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Development and Validation of Instruments to Measure Students' E-Learning Readiness

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Abstract--- *This research aims to develop and validate the used instruments to measure students' readiness to participate in learning through learning management systems. This readiness is known as e-learning readiness. The tool was developed based on four components of e-learning readiness by Ayd & Tasci's model, namely technology, innovation, people, and self-development. The research sample was students of the Elementary School Teacher Education Study Program, Universitas Negeri Makassar. The research used quantitative survey methods. The instrument developed consisted of 36 statement items, with responses in the form of a five-choice Likert scale. The data analysis testing used Rasch modeling through the Winstep program. The results of the study managed to develop an instrument of e-learning readiness, which consisted of 29 items statements under the model. The results of data analysis also showed that the reliability of the respondents was 0.93 and classified as very good. For reliability items, the results of data analysis showed 0.97 and classified as excellent. The result of raw variance explained by the measure of 50.1% also indicates that the requirements for unidimensionality are quite fair; this means the stated instrument is good enough in measuring what should be measured. Overall, therefore, this study has produced a device of e-learning readiness that can predict the availability of following the learning process.*

Keywords---*: instrument validation, e-learning readiness, Rasch modeling.*

I. INTRODUCTION

Developments in information technology and communication (ICT) is increasingly massive and dominating, one of which is marked by innovations in ICT devices and internet networks. ICT devices and internet networks seem to have conjured up various facets of people's lives in Indonesia, including the field of education in general and the learning process in particular. Factually speaking, there have been growing trends of learning shifting paradigm, from the face-to-face classroom to online learning. It happens due to the tremendous benefits offered by the later, i.e., practicality as well as time and money-saving.

Kenresearch pointed out that educational institutions in the country have become more receptive to the implementation of hi-tech technology instruments [1]. University and instructional firms have gained functional advantages, such as multimedia learning, online assessments, vlog tutorial, and online streaming learning. It has also been predicted that more features will be deployed shortly, for instance, smart classrooms, learning management systems, and gamification. Selular.id has noted that Asian countries have shown the highest growth rate in the hi-tech based education industry, especially in literacy development, the demand of contents, adoption of technology, integration with talent

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management, and healthy government initiatives. In line with the mentioned facts, Indonesia has ranked the eighth in the Top Ten Countries with E-Leaning High Growth Worldwide [2].

Realizing the potential condition, the Ministry of Research, Technology, and Higher Education has encouraged tertiary education institutions to adopt and implement e-learning. The minister demands actively that all Indonesian universities and colleges had to consider the advancement of ICT and improve their instructional process with cutting-edge technology. Moreover, the ministry had targeted online classrooms for university students to commence in 2018 [3]. The development of higher education institutions in the future will no longer rely on nuclear activities and lecture centers. Still, it will change based on information technology that leads to e-learning. Higher education institutions in the push to follow the technological developments such to lead to the learning of classless (classrooms), borderless (borderless), and without paper (paperless) that everything based on information technolog[4], [5]y.

Instead of following technology development, various studies have shown the effectiveness of e-learning to support the learning process, both in terms of learning media, learning processes, and the results of their studies. Research by Inayatulloh shows that front-office and back-office applications integrated on the learning management system of all users (students, lecturers, and admin) are of big help for the teaching and learning process, as well as administering data and information about the instructional process [6]. The system developed helps educational institutions to be able to improve the effectiveness and efficiency of online learning processes where increasing efficiency and effectiveness will improve the performance of higher education institutions or institutions as a whole. Another study shows that E-learning is effective in improving the quality of learning because the learning process is not only fixed at one time and in the room [7]. Some other studies also show that students who carry out learning by e-learning or virtual class have better motivation and understanding of learning than those who follow the conventional learning process or face to face [8]–[10].

The implementation of e-learning in lectures will certainly bring many changes, especially in the learning process. Lectures based on face-to-face will gradually change to one based on online or combined (blended). Changing lecture patterns is not easy to be implemented just like that without any preparation, especially for students as the subject of lectures. Not only changing the learning patterns, for students, there is also an important thing that is their readiness in following the e-learning process. Because it requires the readiness of the device, the ability to access, and the ability to take part in online learning. So that various aspects are very likely to become obstacles for the progress of student learning itself. In line with this, the study of Cuthell and Weller which states that not only lecturers who have difficulty implementing e-learning but students also experience obstacles, especially in using computers. The results in the low learning progress achieved by students because learning with the concept of n -based is not as easy when compared to a face-to-face learning system [11], [12]. For that need, the readiness students from the device, the ability to access, change patterns of learning, including motivation[13]–[19].

