The Development of STEM-Based DIGASS Application to Improve College Student Assessment Skills

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Abstract

Assessment application is essential because college students, as prospective teachers, must be able to assess students to find out the right treatment in the process of achieving learning goals. This research aimed to develop the STEM-based DIGASS application to improve college student assessment skills in the era of Society 5.0. This research used Research and Development (R&D) procedures with stages 1) potential and problems, 2) data collection, 3) product design, and 4) design validation. The subjects of this research were college students of the Faculty of Teacher Training and Education, Universitas Muria Kudus. The research instrument used digital assessment needs analysis, prototype development, and digital assessment prototype validation results data. The results of this research found that the STEM-based DIGASS application is feasible to use to determine college student assessment skills with average results in terms of Usability (4.07), Functionality (4.50), and Visual Communication (4.25).

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Introduction

The era of Society 5.0 is an era that requires college students to adapt to the rapid development of science and technology to improve the quality of human resources. Improving the quality of human resources will not be separated from the education process. Education is an undeniable need as a means to develop human resources who have the ability and intelligence to think critically, logically, creatively, proactively, and adaptively to the growth and development of the times in all fields (Ermawati et al., 2023). The main thing in education is to prepare superior human resources. Education must create an attractive learning environment and process to make students active to develop their potential and become a generation of qualified and competent nations in three dimensions, namely the dimensions of attitude, knowledge, and skills (Ermawati & Amalia, 2023).

With the emergence of Era of Society 5.0 in the world of education, there is a need for a change in the educational paradigm. Education needs to shift towards an active learning approach that will encourage students to engage at a higher level than traditional lecture-based methods (Videnovik et al., 2023). Additionally, Riswari and Bintoro (2020) stated one effort to achieve educational goals is to improve learning in the classroom. Indonesia's education system or curriculum must always be improved, considering that this era is also a very fast globalization process (Nugraha & Rahman, 2021). Hakiki and Fadli (2021) stated that the Era of Society 5.0 is an era of technology that integrates with various aspects of human life, including education, where this era requires college students to adapt to the rapid development of science and technology in improving the quality of human resources. According to Hilyana and Hakim (2018), the information technology revolution causes a fast expansion on every side of the modern world and becomes the most critical need in learning media development for schools, universities, and other educational institutions. In education, Era of Society 5.0 requires education that uses digital-based technology for both teachers and students. Digital-based learning can shape students to learn, collaborate, and share ideas with the help of the internet and technology development (Crompton & Brake, 2018). Students must also have a very active character in utilizing digital technology and have skills in operating internet-based technology. The utilization of digital learning can be used to support the learning process. It is the opinion of Garcia-Cabot et al. (2015) that the Extension of digital learning in which mobile devices and wireless technologies are used to support the learning process.

The learning process, be it conventional or digital learning, will not be separated from the assessment process to evaluate learning outcomes so that learning objectives to improve the quality of human resources can be achieved. Assessment is an activity to collect data / or information using various techniques whose results are related to student performance, the learning process in the classroom, and even program comparisons with goals, standards, and learning outcomes. Assessment is an integral and important part of creating effective learning (Ole, 2020). However, from the results of observations made with Faculty of Education and Teacher Training (FKIP) college students that in making assessments, almost all of them use conventional assessments, with many shortcomings. According to Istiandaru et al. (2014), conventional assessment is an assessment that is oriented towards understanding concepts. It means that conventional assessments tend to focus on assessing hard skills without assessing

attitudes and personalities, even though attitudes are also paramount to improving the quality of human resources. The conventional assessment process also requires a long process, from making the assessment instrument and its implementation to the assessment itself. Making conventional assessment instruments tends to be difficult to control because it does not rule out the possibility that the instrument that has been validated is different from the tested instrument. In addition, the implementation is also limited in space and time. Teachers and students must also meet directly to conduct tests as the primary assessment process. After the student has taken the test, the teacher then has to conduct an assessment with high subjectivity due to high dependence on the teacher's physical condition.

