increased and become popular because all teaching and learning activities throughout Indonesia must apply online learning methods to break the chain of the spread of covid-19.

Research that has been done previously [2] with the title Exploring presence in online learning through three forms of computer-mediated discourse analysis has analyzed the effectiveness of online learning in teaching, social and cognitive and the results of the study showed positive results where learning using online media is effective in teaching, social and cognitive.

Research [3]. The research discusses the inability of students to complete timely studies at universities. The study used data mining techniques with two methods namely Algorithm C4.5 and Naive Bayes with preprocessing to obtain a quality dataset to predict student graduation status, the results showed that the C4.5 Algorithm method can be used to predict student graduation status with an accuracy rate of 79.08%.

Previous research conducted an analysis of online learning media on teaching and the use of the C4.5 algorithm method to predict student graduation. In this study, the authors tried to use the C4.5 method to create a measurement model of the effectiveness of online learning in the pringsewu region. The Pringsewu Region itself has never been measured the level of effectiveness of learning using online media. For this reason, research will be conducted to measure the effectiveness of learning using online media in the Pringsewu Region using the C4.5 data mining algorithm in classification using variables that can be used as criteria for determining the effectiveness of learning applications using online media. The C4.5 algorithm method is used because it is a classification method that can be helpful in finding models to describe the classification class effectiveness of applying online learning methods in the Pringsewu Region.

II. LITERATURE RIVIEW

A. Previous Research

Several previous studies related to this research, and used as a reference in this study are set out in table 1 below.

TABLE I. PREVIOUS RESEACH

No	Title	Description
1	The Effectiveness of Integrated Online Learning in the 4.0 Education Era	The research discusses the effectiveness of online learning in the 4.0 era which emphasizes the integration of the environment from various sources. The results of the study show that online learning will be effective if the essential components applied from laurillard include discursive, adaptive, interactive, and reflective aspects. Of the 117 students, 17 participants (14.53%) chose to use only online learning, while the other 89 students (76.07%) tended to choose a combination of online learning. Thus, it is important for innovation in the form of integration with the environment that refers to the digital learning ecosystem component that can accommodate learning styles, flexibility, and student learning experiences so that it can create positive feelings.
2	The Use of E-Learning in Project-Based Learning at SMA Negeri 1 Jepara	This study discusses the effectiveness of using e-learning as a solution to increase teacher-student interaction time which is lacking in the application of project-based learning. The results of the study show that the use of e-learning applications, both Schoology and Edmodo in PBP, is significantly effective, it can be seen from: (1) spiritual attitudes, social attitudes, projects, products, student responses are at a minimum good category and students' learning completeness has reached the Minimum Completeness Criteria (KKM), (2) the significance value is 0.018, which is smaller than = 0.05, which means that there are differences in the use of E-learning Schoology and Edmodo applications in PBP on student learning outcomes, (3) the significance value is 0.598 greater than = 0.05 which means that there is no difference in the learning outcomes of male and female students, and (4) a significance value of 0.906 is greater than = 0.05 which means that there is no relationship between the use of the PBP E-learning application and learning outcomes of male and female students.

B. Data Mining Concept

According to Efrain Turban (2005), Data mining is a process that uses statistical techniques, mathematics, artificial intelligence, and machine learning to extract and identify useful information and related knowledge from various large databases [4].

According to Daniel T. Larose (2004), Data Mining is the process of discovering meaningful new correlations, patterns, and trends by sifting through large amounts of data stored in repositories, using pattern recognition technology as well as statistical and mathematical techniques. [5]

According to Kusrini (2009), the terms data mining and knowledge discovery in databases are often used interchangeably to describe the process of extracting hidden information in a large database. Understanding the two terms have different concepts but are related to each other. One of the stages in the whole process of knowledge discovery in databases is data mining.

Based on some of the definitions of data mining above, it can be concluded that data mining is a process to find patterns using statistical techniques to explore hidden information in one large database.

Knowledge discovery in databases, in general, can be in the picture right below.

