

ASSESSMENT ON DIGITALIZATION OF BASIC PHYSICS COURSES: NEED ANALYSIS ON THE USE OF DIGITAL-BASED ASSESSMENT

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**ASSESSMENT ON DIGITALIZATION OF BASIC PHYSICS COURSES:
NEED ANALYSIS ON THE USE OF DIGITAL-BASED ASSESSMENT****Nurlina^{*1}, D. H. Marisda², Riskawati³, A. D. Sultan⁴, Sukmawati⁵, Akram⁶**^{1,2,3,4,5,6}Faculty of Teacher Training and Education, University of Muhammadiyah Makassar, Indonesia

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Assessment is essential to measure students' achievement of learning objectives. Assessments in Basic physics courses are still categorized as manual, unstructured, and outdated. Using descriptive statistics, this study aims to investigate the need for digital assessments in Basic physics courses. The samples were taken from two public universities, two private universities, and a university with Physics Education Study Programs. They were half of each university students' number per class. The number of respondents from Public university A, Public university B, Private University C, Private University D, and University E were 91, 49, 25, 20, and 29 students, respectively. Data collection was carried out using a questionnaire via a google form. Data obtained was analyzed by calculating the percentage for each indicator. Research indicators consist of the availability of teaching materials, the application of blended models, students' interest in basic physics, and the availability of assessments of the physics learning process. The results show that the five institutions that provide Basic Physics courses have not implemented digital assessments optimally. Of the five tertiary institutions that became the research sample, only one institution achieved the minimum target, with a score of 55.31% in the class of 2021 at university A. Meanwhile, the other four tertiary institutions did not achieve 50% in the last five batches. Therefore, lecturers must develop digital assessments in basic physics courses using the Kahoot application.

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Keywords: basic physics; digital assessment; Kahoot application**INTRODUCTION**

The quality of the learning system in education, especially at the tertiary level, is influenced by several aspects, such as qualified lecturers. To have excellent academic qualifications, lecturers must have other competencies following higher education requirements. In addition, lecturers must also realize national education's goals. Providing good quality lecturers is one of the determining factors for the quality of higher education (Ardianingsih & Yunitarini, 2012; Razak et al., 2016). Learning tools must be oriented to the latest technology to answer the times' challenges and society's needs. The learning tools needed for each course are semester learning plans,

learning modules, student worksheets, textbooks, and learning assessments.

Technology ultimately plays a vital role in all aspects of the learning process, including assessment. Nowadays, the assessment is no longer done manually by the lecturers. Technology-based assessment systems have long been implemented in the learning process (Chien & Wu, 2020; Nielsen et al., 2020), from web-based to digital assessments (Langenfeld et al., 2022). Web-based assessment is carried out with an online system (Permatasari et al., 2019; Dyah & Pratama, 2020; Darmaji et al., 2022) that is easy, effective, and efficient to be applied to the learning process (Wang, 2018; Fritschi et al., 2020; Dhina et al., 2021; Alimorad & Saleki, 2022). Digital-based assessment uses applications based on technology, both online and offline (Amante et al., 2021; Husain, 2021).

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One of the courses in the curriculum of the Physics education study program is the Basic Physics course. This course still uses manual assessment, covering all formative and summative assessments. The assessment system requires a detailed assessment. Formative assessment impacts learning with practice, discussion, and reflection. Formative or summative is assumed to positively impact students' motivation and learning outcomes (Nurlina et al., 2018) under the development of a learning assessment that also focuses on factors that will be assessed and adapted to the needs of the *Merdeka Belajar Kampus Merdeka*-based curriculum.

