Use of Information and Communication Technology in Learning in the Covid-19 Pandemic Period to Improve Student Learning Outcomes

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***Abstract*—During the covid-19 pandemic, the use of Information and Communication Technology (ICT) was vital in lecture activities, because during this pandemic, every country used to impose social restrictions, which impacted on online lectures. This research investigates whether the use of ICT in learning during the covid-19 pandemic can improve student learning outcomes. The study design is descriptive-causality. The variables examined in this research are: assignments (X1), midterm exams (X2), and final exams (Y). This research data is the score of student learning outcomes in the Department of Educational Administration, from 7 courses, 16 classes, with a total of 502 students. Data were analyzed by regression analysis. The results of data analysis conclude the use of ICT in learning during the covid-19 pandemic can improve student learning outcomes. The regression equation of the research variables, is: $\hat{Y} = 9{,}679 + 0.085X1 + 0.775X2$.**

Keywords—information and communication technology, learning, covid-19 pandemic period, student learning outcomes

I. INTRODUCTION

One of the challenges of education today is building 21st-century skills, namely skills and literacy in the development of learning media based on Information and Communication Technology (ICT) to support critical and systemic thinking skills, problem-solving skills, effective communication skills, and collaborative skills. That skill is a characteristic of today's global era society, which is a knowledgeable society. The development of instructional media based on ICT has enormous potential as a means or tool for building these skills in the learning process. Therefore, in modern education, lecturers are required to be able to integrate ICT in the learning process. That is, lecturers must have knowledge and skills in developing learning plans that integrate ICT in them.

The use of ICT today has become commonplace in society. During the current covid-19 pandemic, the use of ICT became a vital requirement in conducting lectures. Most university activities, such as lectures, seminars, and official meetings are held virtually. The media used for virtual activities also varies. Higher education in this context must certainly be able to adapt to the development of ICT. Universitas Negeri Malang (UM) as a university continues to strive to make a breakthrough to be able to adapt to the development of ICT. UM currently has a web-based learning management system called SIPEJAR (*Sistem Pengelolaan Pembelajaran* / Learning Management System).

Changes in learning are always challenging. This is especially true when the change involves the integration of ICT as a solution to learning [1]. These changes have the potential to have an impact on learning, academic practice, and the organization of learning resource organizations. The context of learning change is changing learning programs into flexible learning resources. UM lecturers, in general, have gained sufficient experience by teaching in e-learning with SIPEJAR, so that there is a good understanding of the potential of ICT to provide multimedia content, communication opportunities, and interactive learning experiences. Lecturers also realize that the millennial generation makes software based on ICT, and interactive on the internet a necessity of life.

The software has the potential to improve existing learning programs based on ICT and provide more sophisticated interactions, both verbally, collaboratively, and feedback that is relevant to the learning context [2], [3]. Thus, lecturers also need to review existing approaches and evaluate the use of ICT in the learning process. Providing a more flexible learning environment for students is the main goal. Students currently use any learning paradigm and from anywhere.

Increasing the number of students enrolling in certain programs and simultaneously registering also with studies in other disciplines, is a real challenge for universities to use lectures online. Students benefit greatly from more flexible scheduling and more access to learning resources and learning experiences when lectures use ICT tools [4]. This study investigates whether the use of ICT in learning during the covid-19 pandemic can improve student learning outcomes.

II. METHODS

The research question is whether the use of ICT in learning during the covid-19 pandemic can improve student learning outcomes? To answer the research question, the hypotheses tested in this study are: there is a significant effect of assignments (X1) and midterm exams (X2) on final exams (Y). Referring to the hypothesis being tested, this research uses a descriptive-causality research design. There are three variables examined in this research, namely: assignments (X1), midterm exams (X2), and final exams (Y).

The research data is the score of student learning outcomes in the Educational Administration Department, Even Semester 2019-2020, uploaded on SIAKAD (web-based academic system) UM. The student learning outcomes score data from 7 courses, 16 classes, with a total of 502 students (Table 1), Department of Educational Administration, Faculty of Education, Universitas Negeri Malang. Learning activities this semester use ICT, because in this semester Indonesia also experienced a covid-19 pandemic, so the teaching and learning process at Universitas Negeri Malang was carried out online.

