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Blended learning: Adoption pattern of online classrooms in higher education

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ABSTRACT

This study aimed to describe the patterns of technology usage. Specifically, on the implementation of blended learning (BL) in higher education institutions. The case study explores usage patterns, influencing factors, and success factors. The data sources came from the Google Classroom log activity of 35 departments, consisting of five vocational programs, 28 undergraduate programs, and two professional programs in a university for three years with an average in a semester. A method called the customer window quadrant (CWQ) was utilized to analyze the pattern. In addition, a questionnaire was deployed to measure the teacher's satisfaction with using the Google Classroom in a blended learning setting. The results show two dominant activities in Google Classroom, namely assigning tasks and quizzes. For the quiz, there were two popular question types, i.e., multiple-choice and short answers questions. The activity of using the Google Classroom has doubled in the three years. Assigning tasks to projects becomes the task in the Google Classroom. The usage patterns of Google Classroom are based on the level of importance. There are three activities considered the most important, namely creating class, topic, and material course. Moreover, the most influencing factors are stability, convenience, simplicity, velocity, and reliability.

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1. INTRODUCTION

As the internet becomes inseparable from most people's lives, its influence has been spreading through the educational institution with regards to the changing learning patterns and activities along with the information technology adoption in the institution [1], [2]. The change is important as many worries that higher education will disappear along with the pervasive adoption of technology up to the individual level [3]. There are two ways of organizing teaching and learning activities, namely synchronous and asynchronous [4]. Synchronous is direct learning, known as face-to-face [5], while asynchronous is indirect learning where the teacher uploads the learning materials to the internet, and the students will study independently or in a group at a specified time and conduct a discussion in direct or indirect activities.

A synchronous method with face-to-face models is considered a conventional method [6] which is no longer effective. Although it is already using the internet, the usage is limited to supporting activities only, such as post announcements and learning materials. Moreover, both teacher and students should allocate specific time to do the learning activities which become a burden in some situations [7]. On the other hand, an asynchronous method is learning activities through the internet that provide students freedom in terms of places and times [8], [9]. The method is suitable for independent learning with the emerging term of

e-learning [10]. Implementing this method institutionally requires a lot of money and effort. Institutions have to prepare adequate computer, audiovisual, and internet infrastructure [11]. Likewise, all those involved such as lecturers and students must be trained so they can participate in e-learning activities. Institutions must also provide online services that technically support these two kinds of users [12]. Therefore, in some cases, synchronous learning is still needed to get the effectiveness of learning.

To overcome the weaknesses of the two methods, blended learning (BL) then emerged [13]–[15]. This method combines synchronous and asynchronous learning types [16]. This is one of the solutions that can be used in teaching and learning activities by universities [17]. In such a way, many universities begin to adopt this method [18]. The adoption of BL in universities has been discussed by many previous studies conducted by Graham [14] which measure the level of BL implementation in 11 institutions in America. Research related to BL adoption was also carried out in Malaysia [19] by using the theory of Mezirow's Transformation Learning shows that although the level of adoption is still low, the attitude of users in the involvement of blended learning is quite high. Whereas in South Africa [20], the weak adoption of stakeholders is academic staff because they are used to the old ways. For lecturers and students, it is relatively good by using learning management system (LMS), such as Moodle.

One of the factors that influence BL's success is online learning activities where the internet is not only used for asynchronous activities but also synchronous ones. The active use of e-learning is one of the keys to BL's success. The adoption of e-learning at universities has also been studied previously. The publication by Pradana [21] about the adoption of BL in Brawijaya University Malang, Indonesia reports that the implementation of BL, in this case, has not yet seen significant results because it has not been integrated with existing systems. Meanwhile, the procedure for the use of e-learning patterns has been studied by Modritscher. He measured topic activities related to the number of sessions, length of view, and results of midterm and end of semester [22]. Likewise, the factors that influence user intentions [23] to use it have also been done by Kanwal [24]. Various technology options have been used such as developing your own, using Moodle [25], Google Classroom, and many others.