Assessment is a dynamic, daily, and practical process used in education to determine the extent to which learning objectives are achieved and what students need. Assessment is a daily work in the classroom that a teacher or lecturer must carry out and is used at any time to guide the teaching-learning process, a process that must be carried out continuously and personally, encourage teachers to demonstrate the intra-class learning gained by their students to improve students quality of education in the institution (Menendez et al., 2019). Likewise, in science learning, further assessment is needed by lecturers or teachers to measure students' thinking skills, both in authentic assessment and in developing test items (Rustaman, 2017; Kariri et al., 2018; Muchtar et al., 2019). Non-formal learning also requires assessment in the learning process. It aims to explore cognitive assessment techniques based on teaching experience, and it also aims to determine the success of teaching programs that have been implemented so far (Dharmawan et al., 2020).

The impact of the Corona Virus Disease (COVID-19) pandemic on education has caused learning to be replicated. Not only in the delivery of learning materials, but replication also occurs in assessing the learning process. Teachers

are required to evaluate learning objectively in all subjects (Mahmud et al., 2021). The assessments by lecturers, especially in the Basic Physics course, are still categorized as manual and unstructured. Several studies at the tertiary level in the last three years proved it. Marisda et al. (2022) analyzed the final test questions for Basic Physics subjects in the last three years. They found that the final Basic Physics test questions were not fully oriented to critical thinking skills with analytical essay instruments, student activity worksheets, and problem-solving. Similar research conducted by Suyidno et al. (2018) measured scientific creativity and students' responsibility in attending Basic physics course using a written assessment through physics learning with the Creative Responsibility Based Teaching (CRBT) model. In addition, there is also a formative assessment in measuring Basic Physics learning outcomes on the concept of two-dimensional motion and energy conservation (Park, 2019). Furthermore, the test instrument used in the Basic Physics course measures students' creative thinking skills on indicators of fluent thinking, flexible thinking, and detail (Suyidno et al., 2018; Marisda et al., 2022).

The Physics Education Study Program has 34 compulsory courses divided into odd and even semesters. There are 17 compulsory study programs in odd and 17 in even semesters. Researchers interviewed 13 lecturers who supported compulsory subjects in the Physics Education Study Program in the last three years related to the assessment used in lectures (mid-semester and end-semester assessments). In the last three years, in which the COVID-19 outbreak has hit the whole world, it was imperative that learning and assessment be online. The assessments used for the last three years are Google Form, Quizizz, and Spada Unismuh. The assessment data used in the last three years for each semester in compulsory subjects are presented in Table 1.

Table 1. Assessment Application in Basic Physics Course in the Last Three Year

Type of Assessment	2019			2020			2021		
	Semester			Semester			Semester		
	Odd semester	Even semester	Persent-age (%)	Odd semester	Even semester	Persent-age (%)	Odd semester	Even semester	Persent-age (%)
Google Forms	5	7	35,29	3	5	23,53	3	1	11,76
Quizizz	2	5	20,59	8	11	55,88	11	14	73,53
Spada Unismuh	10	5	44,12	6	1	20,59	3	2	14,71
Amount	17	17	100	17	17	100	17	17	100

Table 1 shows that in the last three years, the assessment system in the Physics Education study program has used online assessments. However, there are some things that lecturers complain about. For example, the application is rather heavy and requires a large enough quota to apply it. Besides that, in the second year of implementing the online assessment, students' interest decreased, from the decrease in the percentage of online assignment submissions to 80%. The use of the Quizizz application has increased each semester. However, students submitted several complaints, such as low-resolution images, causing them cannot see the scale. In addition, when students access the application via cell phone, sometimes certain types of cell phones are slow in opening the application, while the time for the test is limited. Course lecturers complained that this Quizizz application could not be applied to various tests.

Based on the analysis, it is necessary to have an innovation that can cover all sides of students' abilities and needs to maintain with technological developments. One application that can be used in the assessment system is Kahoot (Handayani, 2020; Mdaloose et al., 2021). Assessment using Kahoot combines an assessment system in learning with a monitoring system for students' learning outcomes (Djannah et al., 2021). In addition, the system has several assessment models such as practice questions, pretest, posttest, remedial, enrichment, and material strengthening (Daryanes & Ririen, 2020; Lisnani & Emmanuel, 2020). Kahoot is a website that presents an attractive assessment process and is designed in a user-friendly and multipurpose manner as a learning source, learning media, and assessment process that can meet the demands of the digital generation. Integrating technology in learning, one of which is in learning assessments, is believed to provide convenience for lecturers in conducting ongoing assessments of students, especially for those in Basic Physics courses.

