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Research article

# Analysis of e-learning readiness level of public and private universities in Central Java, Indonesia

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## ABSTRACT

The development of information technology has reached into various fields, such as education. The emergence of e-learning is one manifestation of information and communication technology (ICT) in education. Until recently, only a few universities (6%) have implemented e-learning in Indonesia. Those that have implemented e-learning are still not optimally utilized. Some experts have also warned all organizations that will adopt e-learning to be concerned with thorough preparation to avoid overruns in costs. There is a method that consists of factors to measure the level of readiness of tertiary institutions towards the implementation of e-learning. The level of readiness is obtained through the distribution of questionnaires using 5 Likert scales. This research proposed a framework that produces four factors from the university, which covers the lecturer's characteristics, e-learning facilities, learning environment, learning management, and four factors from the student's side, namely, self-learning, motivation, learner's control, student's characteristic. The measurement results show the level of readiness for e-learning implementation in tertiary institutions in Central Java Province reaches level 3 or ready but needs a few improvements. Improvements that must be made includes (1) Designing exciting learning content through interactive multimedia; (2) Increasing the frequency of e-workshops or e-training related to technological developments, especially to e-learning; (3) encouraging students to be more active in discussions and giving opinions; (4) Developing plans related to infrastructure such as servers related to their capacities; (5) strengthening the role of IT units in serving e-learning users.

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## 1. Introduction

In the previous decade, higher education reached an era of rapid technological development through the internet and the revolution of computer applications [1]. It brings a paradigm change in distance learning and leads to an essential role in some universities in the world [2].

Based on the change in paradigm, it encourages online learning methods by using e-learning. With e-learning, education will be more open with distance learning mechanisms. Besides, e-learning can also share knowledge in an institution, between institutions, or in the community. Three-quarters of universities in continental Europe recognize that e-learning can positively change teaching and learning approaches [3].

There are still a small number of universities in Indonesia that use e-learning to support teaching and learning methods. Out of 100 universities in Indonesia taken randomly, only 36% of universities have adopted e-learning in the form of learning management systems (LMS) such as Moodle, Claroline, Dokeos, Sakai, and Atutor; the rest haven't used it at all [4, 5].

In Indonesia, especially Jawa Tengah Province, several universities have implemented e-learning for teaching and learning activities. An example of the application of e-learning at the ICT-based institute is the only one in Central Java, Telkom Institute of Technology Purwokerto (IT Telkom). Based on the author's interview results, e-learning in IT Telkom has started since 2013 using the LMS. The statistical results show that 26 of the 95 active lecturers made courses for their teaching and learning activities within three years. Also, the total number of active courses currently stands at only 80. This amount is minimal when compared with the average total of lectures given each semester. Another example at Jenderal Soedirman University (UNSOED), e-learning uses LMS technology, which is managed directly by the UNSOED Quality Assurance Learning and Cooperation Development Institute (LP3M). However, many courses are still not yet up to date until the academic year 2018/2019. We can see this because there are even courses that have not been updated since the 2014/2015 school year.

From these data samples, questions arise regarding the conditions of implementing e-learning in Indonesia. Information obtained by the author that the Indonesian government's e-learning program spent approximately 10 trillion rupiahs on funding in 2010 and 2011. With the funds spent, it is unfortunate if the investment fails to be implemented [6] since it can severely impact the organization's business processes [7].

Some developing countries in the world are interested in implementing e-learning, but they are hampered by infrastructure, resources, access to information, personal characteristics, and culture and policies [8]. An exemplary implementation strategy must support the application of e-learning; thus, e-learning can overcome many barriers associated with traditional learning [9]. Many factors can influence the implementation and effectiveness of e-learning, but readiness is a critical determinant of success [10]. Other researchers also mentioned that it is necessary to initiate a study of critical success factors that affect the successful implementation of e-learning [11].

Therefore, to determine the success or failure of e-learning Implementation, we need a model that can measure the level of readiness of higher education, namely e-learning readiness (ELR). The model estimates the readiness of tertiary institutions on the physical side and from the user's side. Most previous studies have not clearly shared the factors influencing e-learning to more specific objects in terms of teachers and students. Moreover, the model also has to be adjusted to the institution's characteristics, especially in Indonesia.

Measurement of universities' readiness level towards the implementation of e-learning, it is also necessary to see the level of readiness at public universities and private universities. According to The Minister of Technology Research and Higher Education in the work cabinet (2014-2019), the paradigm that there is a barrier between public universities and private universities is not valid because they are equal. The difference between public universities and private universities, only in the financing sector. Public universities are funded by the state, while private universities are supported itself. While in terms of the quality of tertiary institutions, it depends on each tertiary institution's learning process, both between public universities and private universities. In this competition era, even a public university can lead to bankruptcy if it is not appropriately managed and will be inferior to private universities. Meanwhile, well-managed private universities can defeat public universities.

Therefore, this study will identify the readiness level of e-learning, especially from University and student's side in public universities and private universities in Indonesia, to give the best practices and ensure implementation effectiveness.