After Google released an educational edition (Google Edu), many universities joined the services. Currently, Google Edu has been used at an international level by 43 countries in various chapters, such as the Jakarta Chapter, Yogyakarta Chapter, Surabaya Chapter, Bandung Chapter, and so on. Whereas Universitas Islam Indonesia as a higher education institution being studied in this research joined Google Edu in 2016 and has actively used various facilities. One of the e-learning used in this package is Google Classroom. Unfortunately, not many studies have discussed how this e-learning pattern is used.

The study aims to elicit the lesson learned from universities that implement BL and adopt Google Classroom. The data in this study were taken from practice at a university. Data at the university is taken from 8 faculties with a total of 32 departments. There are three important questions that will be revealed on this study: i) How is the pattern of using Google Classroom as an e-learning feature in BL activities in tertiary institutions?; ii) What supporting factors found by users, especially lecturers, influence the use of e-learning?; and iii) What are the success factors in using Google Classroom in universities? The results of this study are expected to provide an overview of how Google Classroom usage patterns and factors that support their use can influence the success of BL.

2. RESEARCH METHOD

This research is explanatory and descriptive in nature because it is not preceded by a hypothesis. As a descriptive explanatory study, this study will discuss three main questions: i) How is the pattern of using Google Classroom as an e-learning feature in BL activities in higher education?; ii) What supporting factors found by users, especially lecturers, influence the use of e-learning?; and iii) What are the success factors in using Google Classroom in universities?

2.1. Google Classroom usage pattern

Google Classroom is one of the features released by Google in the Google EDU package. This feature works for teaching and learning management. How the pattern of using this feature in the case of tertiary institutions will be explored from one of the oldest private tertiary institutions in Indonesia located in the province of Yogyakarta, namely the Islamic University of Indonesia. The campus has eight faculties. Under the faculty consists of five diploma programs, 31 undergraduate programs, two professional programs, 11 master's programs, and three doctoral programs. From these data, 32 study programs have actively used Google Classroom. All these data will be taken through the Google API with a three-years activity period since 2018. We are expected to provide an overview of how the use of Google Classroom is carried out. The activities retrieved from these years are then categorized based on the faculty name and department name. In addition, the types of activities mean all the interaction activities which include assignments between lecturers and students.

2.2. Factors that influence the use of Google Classroom

In blended learning activities, especially in the use of electronic media (e-learning), lecturers occupy a central position as driver. If the lecturer is active and concerned with BL activities, students will obey and follow all the patterns offered in the teaching and learning activities. So, this research is more focused on the factors that influence lecturers' using Google Classroom.

The method used to obtain these factors is the customer window quadrant (CWQ) [26]. This method departs from the variable of satisfaction and the level of importance valued by customers. The method, like importance performance analysis (IPA) is measures satisfaction using four quadrants [27]–[29]. In this study, customers are system users, namely lecturers. The satisfaction variable is taken from the features contained in the Google Classroom module. Satisfaction and importance of each feature are visualized in CWQ.

Retrieval of data using a questionnaire method. For CWQ, two main parts of the questionnaire were made. The first part identifies the demographics of respondents, and the second analyzes the satisfaction and importance of Google Classroom features. Judgment rates use the numbers 1-5. The smaller means the less important or more dissatisfied, and vice versa the greater the more important or more satisfying. The satisfaction value (α) is calculated using (1):

$$\alpha i = xi - xv \quad (1)$$

Where:
xi is the average user satisfaction of each feature
xv is the average user satisfaction of all features
if αi>0 then user satisfaction is above average and vice versa if αi<0 means below average.

Likewise, to calculate the degree of importance of a feature assessed by a user using (2):

$$\beta i = yi - yv \quad (2)$$

where:
yi is the average degree of user interest of each feature
yv is the average degree of importance of user satisfaction across features
if βi>0 then the degree of user interest above the average and vice versa if βi<0 means below average.

