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EVALUATION OF THE QUALITY OF ONLINE LEARNING USING THE ROUGH SET METHOD

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Abstract

The occurrence of the Covid 19 pandemic around the world has changed all human physical activities in all lines of life, including activities in carrying out the teaching and learning process in educational institutions. This study seeks to analyze and evaluate the quality of online learning in the Covid 19 era. Measuring the quality of online learning is carried out using the rough set method, where the aspects or attributes used to consist of learning motivation, cognitive and self-efficacy. This research was conducted on students of the Putra Indonesia University YPTK Padang during the Covid 19 pandemic. By using the rough set algorithm technique, it is expected that the pattern or combination between attributes can produce knowledge or information in predicting the quality of online learning in the Covid 19 era. The results of testing with the Rosetta application found that The combination of cognitive and self-efficacy is an attribute that directly determines the quality of online learning in the Covid 19 era

Keywords: *Learning motivation, Cognitive, Self-efficacy, Quality of online learning, Rough set.*

INTRODUCTION

The quality of learning is an important part of all educational institutions because by knowing the quality of learning outcomes, the organization can evaluate and determine targets or improvements in the future towards a better direction. The occurrence of Covid 19 in all parts of the world, including in Indonesia, indirectly had an impact on the quality of learning from school to university level. The government and other education stakeholders are facing changes in unusual learning patterns as a result of Covid-19. Changes in learning patterns from face to face into network platforms (online)[1], [2]. Although this change also has positive impacts such as increasing the ability of teachers, lecturers, and students the use technology in teaching and learning activities. However, limited resources such as limited internet network infrastructure, computer availability, the low ability of teachers in information technology, and the need for assistance to students in the learning process at home

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are also a problem in the quality of online learning.

Besides, the application of online learning with the help of technology has disappeared from the interaction between teachers or lecturers and students which can reduce understanding and knowledge in the learning process [3], [4]. in the e-learning literature, states that not all students will succeed in teaching and learning activities carried out online, the level of student success in online learning depends on environmental factors and student characteristics themselves.

The government, in its report through the Ministry of Education and Culture (Kemendikbud), acknowledges that distance learning (PJJ) that has taken place during the Covid-19 pandemic has reduced the quality of student learning in all regions of Indonesia. Furthermore, he also said that there are still tens of thousands of schools that are late in conducting distance learning (PJJ) due to the absence of internet and electricity in some areas. About 19,277 schools have no internet signal and 35,002 schools have no electricity so that the total number of schools with problems is 54,279 schools, [6], [7].

Hapsari et al., (2017) in Putra et al., (2019) state that evaluating the quality of online learning needs to be done in at least two stages, namely: (1) when content is planned and organized or implemented in a learning management system (LMS), and (2) immediately after the learning is complete. To evaluate and predict the level of quality of online learning in the Covid 19 era, this study uses a data mining approach through the Rough set method. Data mining can be a process to explore hidden knowledge in a data set that can be added value and useful rules in supporting decision making [9]. Furthermore, the Rough set method is said to be a mathematical method that functions to overcome uncertainty and discrepancies. This method was first introduced by Zdzislaw Pawlak in the 1980s [10], [11]. This technique is believed to be able to overcome the problem of uncertainty (missing data, incomplete data and inaccurate and unclear data discrepancies), [12].

Previous research on the quality of online learning has been widely researched such as research, [13]–[21]. All of the research above examines the quality of online learning that is based on a decision support system approach and is not based on a data mining approach or a rough set method. Based on the above problems, this study seeks to evaluate and predict the quality of online learning in the Covid 19 era by using several attributes including learning motivation, cognitive and self-efficacy.

REVIEW OF RELATED LITERATURE

Online learning is the first known since the influence of the development of electronic-based learning, the first to do it is the University of Illinois through a computer-based learning system. Riyana & Pd (2020), Online learning is a system that can facilitate students to learn more widely, more and more differently. This means that online learning is a system that facilitates student interaction in learning, is wider, more numerous, and varied, and

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can be done anywhere at any time without being limited by distance, space and time.