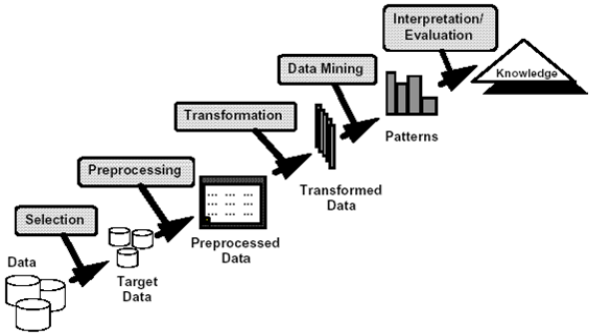

Figure 1 Stages of *Knowledge Discovery in Databases*

Data mining is divided into several groups based on the tasks that can be done, namely [5]:

1) description
   Sometimes analytical research simply wants to try to find a way to describe the patterns and trends contained in the data. Descriptions of patterns and trends often provide possible explanations for a pattern or trend.
2) Estimate
   Estimation is almost the same as classification, except that the estimation target variable is more numerical than categorical. The model is built using a complete record that provides the value of the target variable as the predicted value. Furthermore, in the next review, the estimated value of the target variable is made based on the value of the predictive variable.
3) Prediction
   The prediction has similarities with estimation and classification. It's just that, the prediction of the result shows something that hasn't happened yet (may happen in the future).
4) Classification
   In the classification of variables, objectives are categorical. For example, we will classify income into three classes, namely high income, medium income, and low income.
5) Clustering
   Clustering is a grouping of records, observations, or attention and forms a class of objects that have similarities. A cluster is a collection of records that have similarities with one another and have dissimilarities with records in other clusters. Clustering differs from classification in that there is no target variable in clustering.
6) Association
   Identify the relationship between various events that occur at one time

C. Online Learning

The definition of online learning is a learning method that uses an interactive model based on the Internet and Learning Management System (LMS). Like using Zoom, Google Meet, Google Drive, and so on. Online activities include Webinars, online classes, all activities carried out using internet networks and computers. *[6]*.

With the application of online learning methods, students can exchange information and create interactions that are real-time and non-real-time, in addition, the material can be designed multimedia all and dynamically. Learners can connect to various virtual libraries around the world and make it a medium for improving understanding. Teachers/instructors/lecturers can quickly add reference teaching materials that are case studies, industry trends, and technology projections going forward through various sources to add participants' insight into their teaching materials.

III. Research Methodology

A. Data Collection Techniques

Data collection methods are important in research and are strategies or ways used by researchers in collecting data needed in their research. The data collection methods used in this study are:

1. *Research Library*
   The literature review is conducted by reading, quoting, and making notes sourced on library materials that support and relate to research in this regard regarding data mining Algorithm C4.5
2. Questionnaire
   In this study, the authors will use electronic questionnaires (google form) behind closed doors. The distribution of questionnaires will be divided into two stages, the first stage will be carried out the distribution of questionnaires for the determination of criteria, and the second stage after the test validity and reliability of criteria. The answers provided are adjusted to the Likert scale. According to sugiyono (2016:136), "the Likert scale is used to measure the attitudes, opinions, and perceptions of a person or group about social events or phenomena".

B. Algoritma C4.5

Rock and Maimon, (2012) C4.5 algorithm are one of the methods for making decision trees based on training data that has been provided. The C4.5 algorithm is a development of ID3. Some of the developments carried out in C4.5 are as one that can overcome missing value, can overcome continued data, and pruning.[7]. The decision tree is the result of the process of calculating entropy and information gain, after repeated calculations until all attributes of the tree have a class and can no longer be done in the calculation process. [8].

The decision tree is usually expressed in the form of tables with attributes and records. An attribute states a parameter created as a criterion in the formation of a tree. Change the tree resulting in several rules. The number of rules is equal to the number of paths that may be built from root to leaf node(branch). [7]. Tree Praining is done to simplify the tree so that accuracy can increase. Pruning has two approaches:

1) *Pre-praining*, That is, stopping the development of a subtree early (i.e. by deciding not to further partition training data). When it stops immediately, the node turns into a leaf. These end nodes became the classes that most often appeared among a subset of the sample.
2) *Post-praining*, That is to simplify the tree by removing some subtree branches after the tree is completed. Nodes that are rarely cut will be leaf (end nodes) with classes that appear most often.

In general, the C4.5 algorithm for building decision trees is as follows:[9].

1.Select the attibute as the root.
2.Create branches for each value.
3.For cases in branches.
4.Repeat the process for each branch until all cases on the branch have the same class.