E-learning readiness is defined by Borotis & Poulymenakou as the mental or physical readiness of an organization or individual for a learning experience [20]. Correspondingly, E-Learning Readiness is also the physical and mental readiness of an organization to carry out, take action, and create e-Learning experiences [21]. Studies of History of E-learning readiness in Indonesia, more reviewing e-learning readiness thoroughly in an institution both at the level of secondary school [22], [23], and higher education [24]–[27]. These studies develop instruments to measure E-learning readiness with reference to the aspects raised by: Chapnick categories of readiness include: Psychological readiness, Sociological readiness, Environmental readiness, Human resource readiness, Financial readiness, Technological skills (aptitude) readiness, Equipment readiness, Content readiness [28]; Swatman, with components to measure it are Students 'Preparedness, Teachers' Preparedness, IT Infrastructure, Management Support, School Culture and Preference to Meet Face-to-Face [29]; Akaslan and Law with measuring components are: Technology, People, Content and Institution [30]; Seakow and Samson with measuring components , namely : Policy, Technology, Financial, Human Resources and Infrastructure [21]; Manjot Kaur with its measuring components, namely: Learner, Management, Personnel, Content,

Technical, Environment, Cultural and Financial [31]; Ayd & Tasci with its measuring components, namely: technology, innovation factors, human factors and self-development factors [32].

While studies on the E-learning readiness of the new students in the last few years have started much studied. Study of Alem et al., for example, four used components are as a basis for developing instruments for measuring the implementation of e-learning from the individual participant's learning side, namely: self-competence, self-directed-learning, motivation, financial and usefulness [33]. Later in the study, Xiong develops instruments E-learning readiness for computer-supported collaborative learning (CSCL) with the components: Motivation, Prospective behaviors, and Online learning aptitude [34]. Meanwhile, Hussin et al. develop instruments E-learning readiness based on the components: demographic, Skills readiness, psychological readiness, and budget readiness [35].

The focus of this study is the development of e-learning readiness instruments was developed based on previous research components with indicators adjusted to the situation and conditions. The main components or dimensions that will be the basis of the e-learning readiness model by Ayd & Tasci with its components, namely: technological factors, factors of innovation, human factors, and factors of development [32]. The researcher used this model because considered more adaptive used as a basis to develop instruments of e-learning readiness personal (not the institution as a whole), namely in terms of readiness of students facing the implementation of e-learning. Based on these four dimensions, each dimension developed into indicators that will be the basis for developing instrument statements. However, in developing indicators, this study also adapted the components of the e-learning readiness model in addition to Ayd & Tasci, such as budget readiness [35], motivation, financial, and usefulness [33].

Furthermore, this research will use Rasch modeling assisted by the Winsteps program as a means for data analysis. Previous studies have used the Rasch model to invalidating various measurement instruments in the field of education, especially in the use of e-learning. such as curriculum questionnaires, survey instruments for measuring pre-service teachers' PCK, TPACK Assessment Instrument, Online Collaborative Learning Questionnaire, User Acceptance Instrument for Evaluating E-learning Systems, instruments of learning readiness with e-learning [36]–[41]. The advantage of Rasch modeling is that it makes the results of the statistical analysis of research carried out more accurately. More importantly, Rasch modeling is believed to be able to produce standard error measurement values for the instruments used. Thus it is predicted to improve the accuracy of calculations. Calibration carried out in Rasch modeling includes three things at once, namely: 1) measurement scale, 2) respondent (person), and 3) Item. An uncalibrated instrument has the possibility of producing invalid data and carried out as unsuccessful (failure) activities. While the use of the Rasch model in instrument validation will produce more holistic information about the instrument and better meet the definition of measurement [42].

The aimed results of the research will measure instruments and to obtain accurate information about students' readiness in implementing e-learning in the lecture process. The valid data obtained by the tool will be able to benefit students to evaluate their readiness to participate in online learning, as well as related institutions as a significant consideration to implement e-learning.