The quality of online learning is a set of learning values or goals that must be achieved both in terms of knowledge, skills and behaviour (Knowlege, Skills and Attitude). Sanjaya (2008) explains that learning objectives are related to ABCD elements, namely Audience (who should have the ability), Behavior (what kind of behaviour is expected to be owned), Condition (in conditions and situations in which the subject can demonstrate ability as a result of learning). which has been obtained), and Degree (quality or quantity of behaviour that is expected to be achieved as the eligible limit). This goal is also a target that must be achieved in elearning. Elearning is distance learning that uses computer technology or commonly called the web. Therefore, the quality of online learning is also a major and important goal which is also the concern of all parties at the time of Covid 19.

One of the instruments for evaluating the quality of learning objects is LORI (Learning Object Review Instrument) developed by [27] in Putra et al., (2019). LORI is designed as an instrument to assess the quality of multimedia learning objects. Even though in its evaluation it also relates to learning objectives, LORI is generally used as a tool for evaluating learning objects, not an evaluation tool for the whole program where this learning object is used.

Motivation to learn is a determining indicator and affects the quality of learning. Donald in Sardiman (2014) states that motivation is a change in energy in a person which is marked by the emergence of "feelings" and is preceded by a response to a goal. This means that learning motivation is a description of the strength and seriousness that a person displays in maximizing the teaching and learning process. Motivation to learn is defined as the overall driving force both inside and outside (by not creating a series of efforts to provide certain conditions) which ensures continuity and provides direction for learning activities so that the goals desired by the learning subjects can be achieved, [29].

One of the determining factors and having an impact on the quality of learning is motivation, which is an aspect that affects the realization of the quality of learning, [30]. At the time of Covid 19, it can be said to be a transitional era as well as a challenge to change in carrying out all activities using the help of information system technology, including students who have to study online / online. Some many obstacles and problems can reduce the quality of learning outcomes faced by students. Vivin, (2019), states that the level of anxiety a person has an impact on learning motivation.

Cognitive is one of the abilities a person has in maximizing his or her potential to enrich knowledge by learning either directly or through the use of information technology, (Putra et al., 2019). Through their cognitive abilities, students have a desire to find and know new things in developing their own potential that can strengthen the quality of learning. Indirectly, it can also change the patterns and behaviour of students in learning from conventional to digital. Arikunto (2009), also states that learning

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outcomes are essentially changes in behaviour which include cognitive, affective and psychomotor fields. Therefore, cognitive factors are also said to be an important element that affects the success of e-learning.

Cognitive measurements in this study follow the research Putra et al., (2019), which consists of (a) intrinsic cognitive load (ICL), which is described by students' ability to receive and process information (MMI); (b) extrinsic cognitive load (ECL), which is described by the mental effort (UM) of students; and (c) constructive cognitive load (Germane Cognitive Load / GCL), which is described by student learning outcomes (HB), (Plass, n.d., 2010).

The concept of self-efficacy is an important element of the self-regulatory process (independence) because it can influence the choice of targets and the expected level of achievement [34]. Self-efficacy can be said as a form of confidence and self-confidence of all individuals involved in learning, there is a belief that online learning is believed to be implemented and useful and can help maximize the quality of learning, (Putra et al., 2019).

The self-efficacy assessment follows the indicators developed by [35] including a). Magnitude, an indicator of an individual's belief in his ability to the level of difficulty of the task and selection of behaviour based on obstacles or difficulty levels of tasks or activities b). Generality, an indicator of an individual's belief in his ability to carry out tasks in various activities, and c). Strength, the level of strength of an individual's belief or expectation

METHOD

This research makes Putra Indonesia University YPTK Padang the object of this research. The reason is, this college is one of the first educational institutions to implement online learning, long before the Covid 19 pandemic in West Sumatra Province. The raw data used in this study are the results of online learning quality assessment with attributes that include learning motivation, self-efficacy and cognitive. Data collection was carried out using an online questionnaire with the help of Google Form.

