The Impact of Skills and Knowledge on the Success of Systems for Learning on the Cloud in the Covid-19 Pandemic Era

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Abstract. One of the policies launched by the government in education during Covid-19 pandemic is the shift from offline to e-learning. This policy elicited learning loss due to ineffective interaction among students, between students and teachers and low competence of learning materials. E-learning system needs to be well-prepared to avoid learning loss. This research thus aims to analyze students' and teachers' skills and knowledge on the success of systems for learning on the cloud in the Covid-19 era. Data of this study was collected by surveying students and teachers in Senior High Schools and Vocational High Schools in Pekanbaru. The samples were taken using random sampling in schools implementing systems for learning on the cloud. Questionnaire is conducted to a sample of 240 students and teachers. The data were analyzed using regression analysis technique. This study discovered that the following factors all significantly contribute to the success of systems for learning on the cloud: 1) problem-solving abilities, 2) leadership or management skills, 3) counseling abilities, 4) research and educational abilities, 5) skills and knowledge of new terms in information and technology, and 6) familiarity with Covid-19.

Keywords: E-Learning, Learning Loss, Cloud, Competence, Covid-19

1 Introduction

Education technology that uses online learning platform such as e-learning with the absence of teachers and students develops rapidly to support the success of learning process [1]. E-learning is a learning instruction delivered through digital tools designed to enhance learning experience. These devices can be electronic devices such as computer, laptop, game console, smartphone, and others [2]. Another way to define e-learning is as a web-based learning environment that combines multiple participants with specific processes and technology [3][4]. E-learning has appeared in many domains of society and been benefitted by schools, universities, and many organizations. E-learning system allows its users to study anywhere and anytime [5][6].

Moreover, In March 2020, it was first determined that Covid-19 was spreading throughout Indonesia. Since then, some measures that must be put into effect have been officially recognized by the President of the Republic of Indonesia as the first case of Covid. One of them is distance learning with an online system (e-learning) [7].

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From the studies that have been done, online learning is found to cause learning loss. Learning loss can be defined as a situation in which students lose either general or specific knowledge and skills. This occurs due to prolonged gap or the absence of appropriate learning process [8]. This issue is identified from the ineffectiveness of student-student interaction, student-teacher interaction, and low mastery of learning materials by the teachers [9]. Another study indicates that online learning process affects the process and experience of learning negatively [10].

This problem needs to be anticipated by all parties so that it will not affect the students. Senior and Vocational High School students are young generations and future leaders, thus need to be well-educated. That is why this This study intends to examine the effects of students' and instructors' knowledge and skills when utilizing systems for learning on the cloud during the Covid-19 pandemic.

2 Methods

This research was conducted through a survey in Pekanbaru. This location was opted as the population with the following considerations: 1) the telecommunication network and internet were relatively more complete compared to other areas, and 2) the schools in this area conducted online learning during Covid-19 pandemic. Data were collected using random sampling technique through questionnaire and in-depth interview to 240 samples. Respondents in this study included Senior and Vocational High School students and teachers who used Cloud in the teaching and learning process during the Covid-19 pandemic.

Success of cloud-based learning during the Covid-19 epidemic was one of the variables considered in this study (variable Y). Additionally, the independent factors include capacity to solve issues, skills in management or leadership, abilities in counseling, educational and research abilities, abilities and familiarity with new information and technological phrases, and understanding of Covid-19. The measurement and indicators of research variables are described in Table I.

Table I. Indicators and measurements of research variables

Variable	Measurements	Data
Problem solving skill (X_1)	Capable of using cloud-based e-learning system correctly and have problem solving skill.	Interval
Leadership or management skill (X_2)	Having leadership or management skill that is used in cloud-based e-learning system.	Interval
Counseling skill (X_3)	Consulting with other users.	Interval
Research and educational skill (X_4)	Could easily utilize cloud-based e-learning system by equipped oneself with appropriate knowledge and doing research.	Interval
Skills and knowledge of new terms in information and technology (X_5)	Having knowledge and skill about recent information and technology.	Interval
Knowledge of Covid-19 (X_6)	Having adequate knowledge of Covid-18 and prerequisites to use distance learning system.	Interval

Systems for learning on the cloud during the Covid-19 pandemic (Y)	a) b) c) d)	How well the cloud learning systems function is influenced by the security of the data. It is more economical to adopt a cloud-based e-learning system. The success of cloud-based e-learning systems depends on more storage. A cloud-based e-learning system should be developed in the Covid-19 pandemic with easier accessibility, quicker development, and simple maintenance as some key considerations.	Interval

The research variables were measure using Likert scale 1-5, which then were transformed into three categories as detailed in Table II.