## 2. State of the Art

Warner, Christie, and Choy published the concept of e-learning readiness in 1998 in Australian vocational education and training (VET). They define e-learning readiness as the competence and confidence of students in face-to-face education, the ability to use computer technology, and the ability to get involved in independent learning [12]. In this study's context, e-learning readiness is a picture of a tertiary institution's readiness both in terms of mentality, ability, technological infrastructure

readiness, and support readiness from tertiary institutions for e-learning. The following are some previous studies that researchers will review as reference material based on the problem's relevance:

- a. Dray et al. [13], developing instruments used to assess postgraduate students' readiness in computer education for e-learning. The research method is carried out in three stages. The first stage is developing a research survey. The second stage is analyzing items, and the last step is testing its validity and reliability. A literature study was carried out on several previous studies after setting the research survey, involving experts to provide input on selected factors. From the literature study results, two factors directly affect students' readiness for e-learning, namely learner characteristics, and technology capabilities.
- b. The and Usagawa [8] aim to measure the readiness of e-learning at two universities in developing countries in ASEAN, Indonesia and Myanmar, while determining the improvement strategies needed for countries in ASEAN. There are findings in this study, especially on the factors driving and inhibiting the e-learning readiness at the Yangon technological university (YTU) in Myanmar and the University of Samtatraction (UNIT) in Indonesia. Several indicators used include the role of lecturers, university facilities, and learning environments. While from the perspective of students, the indicators used are student background, the possibility of e-learning benefits, e-learning confidence levels, student expectations.
- c. Paturusi, Chisaki, and Usagawa [14] aim to assess lecturers and students's readiness in using e-learning at Sam Ratulangi University (UNSRAT) in Manado, North Sulawesi. They develop Questioner items consisting of 30 items for students and 40 items for lecturers with 207 total respondents. They found that both students and lecturers alike had a strong desire to use e-learning just as they spent time with computers at home. Based on the questionnaire analysis, it was also found that both students and lecturers were not satisfied with the university's computer facilities. On the other hand, the need for access to computers and the internet is relatively high, so they hoped that the university could improve and prepare these computers and internet facilities. More than 80% of respondents believe that now is the right time to implement e-learning in universities. This is also supported by the high will of students who have never used those facilities before.
- d. Hadining, Sukanta, and Hidayat [15] research use Aydin and Tasci scale. This scale is motivated by the growing development of e-learning in various parts of the world. It obtains many benefits, such as reducing costs and being more effective in delivering learning materials. However, implementation without careful consideration will cause losses, such as wasteful costs, unattractive products, and failures. As in developing other innovations, e-learning requires adequate analysis related to time, costs, infrastructure, and management support. They created a model of e-learning readiness by conducting various literature studies to produce four factors: technology, innovation, people, and self-development. The levels of ELR were developed by dividing 5 selected categories from the 4 intervals, as in Fig. 1.

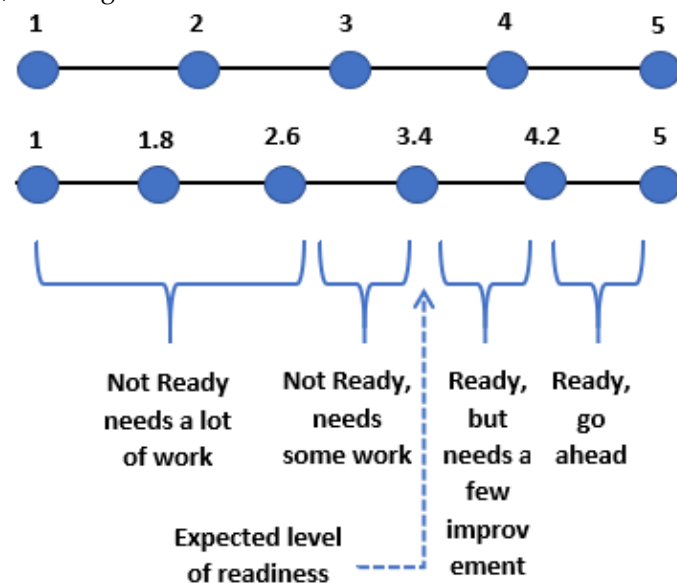


Fig. 1. Level of e-learning readiness [15]

This study also shows that the company in which the survey was carried out is ready to implement e-learning. But there needs to be some improvement, especially in the human resource area, to be implemented successfully. Besides, personal characteristics (gender, age, level of education, and experience using a computer) do not affect their overall perception of company readiness.

Based on some previous research, this research will combine several relevant factors to the case studies in Indonesia, especially in Jawa Tengah Province, and categorize the objects specifically to students and institutions. The reason is the factors need to be adjusted to the characteristics of tertiary institutions in Indonesia. This research uses the level of e-learning readiness from Aydin and Tasci interval to define readiness level.

### 3. Method

The method's formulation is done by determining several factors from various theories and best practices in the e-learning readiness field. A questionnaire was then prepared by setting indicators and individual respondents, followed by conducting a trial at the tertiary institution to measure the extent of the tertiary institution's readiness in implementing e-learning. Then to help the analysis process, interviews were conducted to obtain additional information. From the trial results combined with interviews, strategies are developed to improve the tertiary institutions' readiness for e-learning implementation.

#### 3.1. Formulation of measurement factors ELR

Formulating the e-learning readiness (ELR) measurement method is conducted by determining the factors that will be used as a reference in measuring readiness. Each of these factors is then combined with a readiness measurement tool to have a readiness level when tested. In this study, the ELR factors determined are as follows:

##### a. University Aspect

###### ▪ Lecturer's Characteristic

According to Paturusi, Chisaki, and Usagawa's research [14], lecturer characteristics are implied as to a lecturer's attitude in using e-learning. This factor is mentioned as an essential factor, especially in measuring the readiness of e-learning. Besides that, according to [15], the characteristics of instructors who will use e-learning must have defined first.