BI. DATA COLLECTION

Research Respondents

The study used a non-experimental quantitative research design. The respondents are the students of Primary School Teacher Education study program Universitas Negeri Makassar. The number of respondents who filled out the instrument online through Google Form was 274 students. After data completeness was checked, and there were also double submissions, there were 42 respondents whose results were not used for research data. Based on Morgan's table at the 95% confidence level [43], then with a population of 230 to the minimum sample to be used amounted to 144 samples.

There is a 232 field instrument worthy of research data, and then drawn at random as much as 146 to be used as survey respondents. The following table characterizes the sample.

Table 1. Characteristics of Respondents by Gender

Gender	N	%
Male	21	14
Girl	125	86
amount	146	100

Table 2. Characteristics of Respondents by Class

Class	N	%
2014	32	22
2015	29	20
2016	27	18
2017	58	40
amount	146	100

Research procedure

Instrument Development

This step begins with a literature review of books on e-learning and previous studies on the research of e-learning, especially the analysis of e-learning readiness suitable for a country, institutional and personal. The result was a decisive one model of e-learning readiness as the basis of the development of the instrument. The study then chooses a questionnaire e-learning readiness developed by Ayd & Tasci with the components: technological factors, factors of innovation, human factors, and factors of development [32]. As explained earlier, in developing indicators, this study also adapted the components of the e-learning readiness model in addition to Ayd & Tasci. The following are the initial stages of instrument development grille.

Table 3. E-Learning Readiness Instrument Grid

Factor (Ayd & Tasci, 2005)	Dimension	Indicator	Qty
People	Competence	Ability to access computers, the internet, and online learning resources	2
		Ability to learn independently with technological/online devices	1
	Pioneers of e-learning	Initiatives utilizing e-learning	1
	Learning experiences and habits	Experience of accessing online learning resources and e-learning	3
Technology (internet network	Device availability	Availability and quality of individual devices (smartphone / pc / laptop and internet network)	2

and LMS)		Availability and quality of institutional and lab wifi devices	2
	Utilization of the device	The intensity of utilization of individual devices	1
		Intensity Utilization of UNM wifi devices and com labs	1
	Ease of device	Ease of use of individual and campus devices	1
		Ease of use of UNM wifi devices and computer laboratory facilities	1
	Resistance	Obstacles posed by implementing e-learning	2
		Willingness & ability to facilitate obstacles	2
Adoption of innovation	Knowledge of innovation	Know the UNM e-learning page	1
		Know the procedures for accessing UNM e-learning	1
		Know how to learn through e-learning UNM	1
	Openness to innovation 1. Perception	Interest and hope	1
		Advantages, compatibility, complexity	2
		Environmental and time support	2
	2. Motivation	The need to follow the e-learning	2
		Institutional and lecturer encouragement	2
	3. Attitude	Belief in the benefits of e-learning	1
		Moved to use	1
Self-development	The budget	Willingness to provide a budget to develop the device	1
		The ability to provide a budget for developing devices	1
	Time management	Willingness to manage time for independent learning	1
		Ability to manage time for independent study	1
	Trust	Trust develops the way of learning through e-learning	1
		Trust in the learning process will be better	1
		Trust in learning outcomes will be better	1
	Adjustment	Ability to adjust to changes in study habits	1

The scaling method used in this study was to use a Likert Scale with five responses.

Affirmation: My current ability to access computers and the internet

Answer: Very Good, Good, Enough, Poor and Very Poor

Statement: Internet network availability (personal sim card/wifi data plan at home) for online learning (e-learning) that I currently have:

Response: Very Adequate, Adequate, Enough, Inadequate, and Inadequate.

Obtaining data sample

Before the research data was collected, several colleagues answer a set of the instrument, especially those who took Bahasa Indonesia courses to provide suggestions and evaluations about statements and responses from the language side. As a result, some comments need to be corrected, and reactions are adjusted according to the choice of answers.

Data analysis

After downloading the data recap, the research enters the examination and analysis phase of the research data. The examination is carried out to sort out the data that is not feasible to be forwarded to the analysis. Some data are not worthy of them primarily completed and the case of duplication of data that can be seen on the respondent's identity and nature at e-mail. After that, the researchers randomly took 146 respondents' data, which were sampled and then analyzed using the Winstep program.