To select an attribute as a root is based on the gain value ratio of existing attributes. To calculate the gain ratio use the following equation formula.

$$Gain\_ratio(v) = \frac{Gain(v)}{Split\_Info(v)} \qquad (2.1)$$

Information:
Gain (v) *:* gain of each attribute
Split_Info *:* split attribute information

The value of split info *(v)* can be searched with equations

$$Split_{info(v)} = \sum_{i=1}^{n} \frac{|T_i|}{|T|} - log \frac{|T_i|}{|T|} \qquad (2.2)$$

Information:
n : Number of attributes
T : Number of data Instance frequencies
T_i : Number of frequencies in the i-th value attribute

Meanwhile, the calculation of entropy values can be seen in the following equation.

$$Entropy\ (S) = \sum_{i=0}^{n} -pi * \log_2 pi \qquad (2.3)$$

Information:
S : Case Set
n : Number of cases on partition S
pi : Proportion of Si to S

The C4.5 algorithm has the advantage of being able to produce a decision tree that is easily interpreted, has an acceptable level of accuracy, efficient in handling discrete and numerical type attributes, in constructing the C4.5 algorithm tree to read the entire sample of training data from storage and load it into memory. One of the disadvantages of the C4.5 algorithm in the category of "Scalability" is that it can only be used in the training data can be stored in its entirety and at the same time in memory.

C. Test Validity and Reliability

In a study before analyzing the data, the test of the research instrument will first be conducted. Data testing of research instruments can be done using tests of validity and reliability of instruments to be used in research. In this study, the authors used validity and reliability tests to

measure the validity and reliability of the criteria to be used to measure the effectiveness of online learning.

1. Tes Validity *(Bivariate Person – Product Moment)*

   According to (Sugiyono, 2016:168) "valid means that the measuring instrument used to get the data (measuring) is appropriate. The validity of the measuring instrument is tested by calculating the correlation between the value obtained from each item of the statement and the overall obtained on the measuring instrument. The method used to test validity in this study is Bivariate Person (Product Moment).

   The following product moment correlation formula:

$$r_{ix} = \frac{n\sum ix - (\sum i)(\sum x)}{\sqrt{[n\sum i^2 - (i)^2][n\sum x^2 - (\sum x)^2]}}$$

   Information:

   r_{ix} = Total item correlation coefficient *(bivariate person)*

   i = Item score

   r = Total Score

   n = Many subjects took the test

   Testing criteria *Bivariate Person (Product Moment)*

   a. If r calculates the > r table (test 2 sides with signification of 0.05) then the instrument or statement items correlate signification to the total score (declared valid).

   b. If r calculates the < r of the table (test 2 sides with signification of 0.05) then the instrument or statement items are not correlated signification to the total score (declared invalid).

2. Reliability Test *(Alpha – Cronbach)*

   According to (Sugiyono, 2016: 168) reliability is the result of research where there are similarities in data at different times. Reliability means keajegan, a measurement instrument that can be said to be real if the instrument can be used repeatedly and provide the same measuring results. An instrument reliability test is done to determine the consistency of the measuring instrument, whether the measuring instrument used remains consistent if used repeatedly. The reliability test method in this study used the alpha formula (Cronbach). Alpha formula is a procedure of finding reliability values by not requiring items into two groups (can also be applied to the two-side technique), so it can be applied to instruments with an odd number of items.

   Alpha Formula *(Cronbach)as follows*:

$$r_{ac} = \left[\frac{k}{k-1}\right]\left[1 - \frac{\sum \sigma b^2}{\sigma_{t^2}}\right]$$

Informations:

r_{ac} = Reliability of the instrument

k = Lost of questions

$\sum \sigma b^2$ = Number of item variants

σ_{t^2} = Varian total

Alpha assessment criteria (cronbach)

The significance test was carried out at a significance level of 0.05, meaning that the instrument can be said to be reliable if the alpha value is greater than the critical product-moment r.

D. Research Variabel

The data to be used in the research is data from the results of questionnaires distributed using online media (google form), where the attributes that will be used in the research questionnaire will be tested for validity and reliability first. Some of the attributes to be tested can be seen in the table below.

Table 1. Research Criteria

No	Criteria
1	Internet Access
2	Network Infrastructure
3	Learning Media
4	Device Network
5	Mastery of teachers in technology operation
6	School ICT Infrastructure
7	Learning Concept

IV. DISCUSSION

A. Validity Test

The validity test of the questionnaire was carried out to measure whether or not the questionnaire used in the study was valid. The test is carried out by correlating the score on each item with the total score then processing using the product-moment correlation formula using 109 data from the distribution of questionnaires that have been separated from the error questionnaire data.

