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Digital Assessment Model to Identify Student Creativity in Constructing Mathematics Instructional Media

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Abstract (in English): The novelty of this study is in the exploration of students' creativity skills which are implemented comprehensively in the mathematics learning media course and assessed by digital assessment. The problem in this study is how to develop a digital assessment model to identify students' creativity in constructing mathematics learning media. This research aims to discuss the development of a digital assessment model to identify students' creativity in constructing mathematical instructional media. This study uses a quantitative research method with a cross-sectional approach, involving lecturers and students from three different universities in East Java, Indonesia. The research instruments include observation guidelines, questionnaires, and Focus Group Discussions (FGD) to collect the necessary data. Data analysis using qualitative and quantitative methods. Testing for validity using Pearson Correlation, and reliability with Cronbach's Alpha. The findings of this research indicate a high level of creativity in generating new ideas for constructing mathematics instructional media. However, the results of the questionnaires suggest that most respondents tend to modify and adapt existing instructional media. Furthermore, the implementation of mathematics instructional media constructed by students showed a significant impact on students' learning outcomes and motivation in schools. The results of validity and reliability tests demonstrate that this digital assessment model is not only reliable but also valid for use as an evaluation tool for students' creativity in the context of constructing mathematics instructional media. Based on the findings described above, it can be concluded that the digital assessment model is valid and reliable, making it suitable for implementation in assessing students' creativity in constructing mathematics instructional media.

Keywords (in English): Digital Assessment, Creativity, Constructing, Mathematics Instructional Media.

识别学生在构建数学教学媒体方面的创造力的数字评估模型

摘要：
本研究的新颖之处在于探索在数学学习媒体课程中全面实施并通过数字化评价来评估学生的创造能力。本研究的问题是如何开发一个数字评估模型，以识别学生在构建数学学习媒体中的创造力。本研究旨在探讨如何开发一个数字化评估模型，以识别学生在构建数学学习媒体中的创造力。本研究采用横断面定量研究方法，涉及印度尼西亚东爪哇岛三所不同大学的讲师和学生。研究工具包括观察指南、调查问卷和焦点小组讨论（FGD），以收集必要的数据。数据分析采用定性和定量相结合的方法。使用皮尔逊相关性检验有效性，使用克朗巴赫阿尔法检验可靠性。研究结果表明，受访者在构建数学学习媒体方面具有较高的创造力。然而，问卷结果显示，大多数受访者倾向于修改和改编现有的学习媒体。此外，学生建构数学学习媒体的实施对学生在学校的学习成果和学习动机有显著影响。此外，学生构建的数学学习媒体的实施对学生的学习成果和在校学习的积极性有显著影响。效度和信度检验的结果表明，该数字化评价模型不仅可靠，而且有效，可

以作为评价学生构建数学学习媒体创造力的工具。根据上述研究结果，可以得出结论，该数字化评价模型是有效和可靠的，因此可以用于评价学生构建数学学习媒体的创造力。

关键词：数字评估、创造力、构建、数学教学媒体。

1. Introduction

National education standards consist of 1) educational output standards, 2) educational process standards, and 3) educational input standards. The learning process is done by creating a fun, inclusive, collaborative, creative and effective learning atmosphere [1]. Undergraduate study programs must ensure the achievement of graduate competencies by implementing a curriculum centered around projects or other comparable approaches of learning and assessments that can demonstrate the achievement of graduate competencies. Digital assessment models need to be constructed because developments in science and technology have become a new trend in implementing digital-based learning in education [2]. Lecturers who teach courses, including instructional media courses, must be able to elaborate on the 3 national educational standards. This elaboration attempts to develop student creativity in constructing mathematics instructional media.

The digital creativity assessment model to identify creativity in constructing student mathematics instructional media is considered very urgent to be constructed, because it is in line with the learning principles used in higher education, in addition to realising national standards that have been set. One learning model that can be implemented to develop student creativity in constructing mathematics instructional media is the project-based learning model. Creativity is needed in instructional media courses, where students are directed to construct mathematics instructional media as media plays a crucial role in the successful achievement of learning objectives [3].