The data mining testing technique uses the Rough set method with the Rosetta 1.4.4.1 application test tool. The data mining process in this study begins with the selection of data from the data source to the target data, then the preprocessing stage to improve data quality, then data transformation, [36]. And the last is the stage of interpretation and evaluation of the results of the test which produces output in the form of new knowledge that is useful in supporting decision making. The following is the research framework:

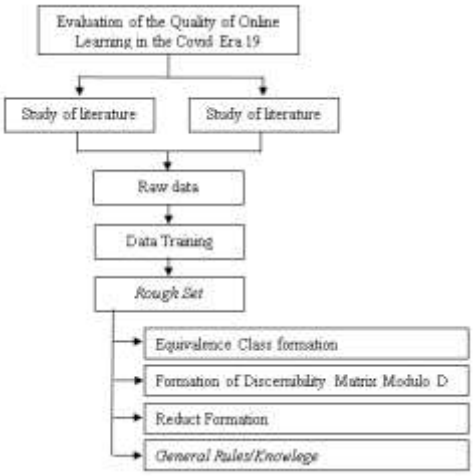

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Figure 1. Research Framework

The following is an explanation of the stages of assessing the evaluation process for the quality of online learning in the Covid 19 era in this study:

1. Literature study, looking for and studying all literature related to this research, both in the form of theoretical studies and previous research that has been carried out to assess and evaluate the quality of online learning
2. Data collection, distributing questionnaires and direct interviews with students of the Putra Indonesia University YPTK Padang regarding all attributes of the quality of online learning in the Covid 19 era.
3. Raw data, the results of collecting questionnaires and interviews are used as initial data used in the testing process related to the attributes of learning motivation, self-efficacy and cognitive.
4. Data Training, is the result of selection and transformation of data from raw data which is ultimately used as data mining that meets the requirements.
5. Rough set,
   a. Equivalence class formation is the process of eliminating the same or repeated data.
   b. The formation of the Discernibility Matrix Modulo D is a matrix that contains comparisons between different data attributes of conditions and attributes of decisions.
   c. Reduct formation is a process to produce decisions or rules/knowledge which can later be used as an evaluation of the quality of online learning in the Covid 19 era.
   d. General rules/knowledge is the final process of data mining testing that produces rules and knowledge that will later be useful in decision making

Data collection in this study was carried out on the Putra Indonesia YPTK Padang University students, as a basis for evaluating or predicting the quality of online learning in the Covid 19 Era. The quality of online learning is the quality of learning as the intensity of systemic and synergistic relationships between lecturers, students, learning climate, and the media learning in producing optimal learning outcomes according to the demands of the University of Putra Indonesia YPTK Padang curriculum.

RESULT AND DISCUS

Assessment of 3 quality attributes of online learning is taken from a questionnaire distributed to 20 students. Furthermore, the collected raw data is assessed for each respondent's answer by paying attention to the level of achievement (level of achievement of the respondent's answer) of each attribute which includes self-efficacy and cognitive learning motivation to predict and determine the extent. the level of quality of learning in the Covid Era 19. Historical data collection from 20 students of the Putra Indonesia University YPTK Padang:

Table 1. Raw Data Results of Assessment of Respondents' Answer Achievement Level

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Number	Student	Motivation to learn	Self Efficacy	Cognitive	Quality of Online Learning
1	Yanda	68,33	78,33	43,33	63,33
2	Ayu Oktavia	81,67	75,00	93,33	83,33
3	Siska sasmita	86,67	86,67	93,33	88,89
4	ria mahardika	83,33	75,00	100,00	86,11
5	Reska alfani	78,33	100,00	66,67	81,67
6	Miftahul Ilma	76,67	80,00	60,00	72,22
7	Diyan	63,33	90,00	93,33	82,22
8	Fellanie Mayesa Putri	90,00	85,00	60,00	78,33
9	Sisi Aisyah Ferimon	100,00	96,67	100,00	98,89
10	Melia	80,00	70,00	93,33	81,11
11	Afifah nur ananda	85,00	90,00	76,67	83,89
12	Riki Ramadhan	61,67	86,67	100,00	82,78
13	Melsa	71,67	76,67	100,00	82,78
14	Krystle Meridian	88,33	80,00	86,67	85,00
15	Viki febriandi	85,00	81,67	86,67	84,45
16	M.iqbal kutia	80,00	98,33	80,00	86,11
17	Putri hayati	86,67	90,00	100,00	92,22
18	Nurjannah saumil rahmi	91,67	100,00	83,33	91,67
19	Taskia Intan Hayati	86,67	83,33	93,33	87,78
20	Aprilia rozalista	86,67	80,00	93,33	86,67

Source: Data Transformation and Selection, 2021

The following is the score formed from the selection process and data transformation with an assessment of the level of achievement of each attribute or indicator, grouped using the theoretical approach, (Arikunto, 2009).

Table 2. Respondents' Answer Achievement Level

Percentage	Assessment Criteria
90% - 100%	Very good
80% - 89.99%	Good
65% - 79.99%	Pretty good
55% - 64.99%	Not so good
0% - 54.99%	Not good

Based on the above approach, final data can be obtained that are ready to be used as data mining as input in the Rosetta application.

Table 3. Data Mining as Input for Rosetta Application

Number	Student	Motivation to learn	Self Efficacy	Cognitive	Quality of Online Learning
1	Yanda	Pretty Good	Pretty Good	Not good	Not good
2	Ayu Oktavia	Good	Pretty Good	Very good	Good
3	Siska sasmita	Good	Good	Very good	Good
4	Ria mahardika	Good	Pretty Good	Very good	Good
5	Reska alfani	Pretty Good	Very good	Pretty Good	Good
6	Miftahul Ilma	Pretty Good	Good	Not good	Pretty Good
7	Diyan	Not good	Very good	Very good	Good
8	Fellanie Mayesa Putri	Very good	Good	Not good	Pretty Good
9	Sisi Aisyah Ferimon	Very good	Very good	Very good	Very good
10	Melia	Good	Pretty Good	Very good	Good
11	Afifah nur ananda	Good	Very good	Pretty Good	Good
12	Riki Ramadhan	Not good	Good	Very good	Good
13	Melsa	Pretty Good	Pretty Good	Very good	Good
14	Krystle Meridian	Good	Good	Good	Good
15	Viki	Good	Good	Good	Good

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	febriandi				
16	M.iqbal kutia	Good	Very good	Good	Good
17	Putri hayati	Good	Very good	Very good	Very good
18	Nurjannah saumil rahmi	Very good	Very good	Good	Very good
19	Taskia Intan Hayati	Good	Good	Very good	Good
20	Aprilia rozalista	Good	Good	Very good	Good

Source: Final Data (data mining), the Year 2021

The next stage is the process of analyzing the Rough Set data using the Rosetta application. This method was first introduced by Zdizslaw Pawlak. The function of this method is as a mathematical aid to solve the problem of uncertainty and obscurity. Meanwhile, the application used for the Rough Set method is Rosetta Software. Rosetta's operational process has several steps to get to the rules.

a) Decision system input process

The input process for the Decision System in Rosetta starts by opening the New Project Form, and creating a new data source with the Microsoft Excel data format as a data source.