Table 2 Variable Test

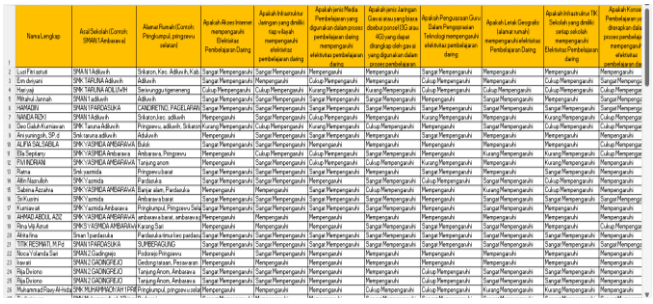

Table 3 Instrument Validity Test Results

No	Criteria	r Count	r Table	Information
1	Internet Access	0.628	0.176	Valid
2	Network Infrastructure	0.651	0.176	Valid
3	Learning Media	0.639	0.176	Valid
4	Device Network	0.648	0.176	Valid
5	Mastery of teachers in technology operation	0.564	0.176	Valid
6	School ICT Infrastructure	0.566	0.176	Valid
7	Learning Concept	0.551	0.176	Valid

Reliability Test

A reliability test was conducted to measure the consistency of the questionnaire which is an indicator of the construct or variable. A questionnaire is said to be reliable or reliable if the answers to the questions are consistent from time to time. Testing the reliability of the instrument using the Cronbach alpha formula.

Table 4 Reliability Testing Results of Research Variables

No	Criteria	r ac	Information
1	Internet Access	0.709	Reliabel
2	Network Infrastructure		
3	Learning Media		
4	Device Network		
5	Mastery of teachers in technology operation		
6	Shool ICT Infrastructure		
7	Learning Concept		

Based on the results of the validity and reliability tests that have been carried out, the 7 criteria presented are said to be valid and reliable as follows:

Tablel 5 Valid and reliable criteria

No	Criteria
1	Internet Access
2	Network Infrastrukture
3	Learning Media
4	Device Network
5	Mastery of teachers in technology operation
6	School ICT Infrastructure
7	Learning Concept

After testing the validity and reliability obtained 7 (Seven) valid and reliable criteria that will be used in this study, namely internet access, network infrastructure, learning media, learning concepts, network devices, mastery in technology operation, and ICT infrastructure owned by schools. In addition to these 7 (Seven) criteria, there are two (2) additional criteria, namely motivation in learning and understanding of learning materials referred to based on previous research conducted by I. M. Purwaamijaya, R. M. Masri, and B. M. Purwaamijaya. [10] where the criteria for motivation in learning and understanding of learning materials have been tested for validity and reliability.

Table 6 Research Criteria

No	Criteria
1	Internet Access
2	Network Infrastructure
3	Learning Media
4	Device Network
5	Mastery of teachers in technology operation
6	School ICT Infrastructure
7	Learning Concept
8	Motivation in Online Learning
9	Students' Understanding of Learning Materials

B. Pre-Processing Data

Data preprocessing is an initial data processing technique carried out in data mining to convert raw data collected from various sources such as Google forms and questionnaires into cleaner information which is then used for further data processing. Based on the distribution of the questionnaires conducted, the results obtained are 670 raw data.