The advantages of teaching aids, a type of media in mathematics education, include making mathematical concepts more tangible, allowing students to actively engage in hands-on learning, and creating enjoyable learning experiences. These tools also help boost students' motivation to learn [4]. Project-based learning is a structured instructional model that engages students in acquiring knowledge and skills through a well-organized process, incorporating real-world experiences and designed to result in the creation of tangible products [5].

Before delivering lectures, lecturers must prepare a Semester Learning Plan (RPS) and design assessments used to evaluate students. To identify creativity in constructing mathematics instructional media among students at Teacher Education Institutions (LPTK) in East Java, Indonesia, a digital assessment model is needed to effectively evaluate creativity. The instructional media course describes how, through a project-based learning model, students compose proposals using miniatures and mathematics instructional media. Students learn to present proposals, miniatures and mathematics instructional media produced in the learning class. Creativity is the domain of soft skills [6].

In this context, creative thinking activities involve students connecting their knowledge and learning theories to the construction of mathematics instructional media. However, students have not fully mastered creativity due to limited opportunities to explore their creative abilities. By participating in lectures, students generate ideas in proposals, develop mathematics instructional media, and present and implement these media to assess their creativity. Students construct instructional media by creating ideas, analysing the characteristics of the material, formulating goals, making sketches, determining materials, creating instructional media, and implementing it in educational units [3]. Students, as future teachers, must possess creativity. A creative teacher is one who can generate innovative ideas and adopt new methods for educating, teaching, guiding, directing, training, assessing, and evaluating students [7]. This research aims to construct a digital assessment model to identify student creativity in mathematics instructional media courses.

This research is important because the developed digital assessment model can provide a new and more objective way to assess students' creativity. This digital assessment model can enhance the accuracy of assessments and provide more useful feedback for the development of student learning outcomes [8]. Formative assessment and feedback through this digital assessment are expected to support self-regulated learning among students [9]. The difference between this digital assessment model and The Torrance Tests of Creative Thinking (TTCT) [10] is that TTCT is used to measure individual creativity in various general contexts, including education, business, and psychological settings, while the digital assessment model is designed to evaluate how students use their creativity in designing or developing mathematics instructional media. The research question is how to develop a digital assessment model to identify students' creativity in constructing mathematics instructional media?

2. Literature Review

[11] defines creativity as the ability to produce work that is both novel and appropriate within a specific context. The work is not only new and original but also useful, meaningful, and valuable. Creativity involves the production of ideas, solutions, or products that are

not only new but also relevant and beneficial in a particular context [12], [13]. Research on the creativity of teachers or pre-service teacher students has been explored in various studies. [14] examined the creative thinking abilities of pre-service teacher students in solving mathematics problems. [15] focused on the creativity of mathematics teachers in conducting lessons based on children's characteristics. [16] investigated the effectiveness of the PjBL model in enhancing the creativity of pre-service teacher students in developing mathematics instructional media inspired by local Cirebon culture. Other studies [17] [18] [19][20] have discussed the creativity of teachers and students in using instructional media. However, no previous research has specifically addressed digital assessment models for identifying creativity in the construction of mathematics instructional media by LPTK students in East Java.

Current assessment models used to measure creativity include the Torrance Tests of Creative Thinking (TTCT), Creative Achievement Questionnaire (CAQ), Creative Personality Scale (CPS), and Test of Creative Thinking - Drawing Production (TCT-DP). TTCT is one of the most widely used creativity tests. It measures aspects such as fluency, flexibility, originality, and elaboration. The test is available in both verbal and figural (drawing) forms [10]. CAQ is a self-report instrument that measures creative achievement across various domains such as art, music, science, and writing [21]. CPS is a self-assessment scale used to measure personality traits associated with creativity, such as openness to new experiences, tolerance for ambiguity, and curiosity [22]. TCT-DP measures creativity through drawing activities, where participants are asked to complete unfinished drawings. The assessed aspects include originality, flexibility, and completeness [23].