###### ▪ E-Learning Facilities

Seakow and Samson research [16] obtained about 60% of lecturers in Thailand said that the main problem of not using e-learning is due to infrastructure limitations. Whereas, if we see, the application of e-learning prerequisites adequate technology. E-learning facilities are essential to be used as an ELR factor because they are related to computer and internet access, which is necessary for running e-learning [14]. That is why this factor was chosen as one of the measurement factors by the author.

###### ▪ Learning Environment

Finance is a crucial factor in implementing e-learning. Without an adequate budget, e-learning will not work as it should. Financial readiness is essential because financial allocation can influence learning strategies that use e-learning. The readiness of the e-learning environment such as employee salaries, availability of resources, learning model preferences is a crucial factor in guaranteeing the successful use of e-learning [14]. That is why this factor was chosen as one of the measurement factors by the author.

###### ▪ Learning Management

E-learning management is related to the planning of competency development of staff and lecturers, especially on the ability to use the technology needed in the future, the existence of professionals in e-learning, and the adequacy of staff implementing e-learning [14]. Based on descriptive analysis, the readiness of the ability to use e-learning is strongly related to ELR factors [1, 17]. That is why this factor was chosen as one of the ELR measurement factors.

##### b. Student Aspects

###### ▪ Self Learning

The self-directed learning parameter is a crucial factor in seeing students' readiness towards the implementation of blended learning [1]. Self-learning parameters tend to have high values with

a mean/average of up to 3.96 [17]. That is why this factor was chosen as one of the ELR measurement factors.

- Motivation

Motivation is one factor that influences the effectiveness of e-learning implementation, so it needs to be investigated [1]. Motivation parameters play an essential role in this research because this aspect's determination is relatively high, up to 3.79 [17].

- Learners Control

One of the factors that influence students' readiness in implementing e-learning is learning control [17]. This factor was chosen because it plays a reasonably high role in the effectiveness of e-learning.

- Student's Characteristic

In addition to lecturer characteristics, which are essential factors, especially in measuring e-learning readiness, student characteristics are also one factor that is no less important to be used as questions in the questionnaire [14]. This factor discusses the utility of computer use, i.e., How often students use computers and the internet [18].

Based on the literature review that has been conducted, a research framework is created to analyze the level of readiness for implementing e-learning in a tertiary institution from the perspective of students and tertiary institutions. The framework can be seen in Fig. 2.

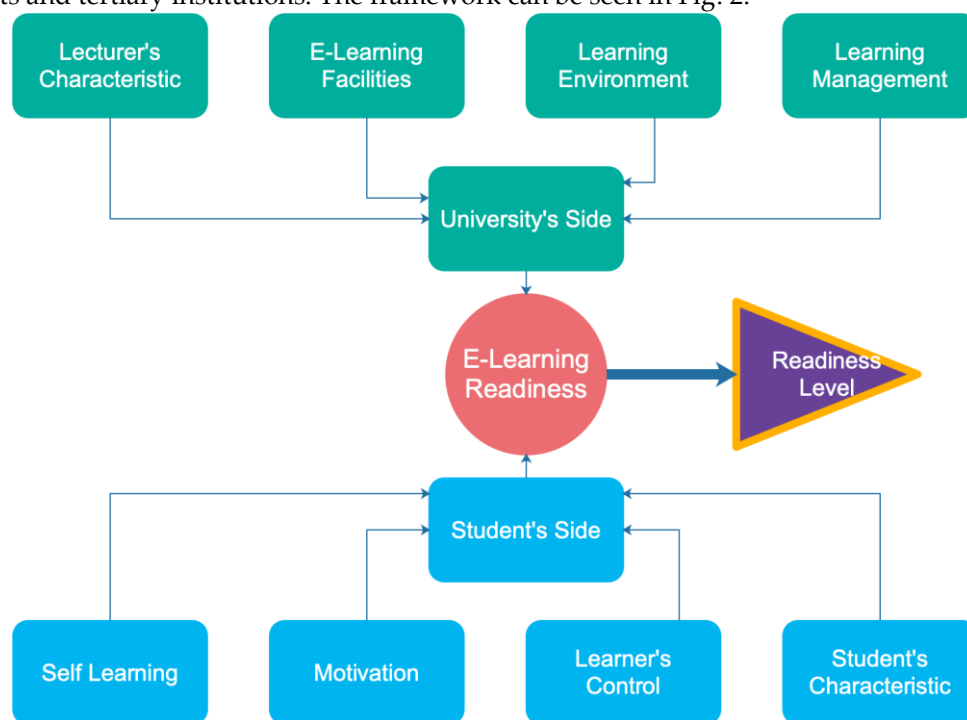


Fig. 2. Framework of research

Fig. 2 shows that eight factors will be used to determine the level of readiness for e-learning implementation. These eight factors come into two sides, namely the university side and the student side. Factors affecting the university include the lecturer's characteristics, e-learning facilities, learning environment, and learning management, while the student side consists of self-learning, motivation, learner's control, and student's characteristics.