Double responses of Having downloaded data recap from google form were eliminated. Next, the researcher randomly took out 146 answers for sampling purposes for further analysis using *Winstep.* The shown result from data analysis is the following.

a) Item measure, to evaluate per item quality by measuring tested item logit.
b) Person measure, to find out per individual condition by measuring tested item logit.
c) Scalogram, aiming to see a figure of data analysis
d) Summary statistics to figure out the whole response quality and item, as well as the interaction between both.
e) Principal component analysis (PCA), to analyze data showing unidimensionality
f) Validity analysis level scale to verify the clarity of each item statemen.

This study aims to reveal and describe in-depth the style of principal leadership in the development of the character of discipline in the SMKN 1 Jombang, the approach used is a qualitative approach. Bogdan and Biklen [27], declared a qualitative approach has the characteristics of the natural setting, as a key instrument, emphasis on process, inductive data analysis, and emphasizes the essence of meaning to every event that occurs in the setting.

The materials that were actively recorded by researchers to collect research data is the transcript of in-depth interviews, participant observation, and documentation. Interviews are used to gather information about the style of principal leadership in developing the character of the discipline, and its effects. To see firsthand observation forms character development disciplines. Documentation used to obtain official documents relating to the policies, rules about discipline.

The data analysis technique used in this research is a case study design then analyzes the data carried by the data analysis stage individual cases (individual case), namely: (1) data reduction, (2) presentation of data, and (3) conclusion. Validity accurately determines whether the research findings from the perspective of the researchers, participants, and readers of reports of research findings. Checking the validity of the data used in this study triangulation of data sources and methods

IV. DATA ANALYSIS

Results

Data analysis using Rasch modeling yielded a fit statistical analysis adjustment indicating whether the gained data or information weighted fit can ideally illustrate students with high performance able to give answer patterns under the difficulty level. Infit, mean square, and standardized values are used as the parameter. According to Suminto and Widhiarso, infit, either inlier sensitive or information weighted fit, is response pattern sensitivity towards object items to respondents, or vice versa, while outlier sensitive fit measures the response pattern sensitivity towards issues with particular difficulty level to respondents, or vice versa [45], [46]. Besides, they also explain that there are three criteria in a parameter to determine the appropriateness, i.e., point measure, outfit mean square, and outfit Z standard. In the context of measuring the items, misfit items are too comfortable with negative logit value, too tricky with the tremendous definite amount from given responses; or the yielded value from the three criteria shows that the items are not qualified. In this

study, data analysis was performed several times until the accuracy item-model is fulfilled. In this study, data analysis was carried out several times to obtain several issues that met the accuracy of the item-model accuracy.

Based on Sumintono and Widhiarso, each level of item and respondent are three criteria to meet: outfit mean square or MNSQ (0.5 <MNSQ <1.5; outfit Z standard or ZSTD (-2.0 <ZSTD<2.0); and point measure correlation, or Pt means Corr (0.4<Pt Mean Corr<0.85) [45], [46]. Considering the data analysis can be elaborated as follows:

In the first phase, respondent measurement shows that 46 respondents are outliers, which are misfit to the model. Scalogram furthermore indicated that data given by these respondents are invalid. For instance, Table 5 illustrates the answers from respondent 040PB for statement q29 and q34 about their attitude toward the innovation of e-learning, which contradicts other elements. While different responses show negative values, their reactions to these statements on the aspect are positive. The similar patterns also occur for respondent 089PD, 092PD, and 120PC. Besides, there are different responses with straight answers in all statements indicating ignorance towards statements, such as respondent 100PA, 105PC, and 107PC. Afterward, 46 respondents identified as outliers were eliminated from the list. Meanwhile, item measurement analysis points out that there are two inconsistent items with the model due to MNSQ, ZSTD, and Pt Mean Corr factor, i.e., q29 and q30. Moreover, nine other things are invalid due to the ZSTD parameter.

Table 4 . Example Response (Respondent's Answer) Pattern

Respondent Code	Response / Respondents *
040PB	44453442332433444555323554551**1**3322**2**444333
089PD	44455554545445444555445543541**1**5432**2**335443
092PD	45453353455545243544544444541**1**2433**2**335444
120PC	44454433443333444554454444411553**3**444334
100PA	33333333333333333343333344333344334333
105PC	33343332333333222344322333332333333333333
107PC	34333333323233222433222322332333333333333

*According to the serial number of statements in the amount of the instrument (q) 1,2,3, ... 40.