This research introduces a novel approach by comprehensively exploring students' creativity skills in mathematics instructional media courses, assessed through digital methods. The focus of the exploration is on constructing mathematics instructional media based on a needs analysis that is first identified, then developed and implemented. The creative thinking process is divided into four stages: (1) Exploring and identifying the objectives; (2) Inventing by reviewing various tools, techniques, and methods; (3) Selecting by identifying and choosing the most feasible ideas; and (4) Implementing by determining how to make an idea actionable [24]. Creative thinking includes synthesising, building, and applying ideas [25]. Creative thinking in mathematics encompasses flexibility, validity, and originality [26], [27]. The theory of creative thinking was developed through levels of creative thinking [28]. The creativity indicators that will be developed through digital assessment models in constructing mathematics instructional media for LPTK students in East Java refer to (1) creating new ideas, (2) expanding basic ideas/concepts to improve and maximise creative efforts, (3) applying creative ideas as a real contribution to life [29]. [19] theory is limited to indicators of creativity in general, whereas this article develops aspects and indicators of creativity in constructing mathematics instructional media.

3. Methods

3.1. Research Design

This study employs a quantitative research method with a cross-sectional approach to identify the aspects and indicators of students' creativity in constructing mathematics instructional media, which are then digitally developed.

3.2 Instruments

The research instruments include observation guidelines to collect data on the Semester Learning Plan (RPS) used by lecturers and the teaching process, questionnaires administered to students, and questionnaires to assess the feasibility of the digital assessment model for identifying students' creativity in constructing mathematics instructional media. The questionnaire items and observation guidelines, as research instruments, have been validated by expert validators to ensure they are valid and credible for data collection

3.3 Respondents

The research respondents were 3 lecturers in mathematics instructional media courses from 3 different universities in Jombang, Kediri and Mojokerto in East Java, Indonesia. There were 60 students involved as respondents who were taking mathematics instructional media courses, aged between 20-21 years, who also came from 3 different universities in Jombang, Kediri and Mojokerto in East Java, Indonesia namely Universitas PGRI Jombang, Universitas Wahidiyah Kediri dan Universitas Islam Majapahit Mojokerto. The subject criteria in this study are: (1) a lecturer who is teaching Learning Media course in the Mathematics Education Program at Universitas PGRI Jombang, Universitas Wahidiyah Kediri, and Universitas Islam Majapahit Mojokerto, Indonesia. (2) the Students who is taking in the Learning Media course in the Mathematics Education Program at Universitas PGRI Jombang, Universitas Wahidiyah Kediri, and Universitas Islam Majapahit Mojokerto, Indonesia, with a total of 60 students. (3) The range of the students' ages from 20 to 21 years old, and both male and female students are involved.

3.4 Data collection techniques

Data collection techniques were carried out by a) observation to explore information related to the SLP used in instructional media courses and the learning process, questionnaires given to students as material for the validity of data from observations of the SLP and the implementation of learning, b) Focus Group Discussion, c) Questionnaire on the feasibility of a digital soft skills assessment model to identify creativity in constructing mathematics instructional media for LPTK students in East Java.

3.5 Data Analysis Techniques

The research data are analyzed using the following techniques:

3.5.1 Qualitative data from observations, student questionnaires and Focus Group Discussions were analysed using qualitative descriptive methods and grounded theory to obtain a digital assessment model to identify creativity in constructing mathematics instructional media for LPTK students in East Java;

3.5.2 The questionnaire was analysed using descriptive quantitative methods to obtain feasibility results from the digital assessment model to identify creativity in constructing mathematics instructional media for LPTK students in East Java.

Validity and reliability tests are used to describe the feasibility of the assessment model. Validity testing involves content validation, where an expert in mathematics education evaluates the alignment of assessment items with the predetermined indicators. Reliability testing aims to assess the consistency of the assessment results. Internal consistency is measured by calculating Cronbach's Alpha. In this article, a value above 0.7 indicates good reliability.

Research activities start from analysing SLP observations and the learning process of mathematics instructional media courses. The next activity was a Focus Group Discussion with the lecturer who taught the mathematics instructional media course to produce a draft digital assessment model to identify creativity in constructing students' mathematics instructional media to create an initial prototype. Activities continued with verification and revision of the digital assessment model that had been produced, and finally giving questionnaires to 62 respondents from 3 different universities in the East Java region, Indonesia, regarding the feasibility of the digital assessment model in identifying creativity when constructing mathematics instructional media for LPTK students in Java East, Indonesia. The questionnaire grid and observation sheet as research instruments have been validated by expert validators to be used as valid and credible instruments in collecting data.