The values obtained from these two calculations will be the values on the CWQ chart. The results will be classified as in Table 1. The sample of respondents was determined using the purposive sampling method. This method is used to select respondent sampling that is consistent with the research objectives [30]. Respondents were taken from lecturers who have the most activities in online activities. Active Google Classroom users are taken because those who know and master more about how BL is implemented using the Google Classroom features. Faculty representatives are taken as representatives of the respondents' backgrounds.

Table 1. CWQ classified by quadrant

Q	Quadrant of CWQ	Ratio between AI and BI	Meaning
I	Motivators	αi >0 simultaneously βi >0	Lecturer wants it and gets it
II	Declarative characters	αi <0 simultaneously βi >0	Lecturer wants it and does not get it
III	Saving opportunities	αi <0 simultaneously βi <0	Lecturer does not want it and does not get it
IV	Invested fitures	αi >0 simultaneously βi <0	Lecturer does not want it and gets it anyway

2.3. Success factors in using Google Classroom

Knowing factors of the teacher’s satisfaction in teaching in Google Classroom is important [31]. Those factors will be taken from two sources, namely Google Classroom activity data and questionnaires. Activity trends show the level of success. Whereas the questionnaire from the same respondents as the previous questionnaire will measure the user's perception of system performance. These two data are then compared to confirm each other so that the result becomes more objective.

3. RESULTS AND DISCUSSION

3.1. Map of Google Classroom usage

The data was successfully collected from 32 study programs for three years using Google API development. The data taken is the number of classes and the number of activities per course. So, from this data it is known that the highest number of classes and activities is per class per lecturer. This is intended to determine the level of implementation of blended learning, whether it is only at the stage of raising awareness, has been fully adopted, or is mature [14]. The activities that were successfully taken were related to the assignment communication given by the lecturer. There are three main assignment activities carried out by lecturers, namely: assignment (assignment with upload files), short answer, and multiple choice. The results of the comparison of the number of classes and the number of activities per faculty are shown in Table 2.

Table 2. Comparison of the number of classes and activities per faculty

Faculties	First year		Second year		Third year	
	Number of classes	Number of activities	Number of classes	Number of activities	Number of classes	Number of activities
Economics	260	633	243	731	333	800
Psychology and Social cultural sciences	142	528	158	452	207	1026
Law	38	110	153	361	235	450
Islamic studies	76	236	66	180	120	544
Civil Engineering and Planning	172	909	220	1051	256	1180
Industrial technology	239	1035	279	1246	351	1901
Mathematics and Natural sciences	112	268	164	394	251	790

Table 2 shows that the faculties with the highest number of classes and the number of activities were the faculties of Industrial Technology, and Civil Engineering and Planning. This is reasonable because scientifically the lecturers in these two faculties are engineering fields that are closely related to computer applications. Other faculties have increased gradually and systematically except the Faculty of Islamic Studies (FIAI) which experienced fluctuations where the even semester in first year decreased compared to before. However, all faculties experienced an increase in activity in the last semester of third year. A comparison of the number of classes per faculty is shown in Figure 1, while a comparison of the number of activities is shown in Figure 2.

From the three assignment activities carried out by the lecturer, the majority were the task of uploading files, followed by the type of short answer, then multiple-choice. A comparison of activities per can be seen in Figure 3. Figure 3(a) and 3(b) shows a comparison of the number of assignments given by lecturers per year for all faculties [32]. The first task of uploading files (ASSIGN) every year has increased activity. The first year amounted to 3,333, increased to 4,042 in the following year, and increased quite sharply in the third year reaching 6,118 activities. The multiple-choice type in Figure 3(b) shows two types of tasks namely multiple choice and short answer. Multiple choice indicated that the second year decreased from 53 to 22 and the following year increased to 63. While the short answer type included many activities and increased each year with the number of initial activities 333, increasing to 351, and in the following year reaching 510. The distribution of activities each faculty in Figure 3(c) and 3(d) shows that the engineering faculty gets the highest number of activities compared to the social faculty.