The description of the data is calculated using the stanfive formula, which previously calculated the mean, standard deviation (SD), maximum score, and minimum score. The stanfive formula is: (1) $X < (\overline{X} - 1{,}5\ SD)$, worse category; (2) $(\overline{X} - 1{,}5\ SD) < X < (\overline{X} - 0{,}5\ SD)$, bad category; (3) $(\overline{X} - 0{,}5\ SD) < X < (\overline{X} + 0{,}5\ SD)$, medium category; (4) $(\overline{X} + 0{,}5\ SD) < X < (\overline{X} + 1{,}5\ SD)$, good category; and (5) $(\overline{X} + 1{,}5\ SD) < X$, the great category [5]. Next, it is presented in the form of a frequency distribution image. Analysis of the data used to test hypotheses in regression analysis. Data analysis using the IBM SPSS Statistics 24 program.

TABLE I. COURSE NAME AND NUMBER OF STUDENTS

No	Courses	Classes	Students
1	English Professional Education Management	3	93
2	Class Management	1	32
3	Management of Students	3	97
4	Project Management	2	60
5	Facility and Infrastructure Management	3	97
6	Introduction to Education	3	117
7	Field Study and Practice	1	6
Total		**16**	**502**

Lectures are carried out using ICT. Especially during the covid-19 pandemic, all lecture meetings were carried out with online learning. Some of the communication and information technology used in lectures include SIPEJAR, WhatsApp, and YouTube. SIPEJAR is a web-based learning management system developed by MEs (Figure 1). The WhatsApp application is commonly used by lecturers and students to communicate related to lectures, namely by creating a WhatsApp Group / GWA (Figure 2). While YouTube is used by lecturers and students in searching for audio-visual material, which is then analyzed according to the content and substance of the course material (Figure 3). Besides, lectures also use the Google Meet application (Figure 4).

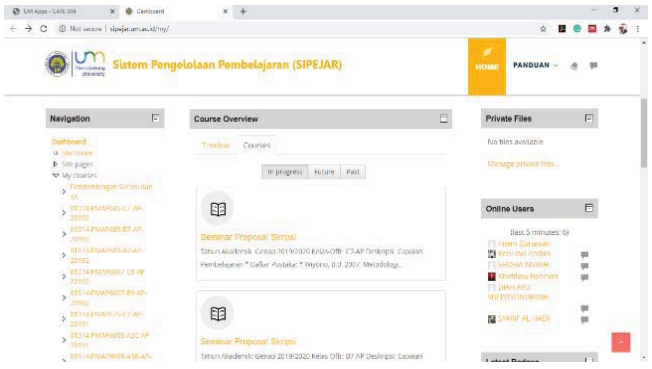

Fig. 1. SIPEJAR homepage

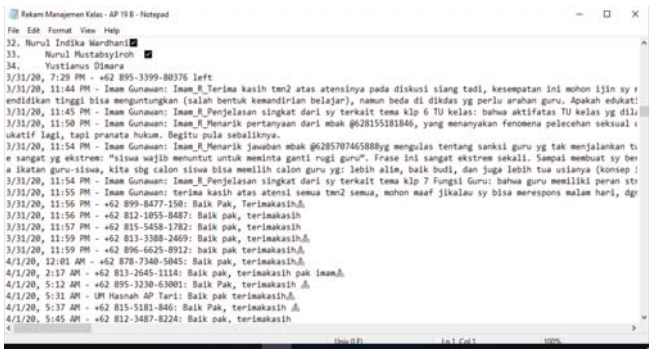

Fig. 2. Lecture with the whatsapp application

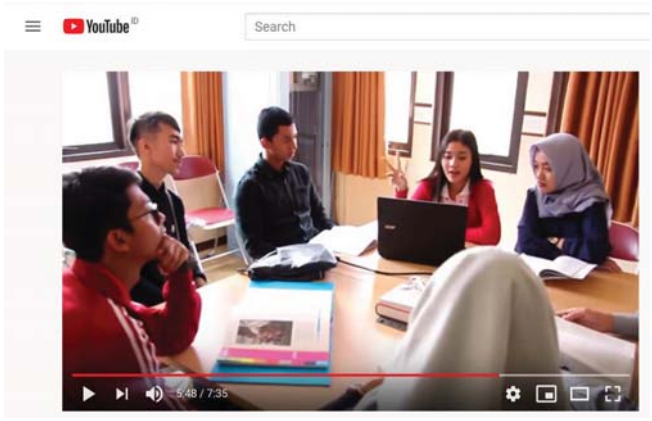

Fig. 3. Using youtube videos (class management analysis)