4. Results

4.1. Data from learning observations and questionnaires identifying aspects and indicators of creativity

Observations were carried out during the learning process of mathematics instructional media courses, which refer to the Semester Learning Plan, to identify emerging aspects and indicators of student creativity. Next, students complete a questionnaire regarding aspects and indicators to identify student creativity in constructing mathematics instructional media. Table 1 shows the results of observations, and Table 2 shows the student questionnaire on the aspect of creating new ideas.

Table 1 Observation results in the aspect of creating new ideas

NO	ASPECT	INDICATOR	Lecturer Observation Result, which shows the indicator	% OCCURRENCE
1	Create new ideas	1.1 Constructed instructional media has never existed.	3	100
		1.2 Construct at least 2 instructional media for the same material.	3	100
		1.3 The constructed instructional media has a difference of at least 2 items from existing media.	3	100
		1.4 Construction instructional media can be used to convey 2 different materials.	3	100

Source: developed by the researcherss

The research results in Table 1 show that all indicators for creating new ideas in mathematics instructional media appeared 100% in observations, indicating a high level of creativity among the participants.

Table 2. Results of Respondent Questionnaire Recapitulation on the aspect of Creating new ideas

NO	ASPECT	INDICATOR	Student respondents who came up with the indicator	% OCCURRENCE
I	Create new	1.1 Constructed instructional media has never	19	31.66

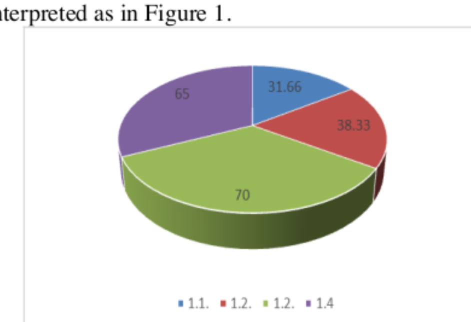
	ideas	existed.		
		1.2 Construct at least 2 instructional media for the same material.	23	38.33
		1.3 The constructed instructional media has a difference of at least 2 items from existing media.	42	70
		1.4 Construction instructional media can be used to convey 2 different materials.	39	65

Source: developed by the researchers

Table 2 shows the results of the questionnaire in Indicator (1.1) relating to the ability to generate original ideas, which is the essence of divergent thinking. The percentage of occurrence of only 31.66% shows that not all respondents can think original in constructing instructional media. Indicators (1.2) and (1.3) show the ability to modify or create variations of existing instructional media ideas, which is also an essential aspect of creativity. Higher percentages for this indicator (38.33% and 70%) indicate that more respondents can make creative modifications rather than create something entirely new. Indicator (1.4) reflects flexibility, namely the ability to use one idea in various contexts. The percentage of 65% shows that many respondents are able to create flexible instructional media. Creativity is often defined as the ability to generate new and original ideas that are useful.

Respondents who are able to create entirely new instructional media (indicator 1.1) can be considered innovators. With only 31.66% able to do so, this shows that radical innovation in instructional media may not have occurred much. Modifications and adaptations (indicators 1.2 and 1.3) are more common because they involve lower risks than creating something completely new. A higher percentage indicates that respondents are more comfortable with incremental innovation. Flexibility in media use (indicator 1.4) suggests that much innovation focuses on creating tools that can be applied in various situations, a pragmatic approach that can increase innovation adoption. Innovation in education often involves the development of new tools and methods that improve learning.

The results of this research indicate that most respondents tend to modify and adapt existing instructional media rather than create completely new media. This is in line with creativity theory, which emphasises the importance of divergent thinking, and innovation theory, which shows that incremental innovation is more accessible to adopt than radical innovation. Flexibility in media use is also an important aspect acknowledged by many respondents, reflecting the need for learning tools that can be used in various contexts. The explanation above can be interpreted as in Figure 1.



Source: primary data from the research results

Figure 1. Results of Respondent Questionnaire Recapitulation on the aspect of Creating new ideas

Table 3 shows the results of observations, and Table 4 shows the student questionnaire on the aspect of expanding basic ideas/concepts to improve and maximise creative efforts.