The weaknesses of conventional assessment will have a fatal effect on the learning process because if the assessment results are not accurate, the follow-up of the assessment results will also be wrong. With the wrong follow-up or handling, the goal of the learning process, namely improving the quality of human resources, will not be achieved. The assessment process is crucial, and almost all college students use conventional assessment as the basis for conducting assessments with many shortcomings. It is very necessary to develop other assessment methods to improve college student assessment skills. Amnie et al. (2021) stated that assessment in learning requires updating the assessments used. It makes authentic assessment an alternative assessment to measure student abilities.

Assessment reform is very suitable if it is associated with the use of technology. Digital technology can make it easier for teachers to make assessments of student abilities (Asrial et al., 2022). In addition, Setiawati (2021) explained that the STEM-based test instrument with hardcopy validated by material experts received a score of 78.36%, language experts 98.67%, and assessment experts 88.75%. Therefore, the STEM-based test instrument is very feasible to use. Meanwhile, the response from the assessment was obtained from students with an average percentage of 93.5% with the criteria "very interesting", and the suggestion is that by utilizing technology, STEM-based test instruments will be more attractive and efficient.

It shows that STEM-based assessment is very suitable for measuring student abilities, especially when combined with the use of technology. Meanwhile, with college students as prospective teachers who will conduct assessments, of course, technology is needed to improve college students' assessment skills, especially STEM-based assessments. To measure college students' assessment skills, researchers will develop and validate the DIGASS (Digital Assessment with STEM-based) application. DIGASS is a website application that can be accessed anywhere and used to assess STEM-based students before being tested on students. The assessment instruments made by students will be validated first by lecturers. The development of DIGASS with digital assessments for digitally-enabled teacher candidates is also supported by the new independent curriculum used to educate in elementary schools. As technology develops, the assessment will be done online, making it possible to be arranged in such a way that work can be done wherever and whenever the arrangement is used. Based on these problems, researchers conducted research entitled "Development of STEM-Based DIGASS Application to Improve College Student Assessment Skills".

Methodology

This research utilizes Research and Development procedures. According to Sugiyono research and development method is a research method used to produce a particular product and test the effectiveness of the product (Sugiyono, 2017). An application developed is the STEM-based DIGASS application. This research aims to develop the STEM-based DIGASS application (Science, Technology, Engineering, and Mathematics) as an effort to improve college student assessment skills in the era of Society 5.0. In this research, the Borg and Gall development model. The steps of using the Research and Development (R&D) method are as follows.

Figure 1. *Steps of the Research and Development (R&D) method*
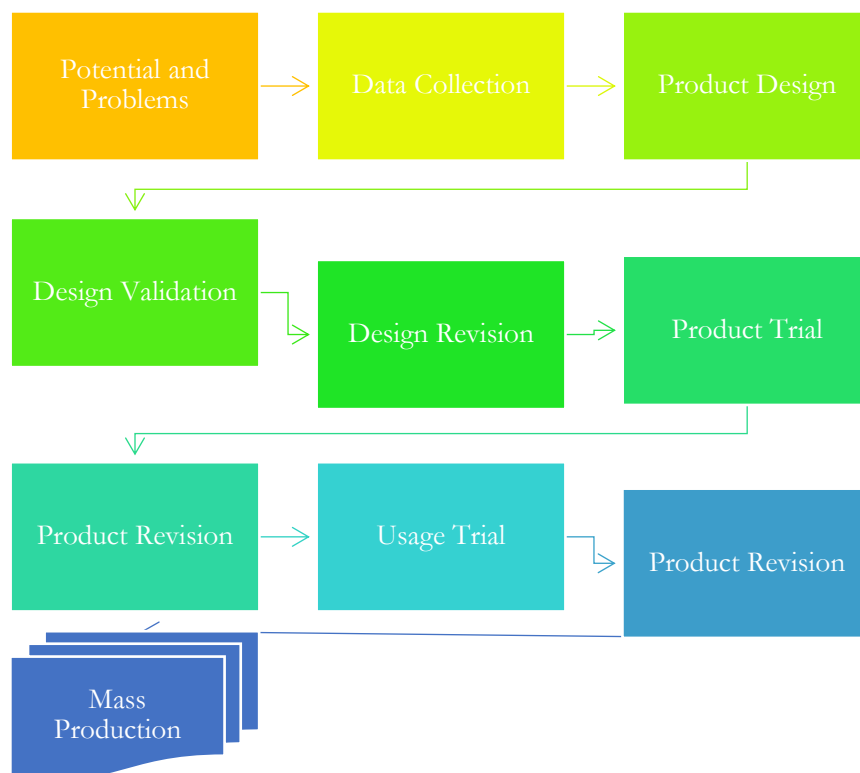
The Bold and Gall model has ten research steps, which are as follows: 1) Potential and Problems, 2) Data Collection, 3) Product Design, 4) Design Validation, 5) Design Revision, 6) Product Trial, 7) Product Revision, 8) Usage Trial, 9) Product Revision, 10) Mass Production (Sugiyono, 2017). In this research, only four stages were taken, namely 1) potential and problems, 2) data collection, 3) product design, and 4) design validation, as follows.