Meanwhile, for Item data analysis (Item measurement) shows that two items do not fit the model because the MNSQ, ZSTD, and Pt Mean Corr factors do not meet the parameters, namely q29 and q30. Besides, nine items are not by the model because of ZSTD, its course that does not meet the benchmarks. So the follow-up is to eliminate the 11 statements. *In the second stage*, the data analysis showed that there were still 19 respondents who were still classified as outliers and thus had to be eliminated again. For items, there are no statements that do not meet the MNSQ, ZSTD, or Pt Mean Corr parameters. *In the third stage*, data analysis showed that there were still four respondents who were still classified as outliers, so they had to be eliminated again. For items, there are no statements that do not meet the MNSQ, ZSTD, or Pt Mean Corr parameters. *In the fourth stage*, the analysis data showed that there were no longer respondents classified as outliers, so this data would then be used for the final analysis consisting of 29 items with 77 respondents.

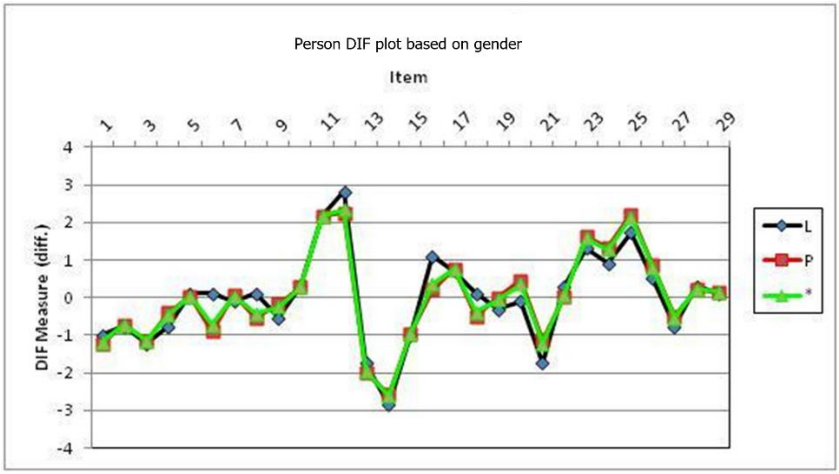
The final data report for respondents (a measurement of people) and statements (Measurement of objects) can be seen in Appendix A. Based on the Winstep Program Statistics Summary Table (Appendix A), it can be explained that 77 respondents gave complete responses to 29 statements. Data Measured Person or data are showing the pattern of responsibility late respondents to provide data that MNSQ infit and outfit 1.00 expectation value that is equal to 1.00. Thus it shows that overall the pattern of respondents' answers is following the model. Data also shows that the reliability of respondents is 0.93. Based on the rating scale of instrument quality criteria by William P. Fisher. Jr. [45]–[47], the respondent's reliability is classified as Very Good. Furthermore, based on the table, you can also see the results of the instrument testing on the Item. Data shows that the MNSQ infit and outfit 1.00 are the same as the expected value of 1.00.

Thereby indicating that overall, this instrument is good, especially the data also show that reliability items were 0.97 and classified as excellent.

The subsequent analysis is Item validity, which can be seen in the Item Misfit Tables in the Winstep program shown in Appendix B. According to three parameters, 1) Outfit Mean Square 0.5 < MNSQ < 1.5; 2) Outfit Z standard -2.0 < ZSTD <+2.0, and 3) Point Measure Correlation 0.4 < Pt Mean Corr < 0.85, all items meet the stipulated requirements.

Next is analyzing data that shows whether the instrument can measure what should be measured or unidimensionality, in this case, is measuring the readiness of students to implement e-learning in the lecture process. The Rasch model uses Principal Component Analysis (PCA) of residuals, which measures the extent to which the diversity of instruments measures what should be measured. It can be explained through Appendix C. The result of the measurement of variance (raw variance) of data, 50.1%, is the same as the expected value of 50.1%. According to William P. Fisher. Jr., the minimum requirement for unidimensionality is 20%. If the value is more than 40%, it is even better, and the variance that cannot be explained by the instrument should not exceed 15% [45]–[47]. Based on these explanations, the results of the raw variance explained by the measure of 50.1% indicate that the minimum 20% unidimensionality requirements can be met and are Fair. The results of the various analysis that cannot be explained by the instrument at 5.9% also meet the criteria that do not exceed 15% and are Fair. Thus this instrument is expressed quite well in the measure of what should be measured, in this case, is to measure a student's readiness to implement e-learning (e-learning readiness) in the lecture.