Table II. Score Criteria

Variable	**Category**	**Interval**
Dependent Variable	High	48 – 70
	Medium	24 – 47
	Low	1 – 23
Independent Variable	High	6.8 – 10,0
	Medium	3.4 – 6.7
	Low	1.0 – 3.3

Data analysis was carried out using Multiple Linear Regression with the SPSS application. The research hypotheses are:

Hypothesis 1 (H_1): In the Covid-19 epidemic age, problem-solving ability has a strong positive impact on the success of systems for learning on the cloud.

Hypothesis 2 (H_2): In the Covid-19 epidemic era, leadership or management ability has a strong beneficial impact on the development of systems for learning on the cloud.

Hypothesis 3 (H_3): In the Covid-19 epidemic age, counseling expertise has a huge positive impact on the success of systems for learning on the cloud.

Hypothesis 4 (H_4): In the Covid-19 epidemic age, research and educational ability have a strong positive impact on the success of systems for learning on the cloud.

Hypothesis 5 (H_5): In the Covid-19 epidemic era, the ability to understand new concepts in information and technology has a large beneficial impact on the success of systems for learning on the cloud.

Hypothesis 6 (H_6): In the Covid-19 pandemic age, understanding Covid-19 has a huge positive impact on the effectiveness of systems for learning on the cloud.

3 Findings and Discussion

In this research, data were collected through questionnaire and in-depth interviews with students and teachers. As an instrument, the questionnaire validity and reliability were initially tested. All items of the questionnaire in this study were valid and reliable (Table III). The validity test was carried out using Pearson Correlation technique. The validity test's findings indicated that the correlation value was more than 0.3. This suggests that all of the survey's questions were accurate. Furthermore, Cronbach's alpha was employed in the reliability test. The alpha value was greater than 0.6, according to the reliability test results. It means that all of the survey's questions were accurate [11].

Table III. The findings of validity and reliability tests

Variable	Validity (r > 0.3)	Reliability (alpha > 0.6)
X_1	0.938	0.771
X_2	0.844	0.736
X_3	0.928	0.857
X_4	0.805	0.762
X_5	0.887	0.766
X_6	0.884	0.707
Y	0.893	0.771

Several assumption tests of linear regression conducted were linearity test, normality test, non-heteroscedasticity test, and non-multicollinearity test. Furthermore, the Ramsey RESET test was used to test the assumption of linear regression model. It is expected that the data distribution of linear regression is satisfied if sig F > 0.05. The normalcy assumption was tested using the Kolmogorov-Smirnov (OF) test. If sig OF > 0.05, it is presumed that the normal data distribution is met. Additionally, a Breusch Pagan (BP) test was performed to verify the presumption of non-heteroscedasticity. It is considered that the non-heteroscedasticity is satisfied if the value of sig BP > 0.05. In addition, Variance Inflation Factor (VIF) was used to test the assumption of non-multicollinearity. If VIF < 5 then the assumption of non-multicollinearity is justified [12]. Based on the test results, the assumptions of four multiple linear regressions were fulfilled as described in Tabel IV.

Table IV. fulfillment of multiple linear regression's assumptions

Assumption	Indicate	Result
Linearity	Sig F= 0.263 > 0.05	Linearity met
Non-multicollinearity	VFI average= 2.874 < 5	Non-multicollinearity met
Normality	Sig KF= 0.316 > 0.05	Normality met
Non-heteroscedasticity	Sig BP = 0.274 > 0.05	Non-heteroscedasticity met

Table V. Proper Test of Research Model

Model	R Square	F	Sig.
	0.857	14.834	0.000

Table V reveals the results of the data's multiple regression analysis. According to the model test's results, 85.7% of a cloud-based learning system's success in the Covid-19 pandemic era can be attributed to a person's capacity for the capacity to solve issues, skills in

management or leadership, abilities in counseling, educational and research abilities, abilities and familiarity with new information and technological phrases, and understanding of Covid-19. The remaining 14.3% was supported by additional considerations. This suggests that independent traits found in this research model could be used to forecast how well systems for learning on the cloud will perform during the Covid-19 epidemic.