This study presents an assessment tool for Basic Physics courses through the Kahoot digital media application in universities. Several previous studies have discussed surveys on the use of digital media in physics learning in general, but no one has examined the topic of using digital-based Physics Assessments in Basic Physics courses in higher education. These studies include research related to the use of Augmented Reality in the United States (Radu & Schneider, 2019), the use of a Web-Based Recitation program in Malang (Diyana et al., 2020), the use of 3D technology in student worksheets in Yogyakarta, (Oktasari et al., 2019), the use of android in Rantauprapat (Safitri et al., 2019), the application of digital media

in improving the learning process of Mathematics and Science (Hillmayr et al., 2020). Most other studies also focus their research on analyzing the effectiveness of media in the physics learning process. From this information, no research has attempted to analyze the use of assessments in a basic physics course in Indonesia. Therefore, this study aims to investigate the use of digital-based media in basic physics assessments in universities. This is also the novelty of this research.

METHODS

This descriptive study explores the need for digital assessments in Basic Physics subjects. Descriptive research uses observation, interview, or questionnaire distribution techniques to obtain information about the object under study. In contrast, descriptive statistics is an empirical analysis of the information obtained through the data collected by describing the data in tables and graphs (Mishra et al., 2019). The data from the answers given by the respondents to the items in the distributed instruments. This study describes the need for digital assessments in basic physics courses.

The observation stage is the initial stage of this research. At this stage, the researcher observed the types of assessments used by a team of lecturers who have been in charge of basic physics courses for the last three years. The assessments are Google Forms, Quizizz, and Spada Unismuh, alternately. The interview stage was conducted online by telephone. Interviews were conducted with five lecturers teaching basic physics courses at five universities. The core question of the interview was about the use of assessments in the basic physics course for the last three years. The interview used is an unstructured interview type. Unstructured interviews are open-ended questions (Roberts, 2020; Fadhallah, 2021; Sussman et al., 2021). In addition, interviews were also conducted with five students of the Physics Education study program only at five different universities. The final data collection stage in this study used the survey method. The survey method is the distribution of questionnaires to 214 students who were selected purposively (Klar & Leeper, 2019; Campbell et al., 2020) at five different universities. This data collection stage is carried out online using the Google Form application.

The research instrument was validated before being used. Instrument validation consists of item validation and reliability. The results of item validity using the Aiken concept with validity standards are influenced by the rating scale, and the number of raters used (Aiken, 1985), which

is included in the valid category with a value of 0.73. As for the reliability of the instrument, the Alpha Cronbach technique was used (Sugiyono, 2013), and a correlation coefficient of 0.789 was obtained in the very strong category. It can be concluded that the instrument developed is valid and reliable (reliable).

The population in the research consists of objects/subjects with specific qualities and characteristics determined by the researcher to be studied and then concluded (Stratton, 2021). The population in this study were active students from 2017 to 2021 at five selected tertiary institutions representing three categories: two public universities, two private universities, and one university that organizes the Physics Education Study Program. Samples were taken by purposive technique. The reason was that the data obtained by the research team was direct data provided by the university. Researchers did not take samples directly. The tertiary institution provided samples to the researchers according to the criteria needed by the researchers. Therefore the number of samples obtained varied for each tertiary institution. The selected respondents were half the number per class from 2017 to 2021 at each institution. The respondents were 91 PTN A students, 49 PTN B students, 25 PTS C respondents, 20 PTS D respondents, and 29 PT E respondents, so the total number of respondents in this study was 214.