Table 7. Raw Data

	Nama	Status (Guru/ Siswa)	Asal Sekolah	Kecepatan Akses Internet yang dimiliki	Infrastruktur Jaringan yang dimiliki wilayah	Jaringan yang dapat diakses Gawai/ Smartph	Media Pembelajaran	Konsep Pembelajaran	Motivasi Dalam pembelajaran online	pemahaman siswa terhadap materi pembelajaran	Penguasaan dalam pengoprasian Teknologi	Letak Geografis (Alamat Rumah)	Alamat Rumah	Infrastruktur TIK Sekolah	Nilai Hasil Evaluasi
1															
2	M.Musthudin	Guru	MAN Pringsewu	Tinggi	Jaringan Mobile	4G	Zoom	Teori dan praktik	Cukup	Cukup	Mampu	Kec. Pringsewu	Pringsewu Selatan	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
3	Noca Yolanda Sari	Guru	SMAN 2 GADINGREJO	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Pringsewu	Podorejo Pringsewu	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
4	Kurniawati	Guru	SMK Yasmida Ambarawa	Sedang	Wifi	4G	Microsoft Team	Teori dan praktik	Cukup	Rendah	Mampu	Kec. Pringsewu	Pringkumpul, Pringsewu	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
5	Tika ayu juita	Guru	Ma gppbqmk Ambarawa	Sedang	Wifi	4G	Zoom	Teori dan praktik	Tinggi	Cukup	Cukup Mampu	Kec. Ambarawa	Ambarawa	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
6	Erna dwijani	Guru	Smk taruna	Sedang	Wifi	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Tunggul pawenang	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
7	Samsul arifin	Guru	SMK	Sedang	Wifi	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Adiluwih	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
8	Nita Gustina	Guru	SMK Teknika Grafika Kartik	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Mampu	Kec. Gading Rejo	Gadingrejo	Jaringan Komputer Baik	Tujuan Pembelajaran Tidak Tercap
9	Novenda febriana	Kelas XI	sma negeri 01 gedong tataan	Sedang	Wifi	4G	Google Clasroom	Teori dan praktik	Tinggi	Cukup	Cukup Mampu	Kec. Gading Rejo	Jl. Sukada bagelen 4	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
10	Dewi indah	Guru	Smk Grafika	Tinggi	Wifi	4G	Google Clasroom	Teori dan praktik	Tinggi	Tinggi	Mampu	Kec. Gading Rejo	Gadingrejo	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
11	Ananda Istiqomah	Kelas XI	SMA negeri 1 adiluwih	Rendah	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Rendah	Kurang Mampu	Kec. Adiluwih	Agung timur	Jaringan Komputer Baik	Tujuan Pembelajaran Tidak Tercap
12	YOGA AGENG SAPUTR	Kelas XI	SMA N 1 ADILUWIH	Sedang	LAN	4G	Zoom	Teori	Rendah	Rendah	Cukup Mampu	Kec. Adiluwih	KUTAWARINGIN	Jaringan Komputer Kurang Baik	Tujuan Pembelajaran Tercapai
13	Frengki fransisko	Kelas XI	Sma N1 adiluwih	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Kurang Mampu	Kec. Adiluwih	Sukosari	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
14	ELLA DESMA JUVITA	Kelas XI	SMA NGGA 1 ADILUWIH	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	SRIKATON	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
15	Zulkifli	Kelas X	Mts ZAMAIS adiluih	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Mampu	Kec. Adiluwih	Bangun sari	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
16	Nuril Safitri	Kelas XI	SMA negeri 1 Adiluwih	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Kutawaringin	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
17	IKFINA MIFTAHURROH	Kelas XI	SMA NEGERI 1 ADILUWIH	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	TUNGGUL PAWENANG	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
18	Tarti anggraini	Kelas XI	SMA N 1 ADILUWIH	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Balairejo	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
19	ARIEL DWI ANDREAN	Kelas X	SMP N 1 ADILUWIH	Sedang	LAN	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	Depan Puskesmas ADILUWIH, Jl.kesehatan	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tidak Tercap
20	Joi limanda	Kelas XI	SMP 11 pesawaran	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori dan praktik	Cukup	Rendah	Kurang Mampu	Kec. Adiluwih	Trirahayu	Jaringan Komputer Kurang Baik	Tujuan Pembelajaran Tidak Tercap
21	Yonatan satya saputra	Kelas XI	SMANDIL	Sedang	LAN	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Pringsewu	Bangunsari	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
22	ARIEL DWI ANDREAN	Kelas X	SMP N 1 ADILUWIH	Sedang	LAN	4G	Google Clasroom	Teori dan praktik	Cukup	Cukup	Cukup Mampu	Kec. Adiluwih	DEPAN PUSKESMAS ADILUWIH, JL.KESEHATAN	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tidak Tercap
23	Alang yogi prasetio	Kelas X	SMA Negri 1 Adiluwih	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori	Cukup	Cukup	Mampu	Kec. Pringsewu	Adiluwih	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
24	Ahmad yatim febrianto	Kelas XI	SMA N 1 Adiluwih	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Mampu	Kec. Adiluwih	Srikaton	Jaringan Komputer Baik	Tujuan Pembelajaran Tercapai
25	Yarisa anggaraini	Kelas X	Mts sa zamais adiluwih	Sedang	LAN	4G	Google Clasroom	Teori	Cukup	Rendah	Kurang Mampu	Kec. Adiluwih	Srikaton	Jaringan Komputer Kurang Baik	Tujuan Pembelajaran Tidak Tercap
26	Endwiratnaningtyas	Kelas X	SMP N 1 Adiluwih	Sedang	LAN	4G	Google Clasroom	Teori	Cukup	Rendah	Kurang Mampu	Kec. Adiluwih	Srikaton	Jaringan Komputer Kurang Baik	Tujuan Pembelajaran Tidak Tercap
27	JESTIN NOVELITA ANG	Kelas X	SMA NEGERI 1 ADILUWIH	Tinggi	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Kurang Mampu	Kec. Adiluwih	SRIKATON	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
28	SATRIA ADI PRASETYO	Kelas XI	SMA N 1 ADILUWIH	Rendah	Jaringan Mobile	4G	Google Clasroom	Teori	Tinggi	Cukup	Cukup Mampu	Kec. Adiluwih	ADILUWIH	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
29	Desti Meliawati	Kelas XI	SMA NEGERI 1 ADILUWIH	Sedang	Wifi	4G	Google Clasroom	Teori	Cukup	Cukup	Kurang Mampu	Kec. Pringsewu	Adiretno kecamatan Kalirejo	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
30	Rizky Andi Yoga	Kelas XI	SMAN 1 pagelaran	Sedang	Jaringan Mobile	4G	Zoom	Teori	Cukup	Cukup	Cukup Mampu	Kec. Pagelaran	Sukaratu	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai
31	Kiki Saputra	Kelas XI	SMA N 1 Adiluwih	Sedang	Jaringan Mobile	4G	Google Clasroom	Teori dan praktik	Rendah	Cukup	Cukup Mampu	Kec. Adiluwih	Adiretno	Jaringan Komputer Cukup Baik	Tujuan Pembelajaran Tercapai