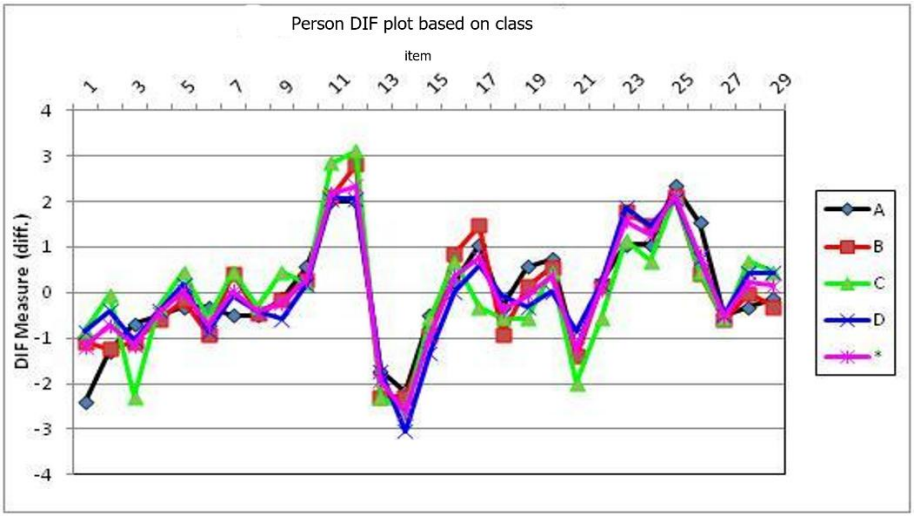
This e-learning readiness instrument was given to male students (code L) and women (code P) and came from 4 batches, namely class of 2014 (code D), 2015 (Code C), 2016 (Code B) and 2017 (Code A). To see whether the statement items in the instrument are biased or not, then the figure can be seen below.



Note: P = Female L = Male * = Average

Figure 1. Person DIF plot based on gender

This instrument was given to males (code L) and females (code P) from 4 batches: 2014 (code D), 2015 (code C), 2016 (code B), and 2017 (code A). Figure 1 shows a further illustration of the possible bias of the statements across genders. The graphic demonstrates that most statements do not cause bias across genders, implying that responses among both genders are not significantly different. Male students show a bit higher readiness that females do on statement q6 (instrument readiness), q8 (internet networking (readiness), q12 (knowledge readiness about LMS), and q16 (e-learning need level).



Note: A = 2017 B = 2016 C = 2015 D= 2014 * = Average

Figure 2. Person DIF plot based on class

Based on the year of entry (class), the statements in the instrument also did not significantly lead to the occurrence of bias. In the graph above shows the majority gave a response that was not much difference between students in the class of 2014 (code D), 2015 (Code C), 2016 (Code B) and 2017 (Code A). Only in statements q3 (initiatives utilizing e-learning), q17 (readiness to support facilities), and q21 (external encouragement to use e-learning) are less likely to be responded to towards being less prepared for students of the class of 2015 and q1 (readiness of skills in accessing computers & internet) for the quality of 2017 students.

Rating Scale Analysis can be used to verify whether the ranking of the options used is confusing or not. In other words, in the instrument of accession, e-learning readiness is whether the respondent can clearly distinguish between the response answers from inadequate to very adequate, never until always, not ready until very ready, and so on. As an analytical material, it can be seen in the Output Category Function (Appendix D). The analysis shows that the average observation starts from logit -2.08 for responses with a score of 1, logit -0.6 8 for answers with a score of 2, logit 0.75 for responses with a score of 3, logit 2.04 for answers with a score of 3 and logit 3.6 for responses with a rating of 5. From here, it can be seen from choice 1 to choice five; there is always an increase in logit value. Based on these data, there was a monotonic increase, which means that the measurement occurred well. The absence of equal scores in these five options shows that respondents can clearly distinguish between response choices that indicate readiness or not.