### 3.2. Incorporation of factors and level of ELR readiness

Each questionnaire item was assessed using a Likert scale in the process of measuring the level of readiness. Using the Likert scale is to obtain each respondent's perceptions and attitudes on the questionnaire items asked. These perceptions and attitudes are the basis for determining each factor's readiness and the institution as a whole. The results of the calculation of the readiness level measurement process are readiness scores. The score is then mapped on the assessment model of the ELR developed by Aydin and Tasci [15]. A model is a measuring tool developed from a 1-5 Likert scale, which can provide an overview of the status of an organization's readiness for e-learning implementation. Aydin and Tasci model; has four groups of different readiness levels. See Fig. 3.

After the four readiness levels are defined, they are combined with the eight factors obtained from the previous discussion (lecturer's and student's characteristics, e-learning facilities, learning and learning management, self-learning, motivation, and learner's control). Merging is done by placing the factors on the left side in the vertical direction and the level of readiness on the top side in the horizontal direction to produce an 8×4 matrix form. Table 1 is an 8×4 matrix resulting from a combination of factors and levels of readiness.

**Table 1**

A matrix of combinations of factors and the level of ELR readiness

ELR Factor	Level 1	Level 2	Level 3	Level 4
Self Learning	-	-	-	-
Students Characteristic	-	-	-	-
Learner's Control	-	-	-	-
Motivation	-	-	-	-
Lecturer's Characteristic	-	-	-	-
E-Learning Facilities	-	-	-	-
Learning Environment	-	-	-	-
Learning Management	-	-	-	-

### 3.3. Questionnaire development

The questionnaire is developed based on previous e-learning readiness research. The question items are cited based on indicators such as in Table 2. These indicators are derived from factors that have been previously formulated so that each question item can reflect their respective factors.

**Table 2**

A list of indicators for each factor and their supporting research

ELR Factor	Indicator	Supporting Research
University's Side	Lecturer's Characteristic	[8, 10, 15]
	E-Learning Facilities	[11]
	Learning Environment	[10]
	Learning Management	[1, 10, 12]
Student's Side	Self Learning	[1, 12]
	Motivation	[1, 13]
	Learner's Control	[12]
	Student's Characteristic	[10, 14, 15]

After the questionnaire was made, then the next step is mapping respondents who answer questions. The mapping process was carried out with the following steps.

- 1) Questions are grouped according to the indicators. Each indicator consists of several questions that vary from 1 to 5 questions.
- 2) The answers given by the respondent after the calculation will reflect the level of readiness.

Respondents were divided into three groups: students, lecturers, leaders, and those responsible for infrastructure in tertiary institutions; in this case, the unit was responsible for managing e-learning.

### 3.4. Distribute the questionnaire

After the questionnaire and respondent are determined, the next step is to conduct a trial by distributing the questionnaire to several public and private universities (STMIK Widya Utama, Institut Teknologi Telkom Purwokerto, Politeknik Negeri Semarang, Universitas Jenderal Soedirman, Politeknik Negeri Cilacap, and Institut Agama Islam Negeri Purwokerto). The tertiary institution in central java chosen for the trial is suitable for the problem's context, which is not yet implementing e-learning but will execute it, or those that have already implemented e-learning, but not optimal in the utilization. The questionnaire was then distributed to all respondents, including students, lecturers, leaders, and units responsible for managing e-learning. Then, from all the questionnaires answered correctly, the average calculation was done to get the score, starting from the indicator score and factor score to the overall score. The method of calculating scores by finding the mean values is based on Aydin and Tasci research[5]. The following is a calculation method to get an overall institution readiness score.

- a. Score readiness per indicator is the level of readiness based on hands forming factors. The score is obtained from the average value of the Likert scale. To find the average readiness score per

indicator, we must first find the average score per question item (S item) in Eq. 1. After that, the score per item questions are then divided by the total number of respondents and referred to as the score per indicator (S indicator) in Eq. 2.

- Average score per question item

$$S_{item} = \frac{\sum x_i}{n_r} \tag{1}$$

- Average score per indicator

$$S_{indicator} = \frac{\sum s_{item}}{n_p} \tag{2}$$

Information

S<sub>item</sub> : Score per item

S<sub>indikator</sub> : Score per indicator

X<sub>i</sub> : Value of item question i

n<sub>r</sub> : Number of respondents

n<sub>p</sub> : Number of questions (in the same indicator)

- b. The readiness score per factor which indicated in Eq. 3 is the level of readiness based on the factors used. The score is obtained from the average value of each indicator in the same factor.

$$S_{faktor} = \frac{\sum s_{indicator}}{n_i} \tag{3}$$

Information

S<sub>faktor</sub> : Score per factor

S<sub>indikator</sub> : Score per indicator

n<sub>i</sub> : Number of indicators (in the same factor)

- c. Overall e-learning readiness score which indicated in Eq. 4 is the level of readiness of higher education institutions to implement e-learning.

$$S_{total} = \frac{\sum s_{faktor}}{n_f} \tag{4}$$

Information

S<sub>total</sub> : Total score

S<sub>faktor</sub> : Score per factor

n<sub>f</sub> : Total number of factors

After getting the score, the level of readiness can be seen based on the ELR readiness measurement scale adopted from the Aydin and Tasci research [15], as shown in Fig. 3.