The data collection technique used in this study is a survey, so the data obtained are facts from the phenomenon and seek factual information. The steps of the survey method consist of collecting data, classifying data, analyzing data, and then making conclusions to describe and see a relationship of influence and relationship between variables. The data collection stage in the study consisted of observation, interview, and online questionnaire distribution using Google Forms. After the data is obtained, then the data is classified based on the research indicators. The data classification results will be analyzed using descriptive statistical analysis in the form of percentages of research indicators. The data from

the analysis is the basis for making conclusions in this study regarding the importance of developing a Kahoot-based digital assessment in the Basic Physics course

The research instrument used is structured and systematic. The statement is similar to a particular object per the research objectives. The instrument is a non-test instrument in the form of a questionnaire distributed digitally via Google Forms to all respondents. The statement from the questionnaire is a mapping of indicators. The indicators of the digital assessment need analysis questionnaire in basic physics course to consist of four indicators: 1) the availability of teaching materials; 2) the application of blended models; 3) students' interest in basic physics; 4) the availability of assessment of physics learning process. The four indicators were obtained based on discussions with Physics Education lecturers from several universities and the results of the analysis of learning outcomes for courses. It becomes a guideline for researchers to determine indicators and questionnaires in research. Before being used, all instruments used in this research were validated by experts (Rachmatullah et al., 2017; Suana et al., 2017). The validator team is an expert in physics and learning media. The research data were analyzed by calculating the percentage using the following formula :

$$P = (n/N) \times 100\%$$

RESULTS AND DISCUSSION

Questionnaires were given to students to find information about students' needs for digital assessments in Basic physics course. The questionnaire depicts four main indicators: availability of teaching materials, application of the blended model, students' interest in basic physics, and availability of basic physics assessment in the learning process. The total number of respondents who filled out the instrument was 214 students from five higher institutions. The results of the need analysis in the digital assessment are presented in Table 2.

Table 2. The Percentage of Need Analysis on Digital Assessment for Basic Physics Course in Five Higher Institutions

Institution Category	University Code	Percentage (%) / Batch				
		2017	2018	2019	2020	2021
Public University	A	28,75	32,19	45,31	48,44	55,31
	B	30,50	35,50	41,00	42,00	42,50
Private University	C	23,33	23,33	30,83	32,50	34,17
	D	26,67	23,33	30,00	31,67	40,00
University	E	26,43	21,43	32,86	35,00	37,86

Table 2 shows the need for digital assessments for Basic Physics courses. In state universities A and B, there was an increase in the application of digital assessments in Basic Physics courses every year selected. However, the portion of the digital assessment is still very low, mostly below 50 percent of the expected level. In private university C, the percentage of digital assessment used remained the same in the first two years and kept going up until 2021, while in private university D, there was a slight decrease in the second

year, but it improved in the rest of the period given. Finally, in University E, the percentage went down in 2018 and increased again in the following years. Overall, there is only 1 class that reached more than 50% of the expected implementation of digital assessment in the Basic Physics Course, that is, in Public university A, Batch 2021 students. Figure 1 shows the analysis of digital assessment needs in basic physics courses at each university for each indicator.

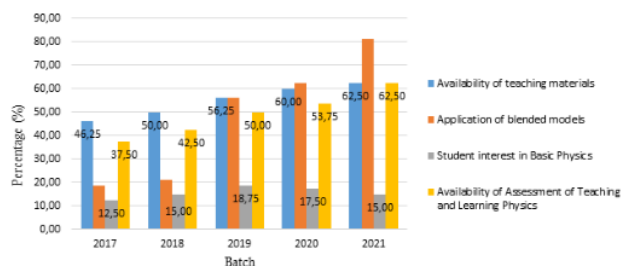


Figure 1. Percentage of Each Indicator in Needs Analysis of Digital Assessment at Public University A in Each Batch