Figure 2. *Borg and Gall model development procedure*

The research instruments used for digital assessment need analysis, prototype development, and data on the results of validating the digital assessment prototype. Product trial design stages include media expert validation. Research techniques and instruments are adjusted to the research objectives. The data analysis technique uses qualitative and quantitative approaches. This research used two media expert lecturers and two assessment expert lecturer validators to validate the STEAM-based DIGASS application in terms of media expert and assessment expert lecturer indicators with the percentage of data from the product validity test results said to be valid if the results of data analysis are decent or very feasible criteria. Validation is a stage of the validity assessment of the product design, and validation is carried out by validators who are experts in their fields (Hadi et al., 2022). This research uses a Likert scale formula with a range of 1-5 to obtain product validity. This validation was then analyzed using the following formula calculation.

$$x = \frac{\sum M}{Mm} \, x \, 100\%$$

Description:
X = Percentage of the expected score of each aspect of the assessment
∑M = Number of scores per assessment aspect
Mm = Maximum score for each assessment aspect.

After data validation, data interpretation is then carried out using the score data interpretation category as follows.

Table 1. *Validity test criteria*

Feasibility Percentage	Qualification	Description
86%-100%	Very Feasible	Very suitable for use and no need for improvement
71%-85%	Worth	Feasible to use with improvements
61%-70%	Decent Enough	Decent enough and needs improvement
46%-60%	Less Feasible	Less feasible and needs improvement
≤45%	Very Less Feasible	Very inadequate and needs improvement

Research design, site, and participants

This Research and Development (R&D) was implemented at Universitas Muria Kudus. The research subjects were college students of the Faculty of Education and Teacher Training Education (FKIP) of Universitas Muria Kudus. The STEM-Based DIGASS research used an R&D model based on the modified Borg and Gall development model. The results of applying the application development procedure with the Borg and Gall development steps were as follows. The initial stage of Borg and Gall's development is potential and problems. The analysis results are the growing times in the era of Society 5.0, require learning tools based on digital technology using the internet. It is intended that college students and prospective educators can use and access at any time and improve college students' skills in using digital technology in the era of Society 5.0.

Data collection

This research used two data collection techniques, namely observation and questionnaire. The observation technique carried out by researchers through observation of college students related to assessment skills. Then, after making observations, researchers got a problem related to the low ability of college student assessment, so a solution was found in developing a STEM-based DIGASS application to improve college student assessment skills in the Era of Society 5.0. Furthermore, researchers made a validation questionnaire that was useful in testing the feasibility of media carried out by media experts, with details of validation carried out by media expert lecturers as validators.

Product design and validation

The product produced in this research is a learning tool in the form of a STEAM-based DIGASS application, which will be able to assist students in making college student ability assessments easier and more accurate. In the product design, the DIGASS application can develop assessment capabilities in digital technology in the Era of Society 5.0. In this research, the product validity assessment was used for the application developed. The validity of the application in this research was carried out by a required expert, namely a media expert and an assessment expert lecturer. The product questionnaire assessment uses a Likert scale. In the

validation test, the validator provides advice on the aspects measured by the media assessment indicators with a value range of 1-5.

Results and Discussion

The following are the results of validation conducted by media expert lecturer validators as follows.