In this process, the drivers we use are the Microsoft Excel Driver (*.Xls) or the Microsoft Excel Driver (*.xls, *.Xlsx, *.xlsm, *xlsb). This is because the data to be used has previously been transformed into a Microsoft Excel file. Then we press the "Next" and end with data storage. The following is the data entry process in Figure 3 below:

Figure 2. *View of Data Decision System*

In the picture above, you can see all the attributes or indicators of the quality of online learning which consist of learning motivation, self-efficacy and cognitive with N = 20 answers for each respondent. Matrix Modulo D. This is useful as a reference for determining the results of the reduct. The following are the results of the reduct in Figure 4:

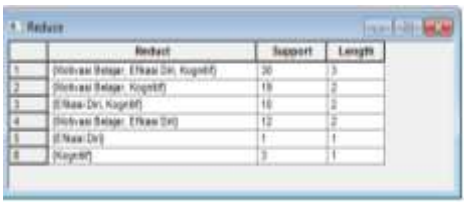

Figure 3. Dinamyc Reduct

Based on the dynamyc reduct carried out, 6 combinations of attributes were obtained in assessing the quality of online learning in the Covid 19 era:

1. Combination of learning motivation, self-efficacy and cognitive with a support value of 30 & length 3.
2. Combination of learning motivation and cognitive with support value 19 and length 2.
3. Combination of learning motivation and self-efficacy with a support value of 12 and length 2.

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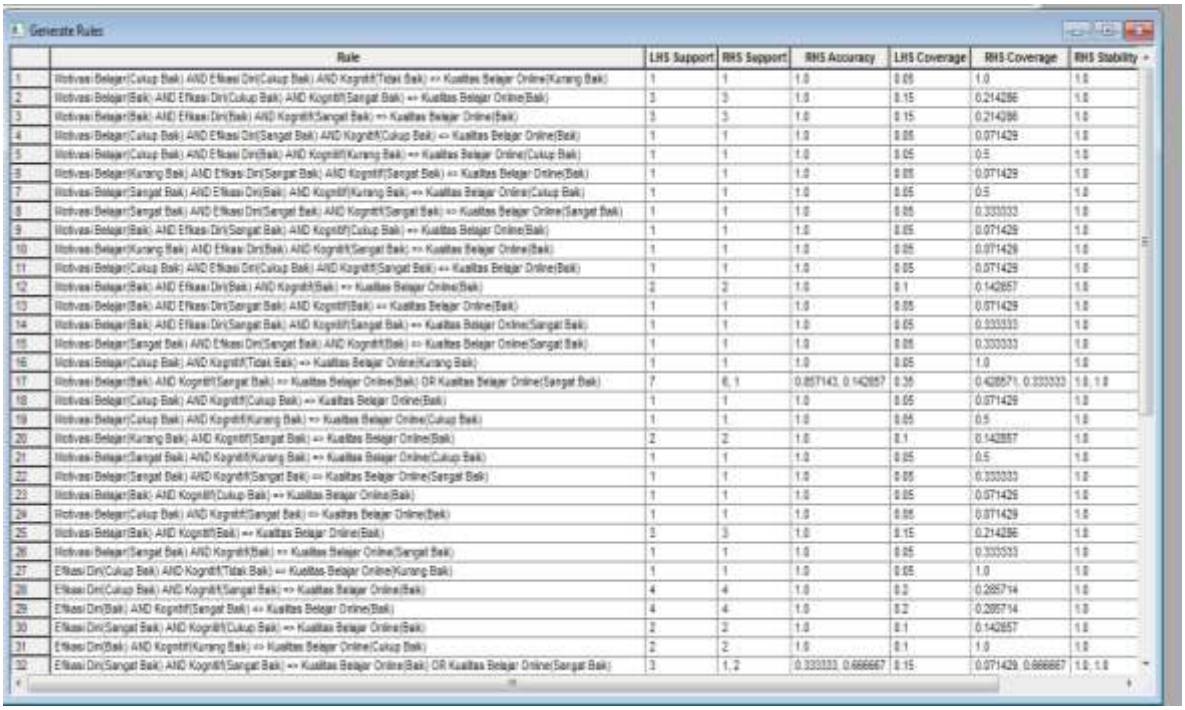
4. Combination of self-efficacy and cognitive with support value 10 and length 2