Fig. 4. Lecture with the google meet

III. RESULTS

The following is a data description of the three research variables, namely: assignments (X1), midterm exams (X2), and final exams (Y). The result of the assignment variable data description (X1) is obtained: mean of 73,30; the standard

deviation of 18.11; a maximum score of 100; and a minimum score of 5. The frequency distribution of assignments (X1) is presented in Figure 5. Based on Figure 4, it is known that students who scored: < 46.14 were 62 students (12.35%); 46,14 - 64,25 as many as 52 students (10.36%); 64,25 - 82,35 as many as 198 students (39.44%); 82.35 - 100.46 as many as 190 students (37.85%); and there are no students who score > 100.46. Referring to the average score (73.30), the assignments variable (X1) is included in the medium category.

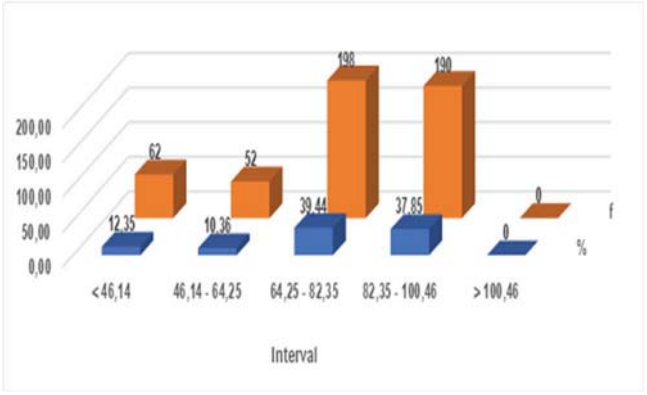

Fig. 5. Frequency distribution of assignments (X1)

The results of the data description of the midterm exams variable (X2) were obtained: mean of 77.38; the standard deviation of 10.59; a maximum score of 100; and a minimum score of 36. The frequency distribution of the midterm exams variable (X2) is presented in Figure 5. Based on Figure 6 it is known that students who scored: < 61.49 were 45 students (8.96%); 61.49 - 72.08 as many as 77 students (15.34%); 72.08 - 82.68 as many as 202 students (40.24%); 82.68 - 93.27 as many as 163 students (32.47%); and > 93.27 as many as 15 students (2.99%). Referring to the mean score (77.38), the midterm exams variable (X2) is included in the medium category.

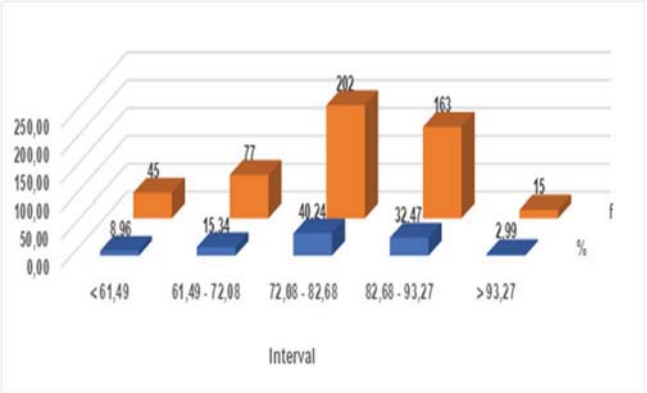

Fig. 6. Frequency distribution of midterm exams (X2)

The results of the final exams (Y) data description results are obtained: mean of 75.91; standard deviations of 9.82; a maximum score of 94; and a minimum score of 25. The frequency distribution of the final exams variable (Y) is presented in Figure 6. Based on Figure 7 it is known that students who scored: < 61.18 were 42 students (8.37%); 61.18 - 71.00 as many as 94 students (18.73%); 71.00 - 80.82 as many as 198 students (39.44%); 80.82 - 90.64 as many as 158 students (31.47%); and > 90.64 as many as 10 students (1.99%). Referring to the mean score (77.38), the final exams (Y) variable is included in the medium category.