Table 2. *DIGASS application validation results*

Expert Validation	Maximum Score	Total Score	Percentage	Criteria
Media Validator 1	155	131	84,51%	Worth
Media Validator 2	155	136	87,74%	Very Feasible
Assessment Validator 1	105	92	87,62%	Very Feasible
Assessment Validator 2	105	83	83,81%	Worth

The table above shows the validation of the DIGASS application in media validator one gets a percentage of 84.51% with "very feasible" criteria but with improvements. Then, media validator two gets a percentage of 87.74% with "worth" criteria but with improvements. For assessment validation of the DIGASS application assessment validator one gets a percentage of 87.62% with "very feasible" criteria. Meanwhile, assessment validator two gets a percentage of 83.81% with "worth" criteria but with improvements. It proves that the DIGASS application is feasible to improve college student assessment. It agrees with Hasanah et al. (2020) that digital assessment can minimize cheating because, in digital assessment, college students must log in one by one, with each college student having their own username and password, so they cannot access each other, and digital assessment can improve the quality of learning outcomes. The average validation results per assessment instrument indicator submitted by researchers to assessment validators in terms of assessment category, question rubric, and assessment rubric. The following are the results of the assessment validation per the assessment instrument indicator.

Table 3. *Per-indicator assessment validation results*

Instrument Assessment Indicator	Maximum Score	Total Score	Percentage	Criteria
Assessment Category	70	60	85,71%	Worth
Question Rubric	80	66	82,50%	Worth
Assessment Rubric	60	54	90,00%	Very Feasible

From the validation results of per indicator of assessment instrument in terms of assessment category, it got a percentage of 85,71% with "worth" criteria with improvement. The suggestion from the validator is to add assessment categories, especially for students in DIGASS. In terms of question rubric, it got a value with a percentage of 82,50% with "worth" criteria with improvement, namely by adding question processing time that can be controlled

by the assessment instrument maker. In terms of assessment rubric, it got a value with a percentage of 90,00% with "very feasible" criteria. Assessment rubric in DIGASS is made automatically for several types of questions that are possible, such as multiple-choice question types and prompts to facilitate the assessment process by college students. The average validation results per media assessment indicator submitted by researchers to media validators in terms of usability, functionality, and visual communication. The following are the results of the assessment per media assessment indicator.
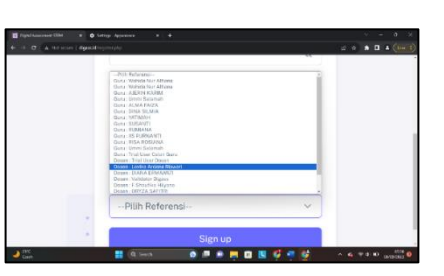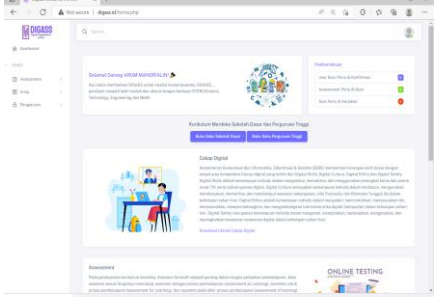
Table 4. *Per-indicator media validation results*
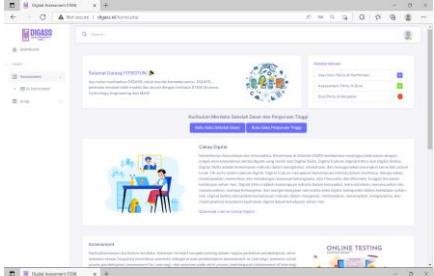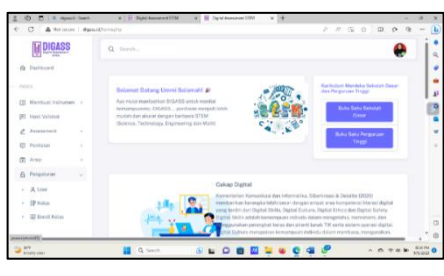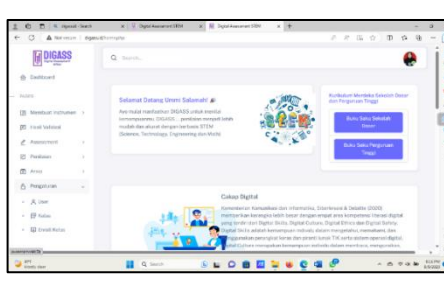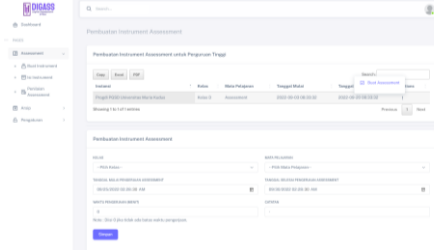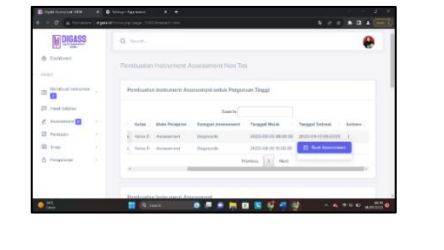
Media Assessment Indicator	Maximum Score	Total Score	Percentage	Criteria
Usability	80	65	81,25%	Worth
Functionality	130	117	90%	Very Feasible
Visual Communication	100	85	85%	Worth