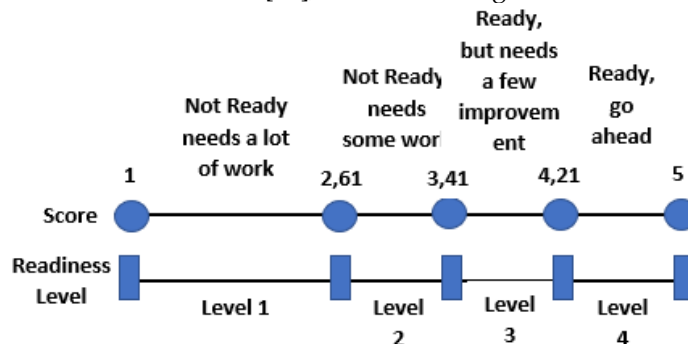


Fig. 3. ELR readiness measurement scale

From the Fig. 2 and Fig. 3, a 2x4 matrix is made to breakdown the indicator for each Factors. These indicators consist of University Readiness (UR) and Student Readiness (SR).

Table 3

A matrix of combinations of factors and the level of ELR readiness

ELR Factor	Level 1	Level 2	Level 3	Level 4
University's Side Readiness Perspective	UR1	UR2	UR3	UR4
Student's Side Readiness Perspective	SR1	SR2	SR3	SR4

### 3.5. Analysis of the results of the questionnaire

At this stage, an analysis of the questionnaire testing was conducted. The data that has been collected is then analyzed descriptively, i.e., the data will be presented in tabular and graphical form. The steps are as follows:

- a. From the survey conducted in the tertiary institution, the author can obtain readiness level on each factor and overall.
- b. Analyze universities with the same level of readiness as those with universities with a better level of readiness so that specific characteristics that describe their readiness level can be identified.

#### 4. Results and Discussion

This section will explain the results of the formulation of methods for ELR measurement, the results of ELR measurement trials at tertiary institutions and analyze the results of these trials.

##### 4.1. The results of the ELR measurement method

The ELR measurement formulation method results in the form of a 2×4 matrix, as in Table 3.

###### 4.1.1. Measurement indicator

This section will describe each indicator that fills a 2×4 cell matrix which based on Aydin and Tasci scale [15], so that it will provide a clear picture of the readiness conditions.

###### a. Indicator of University Readiness

Indicator of University Readiness called “University Readiness (UR)” provides an overview of the level of readiness for the application of e-learning in terms of universities. This indicator's level is determined based on the results of the average value of the college readiness factor. In Table 4 and Table 5, the indicators of higher education readiness are explained for the level of readiness not ready, or UR1 and UR2. At this level, the lecturer has never had or had less experience with the use of e-learning. Besides, facilities, especially access to computers and the internet, are still limited, and culture and environment are also less supportive.

**Table 4**

UR1 indicator

Indicator	Explanation
Lecturer's Characteristic	Lecturers are not ready to integrate e-learning in their learning and lack the competence to implement e-learning
E-Learning Facilities	E-Learning facilities provided by universities are inadequate and limited
Learning Environment	There is no clear vision related to e-learning and the culture and environment of the university does not support the application of e-learning
Learning Management	The university has not facilitated training on e-learning and the related units have not supported the implementation of e-learning

**Table 5**

UR2 indicator

Indicator	Explanation
Lecturer's Characteristic	Lecturers are less ready to integrate e-learning in their learning and lack the competence to implement e-learning.
E-Learning Facilities	E-learning facilities provided by universities are inadequate and limited
Learning Environment	There is less clear vision related to e-learning and the University's culture and environment does not support the application of e-learning
Learning Management	The university less facilitated training on e-learning and the related IT units have not supported the implementation of e-learning

**Table 6**

UR3 indicator

Indicator	Explanation
Lecturer's Characteristic	Lecturers are ready to integrate e-learning in their learning and have enough competence to implement e-learning.
E-Learning Facilities	E-learning facilities provided by universities are sufficient.
Learning Environment	There is clear vision related to e-learning and the University's culture and environment of the university to support the application of e-learning
Learning Management	The tertiary institution has facilitated training on e-learning and the related IT units to support the application of e-learning adequately



UR1 and UR2 show unpreparedness, while UR3 in Table 6 is an indicator that shows readiness, but still needs a little progress. Lecturers begin to have a desire to use e-learning in their learning. While in terms of infrastructure, facilities, especially computers and the internet, are adequate, and leaders to the entire academic community have also become accustomed to a culture of sharing. Table 7 explains the UR4 indicator, which means that tertiary institutions' readiness towards e-learning readiness is at level 4 or ready. This indicator indicates that the tertiary institution is very prepared. Institutional leaders, lecturers as actors and units have a strong desire and commitment to implement e-learning systems in their learning.

**Table 7**

UR4 indicator

Indicator	Explanation
Lecturer's Characteristic	Lecturers are very ready to integrate e-learning in their learning and have enough competence to implement e-learning.
E-Learning Facilities	E-learning facilities provided by universities are very sufficient.
Learning Environment	There is an apparent vision related to e-learning and the University's culture and environment of the university to support the application of e-learning.
Learning Management	The tertiary institution has facilitated training on e-learning and the related IT units to support the application of e-learning fully.

#### b. Indicator of Student Readiness

Table 8 and Table 9 describe student readiness indicators, which are called "Student Readiness (SR)" for Level 1 and Level 2, or SR1 and SR2. At this level, students are still not accustomed to setting goals and learning needs independently, and student motivation or interest in learning online is still very low.