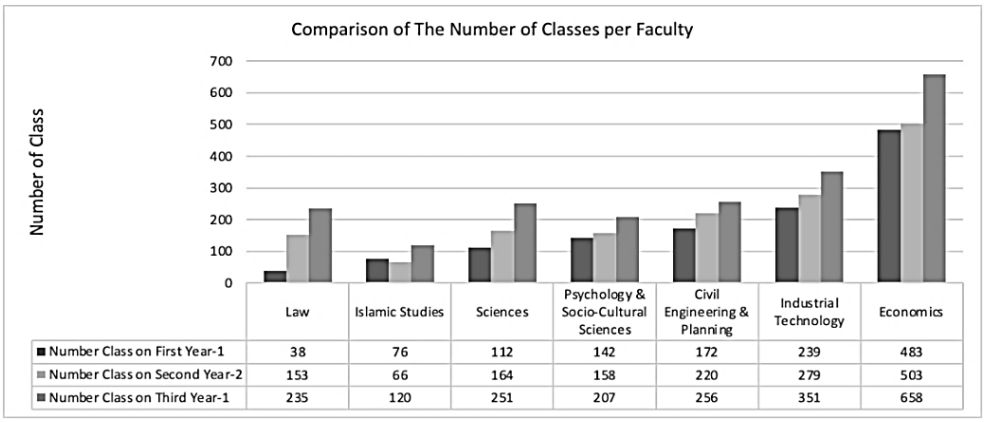

Figure 1. Comparison of the number of classes per faculty

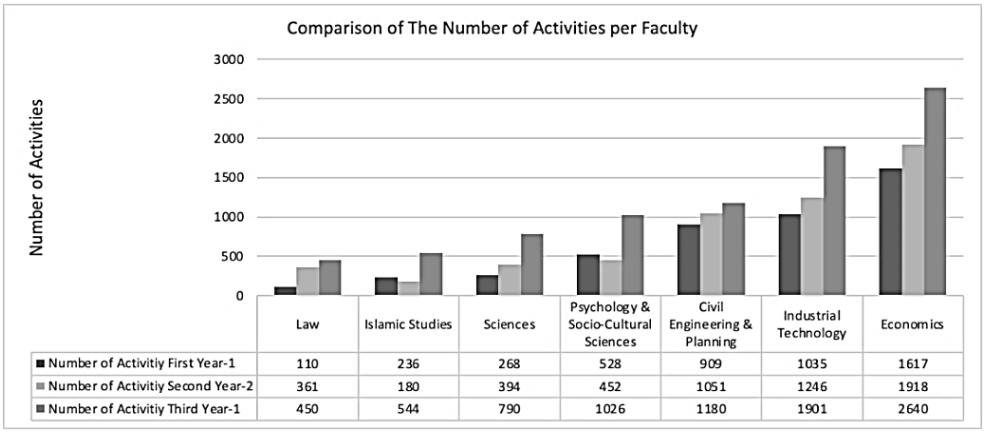

Figure 2. Comparison of the number of activities per faculty

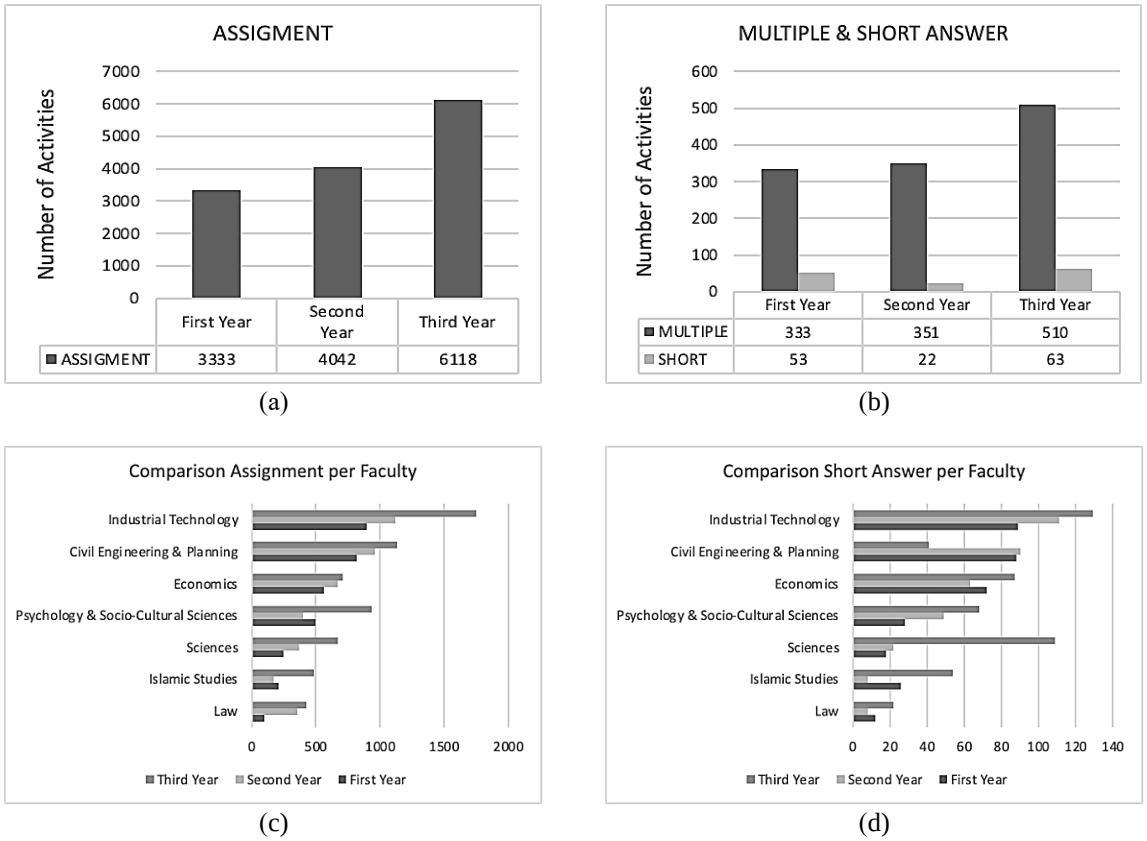

Figure 3. Comparison of the number of activities per years for (a) assignment activities, (b) multiple and short answer, (c) comparison assignment per faculty, and (d) comparison short answer per faculty

3.2. Factors that influence the use of Google Classroom

Determination of the number of lecturers taken as respondents is done using the purposive method [30]. From seven faculties, four faculties were selected with different backgrounds, namely the Faculty of Industrial Technology (FTI), the Faculty of Psychology and Social Culture (FPSB), the Faculty of Mathematics and Natural Sciences (MIPA), and the Faculty of Islamic Sciences (FIAI). The consideration of the faculty selection is that it represents the most and the fewest users, representing the engineering and social faculties, and socially drawn representing psychology (Humanity) and the basis of religion (Religion). The lecturers chosen as respondents were active Google Classroom users as seen from the number of activities during the three years.

Respondent data collected were 31 with demographics per faculty of 16 (52%) FTI, 6 (19%) MIPA, 6 (19%) FIAI, and 3 (10%) FPSB. This figure represents an even distribution based on the number of users in the faculty concerned. By gender, they represent both types with a total of 17 male respondents (54.8%) and 14 females (45.2%). On IT adoption, age will affect users. The age distribution of respondents in this study is in five ranges. Users aged between 26-30 were 6 (25.8%), between 31-35 11 (35.5%), between 36-40 were 4 (12.9%), between 41-45 were 5 (16.1%), and between 46-50 by 3 (9.7%). The types of courses are divided into two categories namely exact and social to show the rating background. In this type it is relatively balanced with an exact number of 16 (51.6%) and a social number of 15 (48.4%). The results of the analysis of data collected based on the CWQ diagram are shown in Table 3. Based on CWQ mapping, there are three features in Quadrant 1 (Q1), four features in Quadrant 2 (Q2), three features in Quadrant 3 (Q3), and two features in Quadrant 4 (Q4). The position of each feature is shown through the CWQ diagram in Figure 4.