DISCUSSION

This research has successfully developed a measuring instrument of students' e-learning readiness. The data showed that the reliability of the respondent was 0.97 (Appendix A). Based on the instrument scale of assessment table quality by William P. Fisher Jr. [45]–[47], the reliability of the respondents is classified as excellent. The data also showed the authenticity of items 0.93 (Appendix A) and was classified as unique. t suggests that the probability of respondents responding to things was likely to be high, and the things defined the latent variable very well [42]. The interaction between respondents and elements, as described in the Rasch Model calculation through the Cronbach Alpha coefficient, which showed a value of 0.93 (Appendix A). This score indicated that there was a high level of interaction between respondents and items. An instrument with excellent psychometric internal consistency is considered a very reliable tool.

The result of raw variance explained by the measure of 50.1% also shows that the requirements for unidimensionality are Fair. Thus, this instrument is expressed quite well in the ratio of what should be measured in this

case is to measure a student's readiness to implement e-learning. Besides, the data analysis shows that the overall instrument of e-learning readiness did not cause to student gender bias and student class bias. The response meaning between male students and female or student class of 2014, 2015, 2016, and 2017 as a whole do not have a significant difference in response. Finally, based on the analysis of the validity of the rating scale, the results of the data analysis show that there is no equivalent value in the observed average of the five instrument options or response statements. It indicates that respondents can differentiate between responses that indicate not ready until very ready.

Previous studies have confirmed that the measurement of learning readiness is essential to support the successful implementation of E-learning in higher education and identify areas that require attention before application, without having to spend the cost, effort and time [48], [49]. Thus, there needs to be a measuring tool to determine the level of readiness from various aspects related to the application of e-learning in a college, one of which is the readiness of students. Besides being used to measure student readiness in general, this instrument can be used to identify student weaknesses and unpreparedness in terms of competence and habits in utilizing ICT, availability, and access to hardware and software, adoption of innovations, and self-development in using technology for their learning. Measuring the readiness of e-Learning makes the institution aware of what is needed to facilitate e-Learning optimally in specific contexts, especially introducing e-Learning to build student readiness for this type of learning [20], [28], [49]. The results of their study emphasize the importance of using appropriate tools to measure e-Learning readiness.

Measuring readiness is an essential requirement for higher education institutions to map the preparedness of students in terms of people, technology, adoption of innovation, and self-development. This mapping is expected to be formally included in the planning and delivery of academic programs in each tertiary institution. This will enable students to have the opportunity to build the readiness and skills needed to independently adapt to the e-Learning environment rather than rejecting new methods [50]. Thus every student is able to feel the maximum benefits of using e-learning in their learning process. Maximizing the e-Learning function becomes very important because it will attract diverse students and determine their success [49]. Therefore it is essential to evaluate e-Learning readiness before the adoption and implementation of e-Learning successfully.

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VI. Study Results, Summary And Contribution

After going through four stages of data analysis by Rasch Model using the Winstep program, this study resulted in an instrument e-learning readiness, which consisted of 29 items following the model statement. Data analysis indicated that the e-learning readiness instrument developed in this study had produced consistent and reliable measurement scores with useful quality items. Moreover, the tool is expressed quite well in the measure of what should be measured in this case is to measure a student's readiness to implement e-learning (e-learning readiness). Besides, the data analysis shows that the overall instrument of e-learning readiness did not cause to student gender bias and student class bias. Finally, based on the review of the validity of the rating scale, the results of the data analysis show that there is no equivalent value in the observed average of the five instrument options or response statements. It indicates that respondents can differentiate between responses that indicate readiness until very ready. Thus overall, this research has resulted in an instrument e-learning readiness capable of measuring the preparedness of students in following the learning process is online or through e-learning.

Limitations of this study, not all aspects of the use of technology used by students are accommodated in the instrument. For example, the diversity of the latest technology used by students makes the preference for technological equipment more personal. Another weakness is, the sample used is still limited both the number and diversity of interests in the field of study. Suggestions for further research are accommodating the latest technological tools that are students' preferences on indicators or response choices in the instrument. Besides, new

research needed to take a broader sample, for example, testing instruments developed across fields of study and taking into account the background of students. Thus the e-learning readiness instrument that will be developed can be truly tested on a more diverse sample.

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