From the results of validation per indicator of media assessment in terms of Usability, it got a percentage of 81.25% with "worth" criteria with improvement. It is because the DIGASS application is a website that uses writing and menus that are easy for users to understand. In addition, the application can also present information that is up-to-date and informative so that learning becomes more active. It agrees with Education et al. (2023) that it can change learning from teacher-centered to student-centered, which makes learning more active.

In terms of functionality, it got a value with a percentage of 90% with "very feasible" criteria without improvement. It means the application has met the feasibility of the application to be used because the components in the STEM-based DIGASS application are functioning properly. This application can follow the Era of Society 5.0, which can improve college students' digital skills and abilities.

In terms of visual communication, it gets a score with a percentage of 85% with "worth" criteria with improvement. In the DIGASS application, visual communication used such as display design and design of the media is good in terms of web color, menu color, and media quality is good. It can build the interest that college students have in using the STEM-based DIGASS application. It agrees with Ulfa that STEM must emphasize a learning experience for college students in school, integrated learning, the ability of students to solve problems, methods of thinking deeply, the ability to manage types of project tasks, and understanding and skills regarding engineering design (Ulfa et al., 2019).

Table 5. *DIGASS app validation suggestions*

| Comments and Suggestions	Old View	New Look
In the old display, the image was cartoonish, while in the new display, it is more real and looks real.		
The old menu display did not have other user references, in the new display other usage references will verify the new usage.		
The old view has fewer menus, the new view has more menus.		
In the old view, there was no notification menu, in the new view there is a notification display menu available		
The old display has not displayed numbers, the new display has displayed numbers		

Comments and Suggestions	Old View	New Look
In the previous display, it only displayed the Test and Non-Test assessment categories. In the new display, it categorizes it into categories		
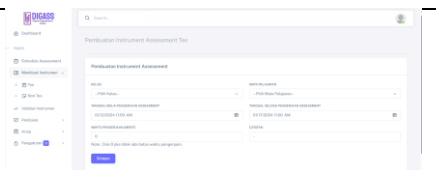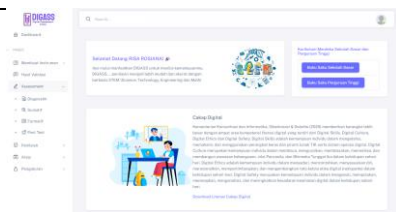
The table above contains comments from media and assessment validators that have been implemented into DIGASS as a refinement of the DIGASS application according to the validation results.

Conclusion and Recommendations

Based on the results and discussion presented earlier, the STEM-based DIGASS application is feasible to determine college student assessment skills. It can be seen from the results of the validation of the DIGASS Application by two validators, with validation results in terms of Usability 4.15 for validator one, and a value of 4 for validator 2. While in terms of Functionality, validator one gave a value of 4.15, and validator two gave a value of 4.85. Additionally, in terms of visual communication, the validation value obtained from validator 1 is 4.4 and 4.1 for validator 2. Based on the validation results, the STEM-based DIGASS application can replace the digital assessment process, of course, with the advantages of the DIGASS application, namely: 1) Assessment instruments are easily controlled from the creation stage to its implementation, 2) The assessment process is more efficient because the time required is faster, 3) Assessment is more objective, and 4) The assessment process is more flexible without being limited by space and time.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest.

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