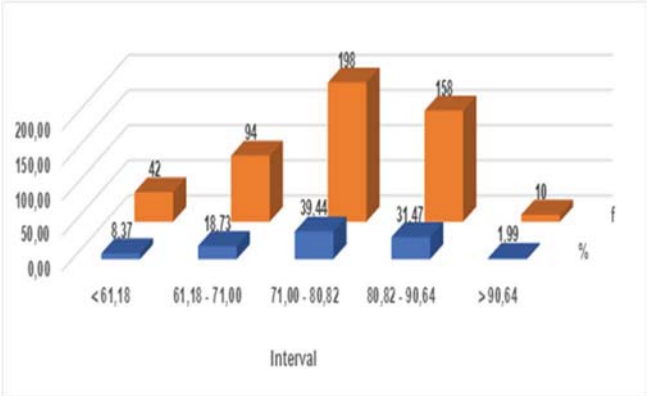

Fig. 7. Frequency distribution of final exams (Y)

Then the data were analyzed using regression analysis to test the hypothesis. The results of the regression analysis of the research variables, the regression coefficients are known: (1) assignments (X1) to the final exams (Y) are 0.971; (2) midterm exams (X2) against final exams (Y) is 0.989; (3) assignments (X1) and midterm exams (X2) to final exams (Y) are 0.990; and (4) ε = 0.141 (from the calculation results $\sqrt{1-R^2} = \sqrt{1-0{,}990^2}$). The empirical model of the three variables is illustrated in Figure 8.

The hypothesis proposed states that there is a significant effect of assignments (X1) and midterm exams (X2) on final exams (Y). The formula used to test the hypothesis is the F test formula. The results of the F test analysis with the help of the IBM SPSS Statistics 24 program obtained a significance value of 0.000. Based on the results of the analysis of the F test using a significance level of 0.05 it can be seen that the significance value obtained is 0.000 < 0.05; so H0 is rejected and Ha is accepted [5]. This means that the hypothesis that there is a significant effect of assignments (X1) and midterm exams (X2) on final exams (Y), is accepted. So, it can be concluded that there is a significant effect of assignments (X1) and midterm exams (X2) on final exams (Y).

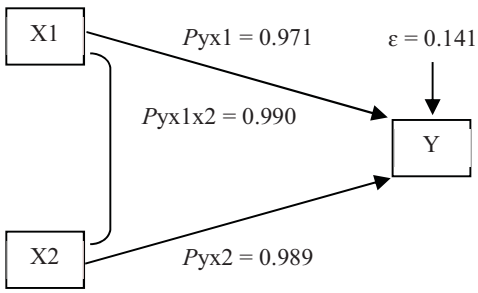

Fig. 8. Empirical model of research variables

Then the regression equation calculated from the research variables is calculated. Referring to the results of the beta coefficient magnitude in Table 2 Coefficients column Unstandardized Coefficients B, the formula of the regression line equation of the research variables is obtained, namely: $\hat{Y}$ = 9.679 + 0.085X1 + 0.775X2. The interpretations of the model based on the formula of the regression equation are: (1) a constant of 9.679 states that if there is no increase in the scores of X1 and X2, then the Y score is 9.679; and (2) a regression coefficient of 0.085 on the X1 variable and 0.775 on the X2 variable states that each addition of one score X1 and X2 will give an increase to the Y variable by 0.085 and 0.775 together.

TABLE II. COEFFICIENTS

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.679	.953		10.155	.000
	Assignments	.085	.015	.157	5.665	.000
	MidtermExams	.775	.026	.836	30.105	.000

a. Dependent Variable: FinalExams

IV. DISCUSSION

The research findings conclude the use of ICT in learning during the covid-19 pandemic can improve student learning outcomes. The results of this research are in line with Husain [6] research which concludes the use of ICT effectively to improve learning outcomes and the effectiveness of learning implementation. The use of ICT significantly influences teacher teaching performance [7]. The results of this research indicate that lecturers must be able to prepare learning designs that integrate ICT properly and correctly following the situation, conditions, and needs of each subject.

To achieve these objectives, lecturers: (1) analyze differences in learning designs that have integrated ICT or not; (2) discuss the steps in preparing learning designs that integrate learning media based on ICT; and (3) applying how to develop learning designs that integrate learning media based on ICT. An open mind is the main requirement so that lecturers can master the skills of designing learning plans that integrate learning media based on ICT. Learning media is an important factor in improving the quality of learning. Very many kinds of learning media, of course, are not used at once. For this reason, it is necessary to choose carefully, which media is more appropriate to achieve the stated learning goals. Some several criteria and steps need to be considered in media selection.