From the analysis of the need for digital assessments for each indicator at Public university A for each batch, it can be known that the availability of teaching materials increased every year, yet this increase was not significant. Besides, the application of the blended model also went up sharply in 2019 and reached its peak in 2021 by 81.25%. This was due to the emergence of the COVID-19 pandemic, which required learning to take place online from home. This is in line with Kobch²⁴ research (2020) which says blended learning that combines face-to-face meetings with online and offline assignments is the best solution for learning at all levels of education during the pandemic and the new normal period after the COVID-19 pandemic (Siripongdee et al., 2020; Mali & Lim, 2021; Megahed & Hassan, 2022). Blended learning also provides an independent space for students to learn. In addition, blended learning allows teachers or lecturers

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to reinvent or revise content¹¹ specially in disciplines that have the potential to provide interesting learn²³ experiences for students in online learning. There is a clear need for conducting studies to demonstrate the effectiveness of blended and hybrid instruction and how lecturers can work on designing their classes, making it an available option during current times and prepare to teach²² the post-pandemic world (Kundu, 2018; Dakhi et al., 2020; Singh et al., 2021). Blended learning is also the best learning solution in Ir¹⁵ during the COVID-19 pandemic and post-COVID-19 (Aji et al., 2020; Saragih et al., 2020; Bordoloi et al., 2021). Students' interest in Basic Physics subjects was quite low, and the level of interest fluctuated during the period. This was related to low student interest in the Department of Education. However, the availability of physics learning assessments increased every year.

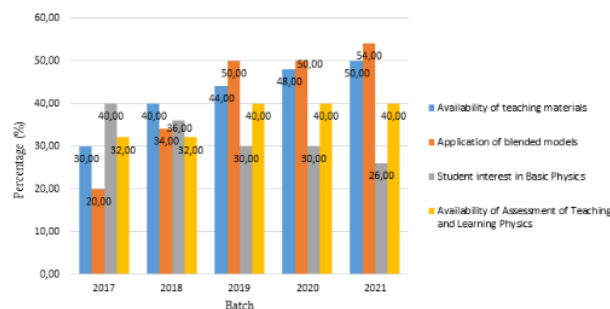


Figure 2. Percentage of Each Indicator in Needs Analysis of Digital Assessment at Public University B in Each Batch

Figure 2 depicts that the availability of teaching materials at Public university B has increased yearly. The availability of teaching materials in the form of books, learning modules, and student worksheets is a factor supporting the success of the learning process (Mudulia, 2016; Onesto Ilomo & Mlavi, 2016). Availability of resources for science teaching and practical implementation in secondary schools, including the availability of learning resources in the form of books and adequate internet facilities, are urgently needed in the Ankpa Local Government

Area of Kogi State, Nigeria (Daluba, 2012). Likewise, the application of the blended model in learning Basic Physics subjects also experiences a rise every year of the period given. Contractive, students' interest in basic physics has continuously declined over five years. Finally, the availability of assessments in Basic Physics courses remained in the same percentage in 2017 and 2018 and improved by 8% in the following year, and the number remained steady until the end of the period.

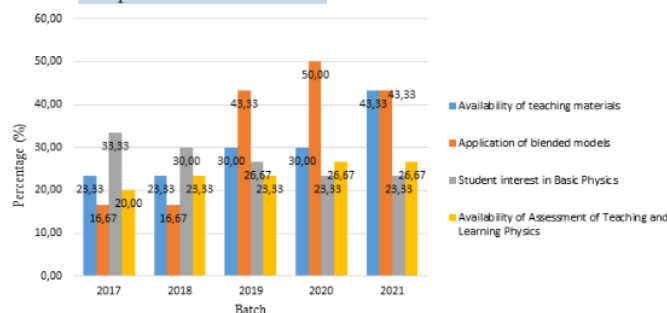


Figure 3. Percentage of Each Indicator in Needs Analysis of Digital Assessment at Private University C in Each Batch