Table 3 Observation results on the aspect of expanding basic ideas/concepts to improve and maximise creative efforts

NO	**ASPECT**	**INDICATOR**	**Student respondents who came up with the indicator**	**% OCCURRENCE**
II	Expand basic ideas/concepts to enhance and maximise creative efforts	2.1 Using learning materials as a basis for constructing instructional media.	3	100
		2.2 Using research results as a basis for constructing instructional media.	2	66.66
		2.3 Using the results of Community Service as a basis for constructing instructional media	1	33.33
		2.4 Using existing instructional media as a basis for constructing new instructional media.	3	100
		2.5 Using courses that have been studied as a	3	100

basis for constructing instructional media.

Source: developed by the researchers

Table 3 shows indicators 2.1, 2.4, and 2.5, showing that lecturers use various sources to develop new instructional media, reflecting flexibility in thinking and adaptation to various contexts. The 100% occurrence of these indicators shows that lecturers consistently use different methods to facilitate creativity. Even though indicators 2.2 and 2.3 appear less often (66.66% and 33.33%), lecturers still show efforts to integrate research results and community service in the creative process, which is essential for creating innovative instructional media.

Indicators 2.1, 2.4, and 2.5 show that lecturers are able to assimilate information from learning materials, existing media, and courses studied to develop new instructional media. This reflects the processes of assimilation and accommodation that are important in constructivism. Indicators 2.2 and 2.3 emphasise using research results and community service.

Table 4. Results of Respondent Questionnaire Recapitulation on the aspect of Expanding Basic Ideas/Concepts to Improve and Maximise Creative Efforts

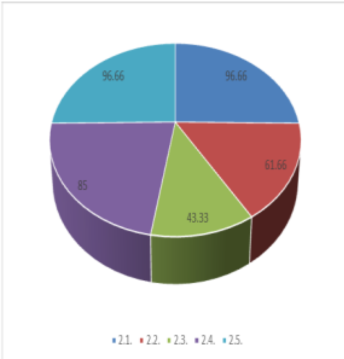
NO	ASPECT	INDICATOR	Student respondents who came up with the indicator	% OCCURRENCE
II	Expand basic ideas/concepts to enhance and maximise creative efforts	2.1 Using learning materials as a basis for constructing instructional media.	58	96.67
		2.2 Using research results as a basis for constructing instructional media.	37	61.67
		2.3 Using the results of Community Service as a basis for constructing instructional media	26	43.33
		2.4 Using existing instructional media as a basis for constructing new instructional media.	51	85
		2.5 Using courses that have been studied as a basis for constructing instructional media.	58	96.67

Source: developed by the researchers

Table 4 states that indicators (2.1) and (2.5) show that almost all respondents (96.67%) use learning materials and courses they have studied as a basis for developing instructional media. This aligns with constructivist principles that emphasise the importance of building new knowledge based on existing knowledge. Indicator (2.4), with 85% occurrence, shows that existing instructional media can be used to construct new instructional media. This indicates that respondents use existing instructional media to construct new ones.

Indicator (2.2), with 61.67% occurrence, shows that most respondents use research results as a basis for constructing instructional media. This suggests that respondents see significant value in integrating research to inform and improve instructional media development. Indicator (2.3), with 43.33% occurrence, shows that Community Service results are used less than research results. This indicates that respondents are more likely to use empirical data from research rather than the results of community service activities.

Indicator (2.4) shows that 85% of respondents use existing instructional media to develop new media. This aligns with the concept of incremental innovation, where innovation occurs through modifying and improving existing products. This research shows that the majority of respondents tend to use existing knowledge and materials as a basis for developing new instructional media. This flexibility in using existing media for further development reflects the incremental innovation approach common in education. The explanation above can be interpreted as in Figure 2 below:



Source: primary data from the research results

Figure 2. Results of Respondent Questionnaire Recapitulation on the aspect of expanding basic ideas/concepts to improve and maximise creative efforts.

Table 5 shows the results of observations, and Table 6 shows the student questionnaire on the aspect of Applying creative ideas as a real contribution to life.