The criteria in question are learning objectives, effectiveness, student characteristics, availability, technical quality, cost, flexibility, the ability of people who use them, and the time available [8]. Stages that can be done by lecturers in choosing learning media are: (1) designing learning activities; (2) determine the message transmission used; (3) determine the characteristics of the lessons to be taught; (4) classifying media based on type; and (5) analyze the characteristics of each media that will be used. However good the media that have been selected, if not used properly, certainly not much benefit [9]. In the use of instructional media, two patterns can be done, namely patterns of use in the classroom and patterns of use outside the classroom. The main procedures that can be carried out in the use of instructional media are preparation, implementation, and follow-up.

Universities as providers of education and learning seek to reduce dependence on face-to-face teaching through the effective use of information technology. This is seen as a way to provide more flexibility in the teaching and learning process, make it easier for students to access more learning resources, and reduce student demands in class. The initial exploration effort that can be carried out by universities before students and lecturers carry out the teaching and learning process is to provide direction that using just one device will not have a significant impact on the effectiveness of the learning process. This is caused by differences in views about teaching approaches, learning, and learning outcomes. Therefore, a good solution is that lecturers can choose according to their lecture needs. The effectiveness of lectures by utilizing ICT is also influenced by tertiary policies. The ability of lecturers to use ICT will be better if the lecturer is also equipped with adequate training related to the use of ICT.

Besides, universities must also design curricula that are appropriate to the needs of their students. The technical ability of lecturers and students in using ICT is a factor that determines the effectiveness of the learning process when lectures take place. ICT has always been a topic of discussion and at the same time used as a tool in finding, processing, managing, displaying, and delivering learning resources [10]. This is the reason that universities must follow the global culture by implementing the development of ICT in the field of education and learning.

Lecturers are no longer a “stronghold of knowledge”. Along with the development of information technology that also affects the learning process, the role of lecturers has changed. The conventional view states that the lecturer acts as one of the “distributors” of information and science, by utilizing the learning media, the lecturer acts as the class manager. The role of lecturers is currently undergoing a shift, namely when carrying out educational and learning activities from the one-way communication model to multi-dimensional communication [11]. The conventional education paradigm presents the conditions in which lecturers carry out the teaching and learning process based on their knowledge and experience. Therefore, education in this paradigm is the main source for students in gaining knowledge and information. Knowledge and information possessed by lecturers are sent and transferred linearly to students.

The conventional learning paradigm is different from the technology-based learning paradigm. The technology-based learning paradigm provides lecturers and students access to modern storage technology. Students and lecturers can access and manipulate information at a faster and more efficient level and can eliminate weaknesses that exist in the implementation of learning with conventional paradigms [12], [13]. Students and lecturers using technology-based learning paradigms can make multi-dimensional communication, namely: (1) students can easily access subject matter and learning resources; (2) easy to interact with other students and the learning environment; and (3) can develop multimedia and technology according to the needs and characteristics of learning. Technology in learning activities facilitates the delivery and processing of information by giving lecturers and students various choices based on continuous assessment of learning activities [14]. The use of technology in learning can also affect students’ motivation and cognitive abilities.

The technology-based learning paradigm gives students direct and fast access to basic science. This can challenge students to manage, manipulate, analyze, and develop the knowledge they learn while encouraging students to reflect and evaluate their learning process. The application of technology-based learning enables students to play an active role in developing their knowledge, which was only as passive recipients of the information. The leadership of higher education becomes the main factor in improving the teaching performance of lecturers [15], [16]. The challenge of learning by utilizing ICT is how lecturers can internalize a hidden

curriculum that can develop student character [17], [18]. Therefore, solid university management is needed [19], [20].

V. CONCLUSION

Data analysis of this study concludes the use of ICT in learning during the covid-19 pandemic can improve student learning outcomes. This is evidenced by the results of hypothesis testing which states there is a significant effect of assignments (X1) and midterm exams (X2) on final exams (Y). The study of website content based on information technology is very important.

Future learning will be carried out by utilizing the website. Learning by using a website can improve learning outcomes, student flexibility in accessing information, and flexibility in applying teaching and learning approaches. As such, the requirement is to ensure solutions are adopted and handled in existing organizational arrangements from majors to universities.

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