**Table 8**

SR1 indicator

Indicator	Explanation
Self Learning	Students are not accustomed to setting goals and learning needs independently.
E-Learning Facilities	Student motivation or interest in online learning is very low.
Learning Environment	The decision to concentrate more and choose online learning materials is very low.
Learning Management	Students do not have the competence to implement e-learning and not ready to take part in the application

**Table 9**

SR2 indicator

Indicator	Explanation
Self Learning	Students are less accustomed to setting goals and learning needs independently.
E-Learning Facilities	Student motivation or interest in online learning is quite low.
Learning Environment	The decision to concentrate more and choose online learning materials is quite low.
Learning Management	Students lack competency to implement e-learning and less ready to take part in its application.

**Table 10**

SR3 indicator

Indicator	Explanation
Self Learning	Students are used to setting goals and learning needs independently.
E-Learning Facilities	Student motivation or interest in online learning is quite good.
Learning Environment	The decision to concentrate more and choose online learning materials is quite good.
Learning Management	Students already have the competence to implement e-learning and ready to take part in its application.

If the SR1 indicator and the SR2 indicator illustrate that the student or learner side is not ready and interested in the implementation of e-learning, the following Table 10 and **Error! Not a valid bookmark self-reference.** 11 shows that the student or learner is accustomed to determining his learning goals independently. The motivation to use e-learning has also been high or included in SR1 and SR2. Table 10 explains the SR3 indicator, which means that technology infrastructure is

ready, although it still needs a little progress. In terms of infrastructure and internet access is available, but it is necessary to increase the number of computers and internet access.

**Table 11**  
SR4 indicator

Indicator	Explanation
Self Learning	Students are very accustomed to setting goals and learning needs independently.
E-Learning Facilities	Student motivation or interest in online learning is very high.
Learning Environment	The decision to concentrate more and choose online learning materials is very high.
Learning Management	Students already have the competence to implement e-learning and very ready to take part in its application.

#### 4.1.2. Implications for theory

The measurement process is carried out by the steps below:

- a. First is conducting a University search that has the same characteristics as the problems needed. The initial search is done by visiting several college websites to find initial data and information related to e-learning. After obtaining preliminary information, a survey is conducted directly to the people responsible for e-learning, in this case, the computer manager's head. The survey aims to ensure that the tertiary institution has not implemented e-learning but already has a plan to implement it or has implemented it. However, the results are still not optimal. Search results found five colleges that can be used as a place of trial.
- b. The licensing process for respondent data collection in private tertiary institutions is more complicated than public tertiary institutions since they have different academic calendars. When one is doing the learning, other institutions are on holiday. Licensing begins by submitting a research certificate to the information systems section and then forwarding permission to the director, after that, waiting for a letter issued by the information system section to be then allowed to meet with lecturers to submit questionnaires.
  - The process of distributing the questionnaire is the same, asking for help from the university to deliver it to respondents. The process is intended to get as many respondents as possible by providing rewards such as free credit prizes for three selected respondents. This mechanism made respondents more interested in conducting questionnaires.
  - Recap all data obtained into excel workbooks. All the questionnaire results were entered into an excel workbook and grouped according to each respondent's group to make it easy to calculate the average score.
  - After the analysis process, some additional data is needed to complete the questionnaire's data. Such data can help in formulating strategies to increase the level of readiness. The data collected includes policies, budget readiness, HR training, and material content availability. This data collection is done by conducting interviews with the head of the computer manager from each university.

#### 4.2. ELR measurement results

After testing the ELR measurements at STMIK Widya Utama, Institut Teknologi Telkom Purwokerto, Politeknik Negeri Semarang, Universitas Jenderal Soedirman, Politeknik Negeri Cilacap, and Institut Agama Islam Negeri Purwokerto, for all these universities, the readiness scores are calculated. The following are the results of the measurements of the three tertiary institutions:

- a. The total number of respondents who returned the questionnaire in STMIK Widya Utama was 11 people, nine from the student group, and two from the lecturer group. All returned questionnaires were filled correctly.
- b. The total number of respondents who returned the questionnaire in Institut Agama Islam Negeri Purwokerto was 15 people, with details of 14 from the student group and one from the lecturer group. All returned questionnaires were filled correctly.
- c. The total number of respondents who returned the questionnaire in Institut Teknologi Telkom Purwokerto was 56 people, with 48 from the student group, seven from the lecturer group, and one from the IT Support unit. All returned questionnaires were filled correctly.

- d. The total number of respondents who returned the questionnaire in Politeknik Negeri Semarang was 39 people, with details of 36 from the student group, two from the lecturer group, and one Head of the Information and Communication Technology Center. There is one overlapping questionnaire so that it is excluded from valid data.
- e. The total number of respondents who returned the questionnaire in Universitas Jenderal Soedirman was 33, with 26 from the student group, six from the lecturer group, and one from the IT Support unit. All returned questionnaires were filled correctly.
- f. The total number of respondents who returned the questionnaire in Politeknik Negeri Cilacap was 35 people, with details of 24 from the student group and 11 from the lecturer group. All returned questionnaires were filled correctly.