Data Penelitian Thesis | Data Olah | U Wilayah | Akses Jaringan | Penguasaan Teknologi

The amount of data in the raw data was obtained from google forms and printed questionnaires distributed in 17 SMA/SMK/equivalent in the Pringsewu district. From a total of 670 data, 147 of them were obtained from google forms and another 523 were obtained from the distribution of printed questionnaires. Of the 670 data collected, only 659 can be processed, while the other 11 data are error data. The error data contained in the raw data is data that cannot be corrected or used, this is because the 3 data are data obtained from junior high school students while in this study focused on online learning at the SMA/SMK/equivalent level, a total of 8 other data are data obtained from outside the Pringsewu area, while in this study only focuses on the Pringsewu district.

C. Modeling Process Using C4.5 Algorithm

This process is an implementation of making a classification model on data classification. In this process, there are two stages, namely the formation of a tree and changing the tree into a rule. In this process, the Rapid miner's application is used as a tool to make the data mining process.

Here are the steps of the C4.5 algorithm using Rapid miner.

a. Import Data Set
   The data set import process is carried out by importing or uploading the data set that will be used in the Rapid Miner application.
b. Change of Role to Target/Label
   At this stage, variable type changes and target/label changes are made.
c. Next, a filter is carried out on the missing data so that the process will not occur Error
d. Application of the Decision Tree Model (C4.5)
   At this stage, the selection of the model that will be used in the classification process is carried out.

After carrying out the four stages of the data testing process using an algorithm, a model formed from student data will be obtained based on variables such as Internet Access, Network Infrastructure, Learning Media, Network Devices, Mastery of Technology Operations, School ICT Infrastructure, Learning Concepts, Motivation in Learning Online, Understanding of Learning Materials, which have been tested for validity and reliability will form a decision tree which can then be used as a model for measuring the effectiveness of online learning.

BAB V CONCLUSION

Based on the discussion that has been described measuring the effectiveness of online learning using the C4.5 Algorithm on the data of high school/vocational/equivalent students in the Pringsewu area, it can be concluded that the model or function that describes the effectiveness of online learning classes on the data of high school/vocational/equivalent students in the Pringsewu area, it was formed using the C4.5 Algorithm method using several criteria that were used as the basis for measuring the effectiveness of online learning in the Pringsewu area, including internet access speed, network infrastructure owned by the region, networks that can be accessed by devices, learning media, learning concepts, motivation in online learning, understanding of learning materials, mastery of technology operation, and ICT infrastructure. From several criteria that are used as the basis for the measurement, then it is processed using a rapid miner to build a measurement model that is described using a decision tree.

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