Figure 3 describes an improvement in the availability of teaching material, and the percentage rose significantly in 2021. The implementation of the blended model stayed stable in 2017-2018 and climbed to 50% in 2020. However, it experienced a decline in the final year of the period. This was triggered by the rampant Corona Virus (COVID-19) outbreak, which requires the learning process to be carried out online. Blended learning is virtual learning that is busy being used as an online learning solution from home during the pandemic, one of which is the Edmodo application (Marisda & Ma'Ruf, 2021; Sefriani et al., 2021). Furthermore, the student's interest in Basic Physics went down from 33.33% at the beginning to 23.33% at the end of the period. The low interest of students in learning basic physics is due to the students' lack of interest in choosing a physics major in university. This is because, from the beginning, students' interest in Physics has decreased (Jua et al., 2018; Riskawati et al., 2021) before choosing the Department of Physics Education. The low interest of students in the Department of Physics Education can be influenced by several factors, such as lack of encouragement from parents, lack of motivation from Physics teachers in high school, difficult

physics material, and declining work opportunities as a physics teacher (Riskawati et al., 2022). In addition, the low interest of students is also influenced by the experiences of students during school who already consider physics to be difficult, especially in understanding content, solving math problems, and solving physics problems (Cottrell, 2017). Finally, the availability of assessments in the Physics learning process slightly increased in 2018 and remained stable for the rest of the period. It can be concluded that during the last five years, University C has not experienced any assessment innovations, especially in technology-based assessments.

Figure 4 shows a digital assessment needs analysis for each indicator in each batch in university D. The graph explains that the highest percentage for each class is the indicator of the availability of teaching materials. For the last five years, University D has had adequate teaching materials available for Basic Physics courses. However, despite the high percentage among others, there was a small decline in 2018, yet it increased the following year. This is a positive action from stakeholders in the Physics Education department who continued to improve teaching materials' availability.

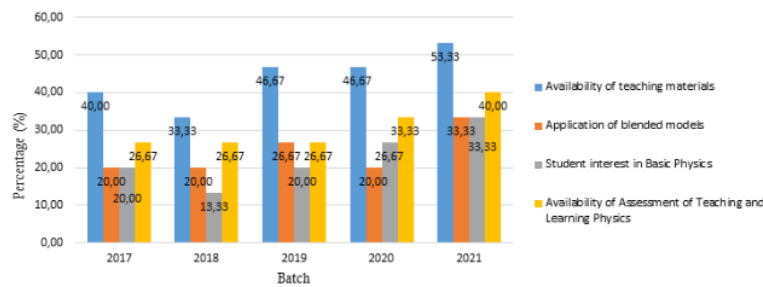


Figure 4. Percentage of Each Indicator in Needs Analysis of Digital Assessment at Private University D in Each Batch

Learning support facilities in higher education are needed, especially in the state of Abia to support the achievement of 21st Century knowledge, namely the availability of teaching materials for lecturers, the use of effective teaching materials for students, and support for internet facilities from universities (Uzuegbu et al., 2013). The same thing was also expressed by Aragao (2013), the availability of adequate learning facilities provides positive support for the achievement of learning objectives, this will certainly improve the quality of learning and student achievement. The availability of teaching and learning resources provides a positive correlation with effective classroom management. Good university management that comes from the availability of teaching

materials from lectures, and the effective use of teaching materials, is one of the benchmarks for higher education quality, as well as being an additional value for promotion facilities for private universities in the community (Aragao et al., 2013; Bizimana & Orodho, 2018; Sylvester, 2018). Meanwhile, the indicator of the availability of Physics assessments has the lowest percentage, particularly in the 2018 batch with 13.33%. However, the Department of Physics Education at Private University D improved the assessment and experienced an increase over the last three years, which was applied to 2019, 2020, and 2021 classes. What is of concern is that the percentage of assessment availability does not reach 50%, only 33.33% in the class of 2021.