Table 3. Relative of significance αi and βi

Area of features	The average rate of satisfaction	The average rate of importance	αi	βi	Quadrant of CWQ
Stream	4.064516129	4.548387097	-0.043010753	0.137096774	II
Create class	4.35483871	4.419354839	0.247311828	0.008064516	I
Create topic	4.35483871	4.419354839	0.247311828	0.008064516	I
Create material	4.290322581	4.483870968	0.182795699	0.072580645	I
Create assignment	4.096774194	4.612903226	-0.010752688	0.201612903	II
Create quiz assignment	3.903225806	4.516129032	-0.204301075	0.10483871	II
Create question	4	4.322580645	-0.107526882	-0.088709677	III
Organize calendar	3.935483871	4.032258065	-0.172043011	-0.379032258	III
Organize drive	4.225806452	4.387096774	0.11827957	-0.024193548	IV
Utilizing YouTube link	4.258064516	4.387096774	0.150537634	-0.024193548	IV
Team teaching	4.032258065	4.35483871	-0.075268817	-0.056451613	III
Marks	3.774193548	4.451612903	-0.333333333	0.040322581	II
Average	4.107526882	4.411290323			

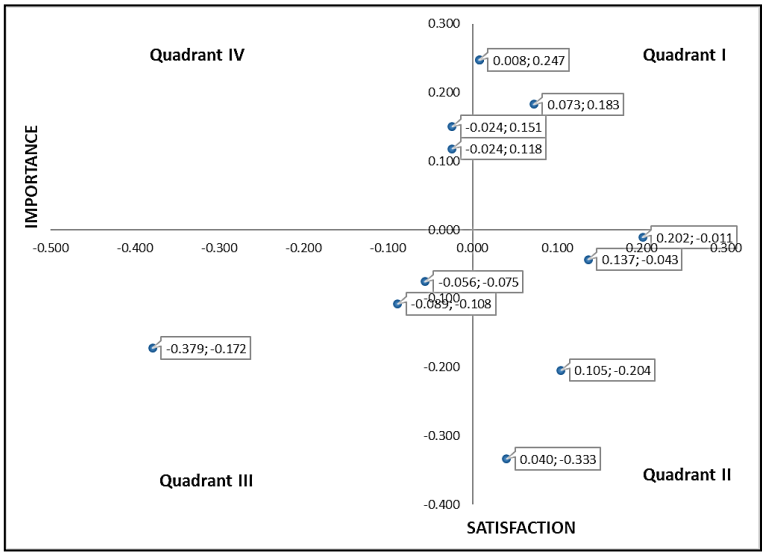

Figure 4. CWQ of user the Google Classroom

CWQ interprets the four quadrants as shown in Table 1 where Quadrant 1 means features that are in line with user expectations so that they motivate to be better developed [26]. These features created class, create topic, and create material. Quadrant 2 contains features that have been obtained by users but the value of satisfaction is below average. The four features of this quadrant are the stream, create assignment, create quiz assignment, and mark (grading) facilities. These four features need to be improved in terms of features. Quadrant 3 contains three features that have incomplete meaning and provide below average satisfaction. This quadrant provides the opportunity to add more features. The three features include creating questions (short answer), organizing drives, and team teaching. Quadrant 4 contains two features, which means investment in features, features that have provided user satisfaction, but the completeness value is still below average. This is a new investment in adding features.