Table 5. Observation results on the aspect of applying creative ideas as a real contribution to life

NO	ASPECT	INDICATOR	Student respondents who came up with indicator	% OCCURRENCE
III	Applying creative ideas as a real contribution to life.	3.1 Implementing constructed instructional media in schools.	57	96.61
		3.2 Students provide instructions for use regarding the constructed mathematics instructional media.	57	96.61
		3.3 Knowing the impact of student learning outcomes after implementing instructional media.	53	89.93
		3.4 Knowing the impact of interest motivation after implementing instructional media.	52	88.13
		3.5 The instructional media that is constructed must be able to be used by teachers and students during learning.	56	94.92

Source: developed by the researchers

Table 5 shows Indicators 3.1 and 3.2, indicating that lecturers encourage implementing instructional media that students have constructed in schools and provide instructions regarding their use. The occurrence of a very high indicator (96.61%) shows that lecturers effectively apply their creative ideas in an educational context. Indicators 3.3 and 3.4 show that lecturers encourage students to implement instructional media and evaluate their impact on learning outcomes and student motivation. The high percentage of occurrences (89.93% and 88.13%) shows the importance of impact evaluation in the creative process. Indicator 3.5 shows that the instructional media constructed must be able to be used by teachers and students during learning. This indicator at 94.92% shows that lecturers pay attention to practical aspects and ease of use of the constructed instructional media.

Table 6. Results of Respondent Questionnaire Recapitulation on the aspect of Applying creative ideas as a real contribution to life

NO	ASPECT	INDICATOR	Student respondents who came up with the indicator	% OCCURRENCE
III	Applying creative ideas as a real contribution to life.	3.1 Implementing constructed instructional media in schools.	57	95
		3.2 Students provide instructions for use regarding the constructed mathematics instructional media.	58	96.66
		3.3 Knowing the impact of student learning outcomes after implementing instructional media.	54	90
		3.4 Knowing the impact of interest motivation after implementing instructional media.	52	86.66

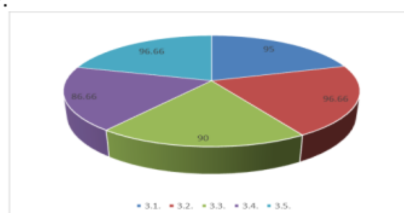
3.5	The instructional media that is constructed must be able to be used by teachers and students during learning.	58	96.66

Source: developed by the researchers

Table 6 shows that indicators (3.2) and (3.5) indicate that almost all respondents (96.66%) provide instructions regarding the use of the instructional media they construct so that teachers and students can use them during learning. This reflects the principle of constructivism, where instructional media is adapted to the context and needs of students. Meanwhile, indicator (3.3), with 90% occurrence, shows that respondents are aware of the importance of understanding the impact of instructional media on student learning outcomes, which is the essence of constructivist learning, which focuses on actual learning outcomes. Indicators (3.3) and (3.4) show that respondents assess the impact of instructional media on learning outcomes and student motivation (90% and 86.66% occurrence).

Indicator (3.5), with 96.66% occurrence, shows that the constructed instructional media must be able to be used by teachers and students during learning. This follows educational technology principles, which emphasise using tools that can be applied in authentic learning contexts. Indicator (3.4) assesses the impact of instructional media on student motivation and interest (86.66% occurrence). This is in accordance with motivation theory, which shows that interesting and relevant instructional media can increase students' motivation to learn.

This research shows that most respondents succeeded in implementing instructional media constructed according to the school subject matter. This is in line with the principles of constructivism, which emphasises contextual and relevant learning. Respondents also assessed the impact of media on learning outcomes and student motivation, reflecting research-based approaches and learning motivation theories. In addition, the instructional media developed can be used by teachers and students, reflecting educational technology principles that emphasise practical applications in teaching and learning. The explanation above can be interpreted as in Figure 3 below:



Source: primary data from the research results

Figure 3. Results of Respondent Questionnaire Recapitulation on the aspect of Applying creative ideas as a real contribution to life

4.2 Focus Group Discussion (FGD)

Focus Group Discussions (FGD) were held at 3 universities in the Kediri, Jombang and Mojokerto Regencies, East Java, Indonesia. The FGD participants were a research team of 4 people: 7 lecturers in mathematics instructional media courses and 7 student representatives taking mathematics instructional media courses. The following FGD results are presented in Table 7 below