From the university's side, Scores for lecturer's characteristic indicators on STMIK Widya Utama, IT Telkom Purwokerto, Semarang State Polytechnic, Jenderal Soedirman University, Cilacap State Polytechnic, and Purwokerto IAIN respectively were 4.2; 4.45; 4.52; 4.35; 4.26; 4.34 so that an average of 4.35 is obtained. Scores for e-learning facilities indicators at STMIK Widya Utama, IT Telkom Purwokerto, Semarang State Polytechnic, Jenderal Soedirman University, Cilacap State Polytechnic, and Purwokerto IAIN respectively were 3.6; 3.85; 3.82; 3.45; 3.75; 3.56 so that an average of 3.67 is obtained. Scores for learning environment indicators on STMIK Widya Utama, IT Telkom Purwokerto, Semarang State Polytechnic, Jenderal Soedirman University, Cilacap State Polytechnic, and Purwokerto IAIN were 3.63; 4.01; 4.17; 3.95; 3.62; 4.13 so that an average of 3.91 is obtained. Scores for learning management indicators in STMIK Widya Utama, IT Telkom Purwokerto, Semarang State Polytechnic, Jenderal Soedirman University, Cilacap State Polytechnic, and Purwokerto IAIN respectively were 3.82; 4.04; 4.01; 3.88; 4.12; 4.22 so that an average of 4.02 is obtained.

Scores for self-learning indicators in STMIK Widya Utama, IT Telkom Purwokerto, Semarang State Polytechnic, Jenderal Soedirman University, Cilacap State Polytechnic, and Purwokerto IAIN were 3.92; 4.16; 4.26; 4.08; 4.18; 4.21 so that an average of 4.14 is obtained. Scores for motivation indicators on STMIK Widya Utama, IT Telkom Purwokerto, Semarang State Polytechnic, Jenderal Soedirman University, Cilacap State Polytechnic, and Purwokerto IAIN were 3.51; 3.90; 3.76; 3.72; 4.06; 3.95 so that an average of 3.81 is obtained. Scores for learner's control indicators in STMIK Widya Utama, IT Telkom Purwokerto, Semarang State Polytechnic, Jenderal Soedirman University, Cilacap State Polytechnic, and Purwokerto IAIN were 3.74; 3.94; 3.92; 3.88; 3.86; 3.95 so that an average of 3.88 is obtained. Scores for student's characteristic indicators in STMIK Widya Utama, IT Telkom Purwokerto, Semarang State Polytechnic, Jenderal Soedirman University, Cilacap State Polytechnic, and Purwokerto IAIN were 3.82; 3.79; 3.96; 3.76; 4.04; 3.97 so that an average of 3.89 is obtained.

Based on the result, the average score of the perspective of readiness for implementing e-learning in Central Java Province can be seen Table 12. Overall, universities in Central Java Province have a readiness score of 3.97, which means it is ready but needs a few improvements. Thus, universities in Central Java province, both public and private, are already prepared to implement e-learning, but they still need a little improvement.

**Table 12**

Score readiness for the implementation of e-learning in Central Java

Factor	Readiness Score
<b>Total Readiness</b>	<b>3,97</b>
<b>University Readiness</b>	<b>3,99</b>
Lecturer's Characteristic	4,35
E-Learning Facilities	3,67
Learning Environment	3,91
Learning Management	4,02
<b>Student Readiness</b>	<b>3,94</b>
Self Learning	4,14
Motivation	3,81
Learner's Control	3,88
Student's Characteristic	3,89

Furthermore, when compared between private and state universities, it was found that almost all of the readiness scores indicated that public universities were better prepared. Private universities are only better prepared, especially for one indicator called e-learning facilities, with an average score of 3,72 compared to public universities, which has an average score of 3,64. If these factors (Table 12) are broken down into the level of readiness based on Fig. 3 then the results are as in Table 13.

**Table 13**

Matrix of ELR readiness of tertiary institutions in Central Java Province

ELR Factor	Level 1	Level 2	Level 3	Level 4
Self Learning				
Students Characteristic				
Learner's Control				
Motivation				
Lecturer's Characteristic				
E-Learning Facilities				
Learning Environment				
Learning Management				

Based on Table 12 and Table 13, it can be seen that almost all factors are at level 3 (ready, but needs a few improvements) and 1 factor is at level 4 (go ahead). The following is an explanation of each factor:

- a. Self learning  
These factors obtain a level of readiness at level 3 or ready, need a few improvements. In terms of students (learners), they are used to setting goals and learning needs independently.
- b. Student's characteristic  
These factors obtain a level of readiness at level 3 or ready, need a few improvements. This means that in terms of students (learners), they already have sufficient competence to implement e-learning and, at the same time, are ready to take part in its application. This is shown from several questions concerning the readiness to use technology and their familiarity in terms of online communication with their friends and lecturers.
- c. Learner's control  
These factors obtain a level of readiness at level 3 or ready, need few improvement. This means that in terms of students (learners), they already have a decision to concentrate more and choose learning materials online rather than asking directly from the lecturers or their friends.
- d. Motivation  
These factors obtain a level of readiness at level 3 or ready, need few improvement. This means that in terms of students (learners), they are quite interested in and towards learning online. This is because for those studying independently on the internet is an effective way.
- e. Lecturer's characteristic  
This factor obtains a level of readiness at level 4 or ready, go ahead. This means that in terms of tertiary institutions, lecturers are prepared and have sufficient competence to implement e-learning indicated by the frequency of their online communication with colleagues and students, besides their level of use of technology, especially the internet, computers, and smartphones.
- f. E-learning facilities  
These factors obtain a readiness level at 3 or ready, need a few improvements. This means that in terms of tertiary institutions, the facilities provided by tertiary institutions are sufficient, including adequate internet bandwidth infrastructure, the number of computers that can be accessed, and a good e-learning platform.
- g. Learning environment  
These factors obtain a level of readiness at level 3 or ready, need a few improvements. This means that in terms of tertiary institutions, there is already a clear vision relating to the implementation, the culture, the environment, and also application supporting to implement e-learning. This is indicated by the target of implementing e-learning from each institutions in the near future.
- h. Learning management  
The tertiary institution has facilitated training on e-learning and related IT units to fully support the application of e-learning. These factors obtain a level of readiness at level 3 or ready, need a few

improvements. The University side facilitates socialization and training on e-learning, while the related units support applying e-learning.