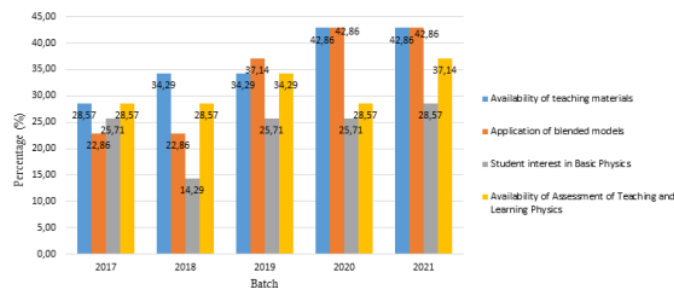


Figure 5. Percentage of Each Indicator in Needs Analysis of Digital Assessment at College E in Each Batch

Figure 5 reveals that in the class of 2017, the highest percentage is the indicator of the availability of teaching materials and the availability of assessments, each of which is 28.57%, while the lowest indicator is student interest in Basic Physics. In 2018, the indicator of students' interest in Basic Physics had the lowest percentage. Their initial perception also influences students' low interest in learning basic physics since high school. Students have negative perceptions of physics lessons, difficulty remembering science concepts or problem-solving complexity of

calculating math problems, and a lack of information from high school teachers related to professional fields that require expertise in physics (Hong & Lin-Siegler, 2012; Fadila et al., 2020). Meanwhile, the indicators for the availability of assessments remained steady from the 2017 class to the 2018 batch. In the last three batches, namely 2019, 2020, and 2021, the lowest indicator was still students' interest in Basic Physics, but during the last three years, their interest did not decrease yet increased in the class of 2021. In addition, the availability of assessments percentage

fluctuated during the period. Overall, it can be seen from the graph above that the percentage for all indicators of needs analysis in the digital assessment at High School E did not reach 50%, so innovations are still needed to support learning.

For the past three years (the COVID-19 pandemic), physics education lecturers at the Muhammadiyah University of Makassar have used online assessments. These applications are Google Forms, Quizizz, and Spada Muhammadiyah University Makassar. However, there are some things that lecturers complain about. The complaints include the applications used are rather heavy, so it requires a large enough quota to apply them, besides that in the second year of applying for the online assessment, student interest is reduced, which can be seen from the decrease in the percentage of sending assignments online to 80%, this is because students are bored in solving problems presented in the form of Google Form. The display of questions presented in the google form contains text narration and no image illustrations, so it impacts decreasing student interest in solving questions through the google form. The use of the quiz application is quite popular with students. However, there are complaints from the course lecturers that not all types of questions can be presented on the quiz application.

Based on this consideration, the research lecturer team applied the Kahoot application, which looks like an online game, with the hope that students' boredom can be reduced and students also become more enthusiastic in terms of working on questions, both multiple choice, essay, and true false questions. Based on this situation, digital-based assessment is very much needed in learning, especially learning Physics in supporting the improvement of student cognitive learning outcomes.

CONCLUSION

Based on the results of the analysis, of the five universities, only one has a needs analysis percentage reaching 50%, namely Public university A, with a score of 55.31% in the class of 2021. Meanwhile, the other four universities have never reached the percentage of 50% in the five batches. Furthermore, the analysis of each indicator shows that the percentage fluctuated in each batch. Of the five universities, there are two universities where the percentage of assessment analysis for each indicator never reaches 50% for each batch: Private University D and University E. Private University C reached 50% in the implementation of the Blended Model in 2020 but reached under 50%

in the other indicators. For Public university B, the indicator "Implementation of the Blended Model" in 2019, 2020, and 2021 classes and the "Availability of teaching materials" indicator in the 2021 batch has reached 50%. For Public university A, several batches reached a percentage of 50%: the indicator of "availability of teaching materials" in the 2018-2021 class, "Implementation of the Blended Model" in the 2019-2021 class, and the indicator "Availability of Physics assessments in the learning process" in the 2019-2021 class. Therefore, it can be concluded that the general needs assessment percentage is still low. As an implication, it is necessary to develop an updated and still related to the applied curriculum, a technology-based assessment, in this case, a Kahoot-based assessment. The Kahoot-based assessment is a breakthrough innovation in the form of a fun game for prospective physics teacher students

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