The next step is to find a dynamyc reduct, to get rules or knowledge through the general rules process, here are the test results:



	Rule	LHS Support	RHS Support	RHS Accuracy	LHS Coverage	RHS Coverage	RHS Stability
1	Motivasi Belajar(Cukup Baik) AND Efikasi Diri(Cukup Baik) AND Kognitif(Tidak Baik) => Kualitas Belajar Online(Kurang Baik)	1	1	1.0	0.05	1.0	1.0
2	Motivasi Belajar(Baik) AND Efikasi Diri(Cukup Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik)	3	3	1.0	0.15	0.214286	1.0
3	Motivasi Belajar(Baik) AND Efikasi Diri(Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik)	3	3	1.0	0.15	0.214286	1.0
4	Motivasi Belajar(Cukup Baik) AND Efikasi Diri(Sangat Baik) AND Kognitif(Cukup Baik) => Kualitas Belajar Online(Baik)	1	1	1.0	0.05	0.071429	1.0
5	Motivasi Belajar(Cukup Baik) AND Efikasi Diri(Baik) AND Kognitif(Kurang Baik) => Kualitas Belajar Online(Cukup Baik)	1	1	1.0	0.05	0.5	1.0
6	Motivasi Belajar(Kurang Baik) AND Efikasi Diri(Sangat Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik)	1	1	1.0	0.05	0.071429	1.0
7	Motivasi Belajar(Sangat Baik) AND Efikasi Diri(Baik) AND Kognitif(Kurang Baik) => Kualitas Belajar Online(Cukup Baik)	1	1	1.0	0.05	0.5	1.0
8	Motivasi Belajar(Sangat Baik) AND Efikasi Diri(Sangat Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Sangat Baik)	1	1	1.0	0.05	0.333333	1.0
9	Motivasi Belajar(Baik) AND Efikasi Diri(Sangat Baik) AND Kognitif(Cukup Baik) => Kualitas Belajar Online(Baik)	1	1	1.0	0.05	0.071429	1.0
10	Motivasi Belajar(Kurang Baik) AND Efikasi Diri(Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik)	1	1	1.0	0.05	0.071429	1.0
11	Motivasi Belajar(Cukup Baik) AND Efikasi Diri(Cukup Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik)	1	1	1.0	0.05	0.071429	1.0
12	Motivasi Belajar(Baik) AND Efikasi Diri(Baik) AND Kognitif(Baik) => Kualitas Belajar Online(Baik)	2	2	1.0	0.1	0.142857	1.0
13	Motivasi Belajar(Baik) AND Efikasi Diri(Sangat Baik) AND Kognitif(Baik) => Kualitas Belajar Online(Baik)	1	1	1.0	0.05	0.071429	1.0
14	Motivasi Belajar(Baik) AND Efikasi Diri(Sangat Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Sangat Baik)	1	1	1.0	0.05	0.333333	1.0
15	Motivasi Belajar(Sangat Baik) AND Efikasi Diri(Sangat Baik) AND Kognitif(Baik) => Kualitas Belajar Online(Sangat Baik)	1	1	1.0	0.05	0.333333	1.0
16	Motivasi Belajar(Cukup Baik) AND Kognitif(Tidak Baik) => Kualitas Belajar Online(Kurang Baik)	1	1	1.0	0.05	1.0	1.0
17	Motivasi Belajar(Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik) OR Kualitas Belajar Online(Sangat Baik)	7	6, 1	0.857143, 0.142857	0.35	0.428571, 0.333333	1.0, 1.0
18	Motivasi Belajar(Cukup Baik) AND Kognitif(Cukup Baik) => Kualitas Belajar Online(Baik)	1	1	1.0	0.05	0.071429	1.0
19	Motivasi Belajar(Cukup Baik) AND Kognitif(Kurang Baik) => Kualitas Belajar Online(Cukup Baik)	1	1	1.0	0.05	0.5	1.0
20	Motivasi Belajar(Kurang Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik)	2	2	1.0	0.1	0.142857	1.0
21	Motivasi Belajar(Sangat Baik) AND Kognitif(Kurang Baik) => Kualitas Belajar Online(Cukup Baik)	1	1	1.0	0.05	0.5	1.0
22	Motivasi Belajar(Sangat Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Sangat Baik)	1	1	1.0	0.05	0.333333	1.0
23	Motivasi Belajar(Baik) AND Kognitif(Cukup Baik) => Kualitas Belajar Online(Baik)	1	1	1.0	0.05	0.071429	1.0
24	Motivasi Belajar(Cukup Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik)	1	1	1.0	0.05	0.071429	1.0
25	Motivasi Belajar(Baik) AND Kognitif(Baik) => Kualitas Belajar Online(Baik)	3	3	1.0	0.15	0.214286	1.0
26	Motivasi Belajar(Sangat Baik) AND Kognitif(Baik) => Kualitas Belajar Online(Sangat Baik)	1	1	1.0	0.05	0.333333	1.0
27	Efikasi Diri(Cukup Baik) AND Kognitif(Tidak Baik) => Kualitas Belajar Online(Kurang Baik)	1	1	1.0	0.05	1.0	1.0
28	Efikasi Diri(Cukup Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik)	4	4	1.0	0.2	0.285714	1.0
29	Efikasi Diri(Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik)	4	4	1.0	0.2	0.285714	1.0
30	Efikasi Diri(Sangat Baik) AND Kognitif(Cukup Baik) => Kualitas Belajar Online(Baik)	2	2	1.0	0.1	0.142857	1.0
31	Efikasi Diri(Baik) AND Kognitif(Kurang Baik) => Kualitas Belajar Online(Cukup Baik)	2	2	1.0	0.1	1.0	1.0
32	Efikasi Diri(Sangat Baik) AND Kognitif(Sangat Baik) => Kualitas Belajar Online(Baik) OR Kualitas Belajar Online(Sangat Baik)	3	1, 2	0.333333, 0.666667	0.15	0.071429, 0.666667	1.0, 1.0