Based on the measurement results, universities in Central Java seem to be ready to welcome the e-learning era from students and universities' perspective. We can see this from the measurement of ELR factors that almost all college readiness and student readiness levels have achieved level 3 (ready, but need few improvements). Meanwhile, lecturer characteristics in the college readiness factor have reached level 4 (ready, go ahead). In addition to the characteristics of the lecturer, there are still several things that need to be improved to formulate an improvement strategy based on each factor [17, 19, 20], namely:

- a. Several interviews were conducted with the head of the Information Technology department of IT Telkom Purwokerto, some lecturers in IAIN Purwokerto, Politeknik Negeri Cilacap, and Politeknik Negeri Semarang. It can be concluded from the interview that in Self-learning and motivation factors, there are still some students who are not used to independent learning. They are still dependent on their study partners who always teach related subjects in a particular semester. The strategy that must be carried out is to create exciting learning content through interactive multimedia presented in e-learning to attract students to study independently. Another method is Holding independent learning workshops as envisioned by the minister of education and culture Republic of Indonesia. Other approaches are recording lectures into podcasts and setting the university websites and e-learning to be mobile-friendly.
- b. The strategy that might be performed in Student's characteristics factor is that universities should increase the frequency of e-workshops or e-training related to technological developments, particularly e-learning, website management, and office via online conference, especially in pandemic like nowadays.
- c. For the learner's control factor, the strategy that might be applied by the tertiary institution is to create a policy related to the application of e-learning. The approach should allow the lecturers to upload all materials into e-learning instead of conventional methods such as using the flash disk or giving the materials directly to the students.
- d. A strategy that universities might undertake in facility factors is to make infrastructures plan such as increasing the servers capacity, storage, network bandwidth, and CPU processing speed. That effort is necessary to meet the great demand for e-learning storage
- e. In the learning environment and management factors, tertiary institutions' possible strategy is to set targets for implementing e-learning into each university's strategic plans so that its achievement can be monitored Another effort that can be done is by maximizing the role of the unit serving all stakeholders through socialization, training, and creating exciting content to optimize the use of e-learning.

### 4.3. Implications

Research that has been written has several implications both in terms of theory and practice. The following is an explanation of each of these implications.

#### 4.3.1. Implications for theory

This research produces two factors that can measure a tertiary institution's readiness to implement e-learning from tertiary institutions and students' perspectives. The combination of higher education and students' readiness factors was made using Aydin and tasci readiness levels, resulting in an 8x4 matrix that can describe an institution's readiness based on its factors. The factors obtained in this study are expected to be a reference for further research related to the theory of e-learning readiness.

#### 4.3.2. Practical implications

This study's results can become input for universities in Indonesia to implement a learning system that uses e-learning. Based on the analysis results, eight factors must be considered before e-learning is implemented.

The implications for the eight tertiary institutions that become the testing ground are input and recommendations for strategies that can be carried out to increase readiness level. Based on the analysis results, the questionnaire and interview obtained factors that need to be improved. Their respective

improvement strategies have accompanied each element. Thus, it is expected that the three tertiary institutions which become the subject of the study can increase their level of readiness and be able to implement and use e-learning in each of their learning.

## 5. Conclusion

The analysis results of the factors that can be used to measure the readiness for the implementation of e-learning in terms of tertiary institutions and students consist of eight elements combined from various previous theories and adjusted to the characteristics in Indonesian tertiary institutions.

The measurement results show that from the four indicators of university readiness (UR), three reach UR3, while another gets UR4. Meanwhile, all indicators of student readiness (SR) went SR3. This measurement concludes that the readiness level for e-learning implementation for tertiary institutions in Public and private universities in Central Java reaches level 3 (ready), but needs some improvement. We can say that universities in Central Java can be said to be ready to implement e-learning with several continuous enhancements that must be considered.

Based on the results of ELR measurements and interviews, the formulation of strategies to improve the readiness of e-learning implementation includes (1) Create exciting learning content through interactive multimedia via youtube or other asynchronous media so that when presented in e-learning attracts students to study independently and hold workshops on freedom of learning as envisioned by the minister of education and culture Republic of Indonesia; (2) Increase the frequency of e-workshops or e-training related to technological developments, especially as e-learning, website management, and office via online conference especially when in pandemic like nowadays; (3) Makes a policy related to the application of e-learning, that all types of material from lecturers must be uploaded into e-learning and not through conventional methods; (4) Make plans related to infrastructure such as servers related to their capacities such as storage, network bandwidth, and CPU processing speed due to e-learning content that will increasingly booming (5) Strengthening the role of units in serving e-learning users.

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