Table VI. Testing results of variables which influence success of cloud-based learning systems in Covid-19 era

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Hypothesis
	B	Std. Error	Beta			
Constant	23.009	2.667		8.662	0.000	
X_1	0.402	0.114	0.401	3.386	0.018	Accepted
X_2	0.410	0.091	0.095	3.786	0.023	Accepted
X_3	0.257	0.108	0.140	4.441	0.020	Accepted
X_4	0.418	0.048	0.276	3.859	0.000	Accepted
X_5	0.323	0.048	0.175	3.363	0.019	Accepted
X_6	0.290	0.032	0.061	2.380	0.017	Accepted

Note. Dependent Variable: The success of systems for learning on the cloud in Covid-19 era

Table VII. Average score of research variables

No.	Variable	Mean	Category
1	X_1	7.84	High
2	X_2	6.68	Medium
3	X_3	7.39	High
4	X_4	6.94	High
5	X_5	7.53	High
6	X_6	7.60	High
7	Y	46.12	Medium

Table VII displays the mean score for the research variable. The success of cloud-based learning systems during the Covid-19 epidemic era, according to the responders, is often in the medium category with a mean of 46.12 percent. These data confirms that the initially predicted issue of learning loss during Covid-19 era is not entirely true. It is proven by learning activities that are still carried out using some applications such as Zoom, Google Meet, Google Classroom, Edmodo, Skype, and others. The indicators of the success of cloud-based learning system can be perceived from four aspects, namely: 1) The security of information influences the success of the systems for learning on the cloud; 2) The use of systems for learning on the cloud is more cost-effective; 3) Users have more storage by using systems for learning on the cloud; and 4) In the Covid-19 epidemic, establishing a cloud-based e-learning system requires a number of key considerations, including improved accessibility, quicker creation, and simple maintenance.

Research on the infrastructure characteristic of cloud has been done using the client-server model. The descriptive introduction to this study covered the possible impact of cloud-based applications on education. The result showed that cloud-based application could assist researchers and experts in understanding the relevance of knowledge. Cloud-based application is potential to develop digitalized infrastructure of education and modernization in educational sector [13][14].

A novel learning environment based on business competency has been developed in order to undertake research on the paradigm shift in business education. Both quantitative and qualitative research methodologies were used in this study. A questionnaire that was developed and used was delivered to the business and management program participants. Six logistic regressions were developed using the SPSS application program and were based on the hierarchical conceptual model. The result of this research indicates that there is a dire need of change in paradigm of business education. In other words, it is crucial to shift the education process that typically involves transferring knowledge into an education based on business competence [15][16].

The sustainability of systems for learning on the cloud may be affected by human, organizational, and technological aspects, according to research that suggests combining the expectation confirmation model, flow theory, and human-technology-organization framework. Medical staff in Taiwanese hospitals were surveyed for data. 368 or 73.6% of the 500 shared surveys could be used for analysis. The study's findings indicated that people, organizations, and technology all have an impact on how long systems for learning on the cloud will be available to medical professionals [17][18].

Research on theoretical framework and model revealing the success of e-learning portal has been done in Malaysia. Empirical data of this literature study were collected and analyzed using Structural Equation Modelling (SEM). This research used gender as its variable. The research result demonstrates that the quality of system and information has a direct relationship with the male users' satisfaction using the e-learning. The e-learning system is supported by the information's quality. E-learning and user satisfaction had a similar, favorable association. Furthermore, the service and the caliber of the information provided by female respondents are supported by user satisfaction and system usage. The system's quality has a beneficial impact on how satisfied consumers are. Thus, it can be concluded that there was a positive relationship between e-learning portal and users' satisfaction. The result of this study depicts that men and women have various stages in utilizing e-learning system at universities in Malaysia [19].

Hypothesis 1 (H_1): It is acknowledged that problem-solving abilities have a considerable favorable impact on a cloud-based learning system's ability to function successfully during the COVID-19 pandemic (considerable, $0.018<0.05$). The success of systems for learning on the cloud during the COVID-19 pandemic was influenced by problem-solving ability by 0.402. The success of the cloud-based learning system during the Covid-19 epidemic must thus rise by 0.402 units for every unit that the respondents' problem-solving ability increases, under the ceteris paribus assumption. The mean of the respondents' problem-solving skill was high (7.84).

Hypothesis 2 (H_2): It is also acknowledged that leadership or management ability significantly contributes to the success of systems for learning on the cloud during the Covid-19 pandemic (Significant, $0.023<0.05$). The effectiveness of the cloud-based learning system during the COVID-19 pandemic was 0.410 influenced by management or leadership ability. According to the premise of ceteris paribus, if the leadership or management competence of the responders grows by one unit, then the success of the systems for learning on the cloud during the Covid-19 pandemic increases by 0.410. The mean of the respondents' leadership or management skill was 6.68 and can be classified into medium category.