Figure 4. General Rules

Based on the table of general rules, there are 52 combinations of attributes consisting of learning motivation, self-efficacy and cognitive which can be useful rules or knowledge in evaluating and predicting the level of quality of online learning in the Covid 19 era. For assessment of existing rules, we can pay attention to the value of LHS Support by looking at the value that tends to be the highest compared to the value of other LHS support combinations.

Based on the image of the general rule above, it is known that the attribute combination value with the highest LHS support value is rule 48 with LHS support value 11, which states that the quality of online learning is largely determined by cognition. This shows that institutions or organizations must pay attention to the cognitive abilities of students and lecturers in improving the quality of online learning in the Covid 19 era.

Furthermore, from the general rules table the second LHS support value that determines the quality of online learning is in rule number 46 with the value of LHS support 8. While the third rank is in rule number 47 with a value of LHS support 7. These results indicate that the attributes of student self-efficacy become attributes that determine the quality of online learning in the Covid 19 era.

CONCLUSION

Based on the above discussion, it can be concluded that the Rough Set method is considered capable of identifying and

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evaluating the quality of online learning appropriately and well at the time of Covid 19. The three attributes that include learning motivation, self-efficacy, and cognitive ability can be a determining factor for the quality of online learning. Where the combination of cognitive and self-efficacy is the combination that most determines the level of quality of online learning in the Covid 19 era.

This finding is expected to provide information and become a rule for institutions or universities to improve the quality of online learning in the future. The results of this test have a level of accuracy that requires further testing, because in this study only one technique was used, namely the rough set method. In the future, further research is needed to compare the results of predictions and determine theory with other approaches or methods that can also produce better evaluations and predictions of the quality of online learning in the Covid 19 era.

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