The four quadrants also mean that Q1, Q2, and Q4 are the driving factors for the use of Google Classroom because Q1 is a user assessment that states what is obtained in line with expectations. Q2 shows user acceptance of available features even though their satisfaction is still below average. Whereas Q4 shows positive satisfaction even though the completeness of the features is still below average. While the less encouraging factor in using Google Classroom is Quadrant 3, which shows that both the completeness of features and satisfaction are still below average.

3.3. Factors affect user satisfaction

Google Classroom activity data as shown in Table 1, if the comparison of the number of classes and total activity for three years is calculated: in firs year, number of classes 1039 with total activity 3,719. In second year, number of classes 1,283 with total activity 4,415. The number of classes increased by 23.48% from the previous year. While the amount of activity increased by 18.71%. In third year, the number of classes was 1,753 with a total activity of 6,691. The number of classes increased by 36.63% from the previous year. While the activity increased significantly by 51.55%. This increase shows a positive progress so that it can be stated to have a positive effect on the implementation of BL [14]. Based on 31 responses back from the questionnaire data, the results of the 10 statements obtained as shown in Figure 5.

Performance Perception	Average of Performance
Complexity	2.838709677
Automation	3.548387097
Conformity	3.612903226
Informative	3.838709677
Productivity	3.838709677
Reliability	4.290322581
Velocity	4.387096774
Simplicity	4.419354839
Convenience	4.419354839
Stability	4.548387097

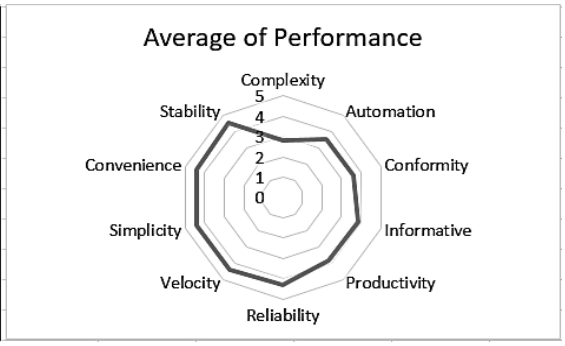

Figure 5. Google Classroom performance perceptions

The Likert scale used is in the range 1-5 where the higher the value the higher the perception of system performance. Specifically, the complexity of the meaning is the opposite so that the lower the better [33]. This figure confirms the simplicity variable with a significance value of 4.41. After the complexity variable is converted into the simplicity value, the average performance perception is 4.13. The value is above average with good qualifications, so it is consistent with the increase in class data and the number of activities [34].

4. CONCLUSION

Blended learning has been emerged as an approach to optimize the use of technology in Google Classroom. This research aims to explore the pattern of its usage in university context. There are three findings related to the use of Google Classroom. First, the usage of Google Classroom in BL setting was increasing up to 51.55% in three years period. The most frequent activity is uploading assignment's file. This model is often used to get feedback from self-learning worksheets, project-based assignments, and problem solving. However, the use of multiple-choice and short answer quiz activities is still low. While, the influence factor of the use of Google Classroom in the BL setting is the availability of key features that support the learning activity. Based on CWQ diagram, there are 10 features shown in Q1, Q2, and Q4. On the other hand, two features are identified as a low-utilized feature, i.e., create question (short answer), organize calendar, and team-teaching facilities. Finally, based on the questionnaire, the level of user satisfaction with using Google Classroom is very satisfying, especially in reliability, velocity, simplicity, convenience, and stability.

The three research results can be used by stakeholders, especially for lecturers as a reference for implementing BL in classroom activities. The references include: i) the potential for more use of independent activity-based assignment models, ii) ensuring to better organize classes, namely grouping topics and uploading teaching materials, as well as providing project assignment activities, quizzes, and conducting assessments transparently, iii) paying attention more on the elements of reliability, velocity, simplicity, convenience, and stability in the development of features and activities in BL.

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