Hypothesis 3 (H_3): The hypothesis that the success of systems for learning on the cloud during the Covid-19 epidemic is significantly positively influenced by counseling skill is accepted (Significant, $0.02<0.05$). During the Covid-19 epidemic, the effectiveness of the

cloud-based learning system was affected by counseling competence to the tune of 0.257. Assuming ceteris paribus, this indicates that if the respondents' counseling competence rises by one unit, the cloud-based learning system's success during the Covid-19 pandemic also increases by 0.257 units. The mean of the respondents' counseling skill was high, accounted for 7.39.

Hypothesis 4 (H_4): The success of systems for learning on the cloud during the COVID-19 pandemic is considered to be significantly positively influenced by research and educational skills (Significant, 0.00<0.05). The success of the cloud-based learning system during the COVID-19 pandemic was impacted by research and educational skills to the tune of 0. 418. This means that, under the premise of ceteris paribus, if the respondents' research and educational skills rise by one unit, the success of the cloud-based learning system during the Covid-19 pandemic also increases by 0.418. Similar to some other skills, the mean of the respondents' research and education skills was high, accounted for 6.94.

Hypothesis 5 (H_5): It is agreed (considerable, 0.019<0.05) that knowledge of new terminology in information and technology and competence in using them have a considerable favorable impact on the systems for learning on the cloud during the Covid-19 epidemic. The effectiveness of a cloud-based learning system during the Covid-19 epidemic was influenced by skills and understanding of new terminology in information and technology by a factor of 0.323. Implicitly, the success of the cloud-based learning system during the COVID-19 pandemic grows by 0.323, given that skills and knowledge about new words in information and technology are enhanced by one unit; ceteris paribus assumption. The mean of respondents' skills and knowledge about new terms in information and technology was high (7.53).

Hypothesis 6 (H_6): Knowledge of Covid-19 has a significant positive influence to the success of systems for learning on the cloud during Covid-19 pandemic is accepted (Significant, 0.017<0.05). The impact of knowledge about Covid-19 to the success of cloud-based learning system during Covid-19 pandemic was 0.290. It suggests that if the knowledge about Covid-19 is increased by one unit, the success of the cloud-based learning system during Covid-19 pandemic also increases by 0.290, the assumption of ceteris paribus. The mean of respondents' knowledge about Covid-19 was high, accounted for 7.60.

The findings of this research are particularly relevant to global demand to improve service, education, and the rapidly growing energy utilization [20][21]. Three categories of e-learning success were identified through the assessment of several variables: 1) Execution method variables; 2) behavioral understanding factors; and 3) performance dimension variables. The purpose of this study is to pinpoint several factors that influence how well e-learning works. Other studies covered in this paper have only looked at technological characteristics and users' perceptions of e-learning's advantages. The most important and determining factors in the success of an e-learning system are the knowledge and abilities of the students and teachers. The characteristics of e-learning assist students in improving their learning process by integrating problem-solving abilities, leadership or management skills, counseling skills, research and educational skills, training skills, and skills for overcoming new challenges [22][23].

The skill and knowledge of students and teachers are crucial elements in e-learning process. If teachers and students possess the necessary skills (e.g. technology skills and digital literacy), they would be able to utilize the facilities and tools available in systems for learning on the cloud such as logic design, curriculum content, teachers' qualification, and interactive facilities appropriately; thereby contributing to the internal program efficiency. The effectiveness of the learning process, student satisfaction, and academic success would all be

enhanced by having the requisite abilities. This scenario would probably increase the internal effectiveness of the e-learning program and could result in its success [23][24].

It is crucial that everyone considers the policy implications of the success of cloud-based learning systems in order to increase students' and teachers' proficiency in using cloud-based applications in areas such as the capacity to solve issues, skills in management or leadership, abilities in counseling, educational and research abilities, abilities and familiarity with new information and technological phrases, and understanding of Covid-19.

The discovery of factors determining the success of cloud-based learning system in Covid-19 pandemic becomes the novelty of this research. These findings make it easier to formulate strategic steps in finding solution to learning loss issue in a cloud-based learning. In addition, the findings can be used as a reference to accelerate digitalization in education.

Some limitations should be acknowledged in this research. The study's focus is somewhat limited because it primarily looks at how knowledge and skills relate to the efficacy of cloud-based learning systems during the Covid-19 pandemic. The effect of culture and the state of the economy, for instance, on the success of a cloud-based learning system has not yet been examined. As a result, more research is needed to examine additional contributing aspects influencing the performance of cloud-based learning systems.

4 Conclusion

The following skills are essential for the success of systems for learning on the cloud during the Covid-19 pandemic: 1) the capacity to solve issues; 2) Skills in management or leadership; 3) abilities in counseling; 4) Educational and research abilities; 5) abilities and familiarity with new information and technological phrases; and 6) Understanding of Covid-19.

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