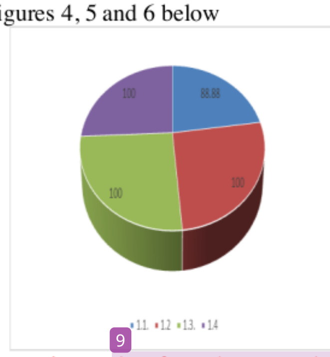
Table 7 Focus Group Discussion (FGD) Results

NO	ASPECT	INDICATOR	OPINIONS OF FGD PARTICIPANTS		% AGREE
			AGREE	DISAGREE	
1	Create new ideas.	1.1. Constructed instructional media has never existed.	16	2	88.88
		1.2. Construct at least 2 instructional media for the same material.	18	0	100
		1.3. The constructed instructional media has a difference of at least 2 items from existing media.	18	0	100
		1.4. Construction instructional media can be used to convey 2 different materials.	18	0	100
2	Expand basic ideas/concepts to enhance and maximise creative efforts.	2.1. Using learning materials as a basis for constructing instructional media.	18	0	100
		2.2. Using research results as a basis for constructing instructional media.	16	2	88.88
		2.3. Using the results of Community Service as a basis for constructing instructional media	12	6	66.66
		2.4. Using existing instructional media to construct new instructional media.	100	0	100
		2.5. Using courses that have been studied as a basis for constructing instructional media.	100	0	100
3	Applying creative ideas as a real contribution to life.	3.1. Implementing constructed instructional media in schools.	100	0	100
		3.2. Students provide instructions for use regarding the constructed mathematics instructional media.	100	0	100
		3.3. Knowing the impact of student learning outcomes after implementing instructional media.	100	0	100

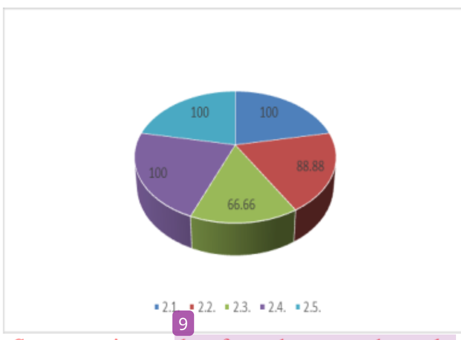
3.4. Knowing the impact of interest motivation after implementing instructional media.	100	0	100
3.5. The instructional media that is constructed must be able to be used by teachers and students during learning.	100	0	100

Source: developed by the researchers

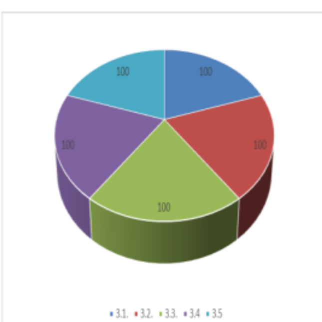
The presentation in Table 7 can be interpreted in the form of Figures 4, 5 and 6 below



Source: primary data from the research results
Figure 4. Creating new ideas.



Source: primary data from the research results
Figure 5. Expanding basic ideas/concepts to enhance and maximise creative efforts.



Source: primary data from the research results
Figure 6. Applying creative ideas as a real contribution to life

Table 7 and Figure 4 shows that most FGD participants agree (88.88%) that the instructional media being constructed should never have existed before. All participants agreed that students should construct at least two instructional media for the same material. All participants agree that the construction of instructional media should differ at least two items from existing media. All participants agree that the instructional media constructed must be able to convey two different materials.

Table 7 and Figure 5 show that all participants agree that learning material must be used to construct instructional media. The majority of participants agreed (88.88%) that research results should be used as a basis for constructing instructional media. The majority of participants (66.66%) agreed that the results of Community Service should be used as a basis for constructing instructional media. All participants agree that existing instructional media could be used to construct new instructional media. Developing effective instructional media often involves adapting and improving existing media. All participants agreed that the subjects studied should be used to construct instructional media.

Table 7 and Figure 6 indicate that all participants agree that the constructed instructional media must be implemented in schools. All participants agreed that students must provide instructions regarding the instructional media they create. Clear and effective instructions are essential in using instructional media. All participants agree that the impact of student learning outcomes after implementing instructional media must be known. All participants agree that the motivational effect of interest after implementing instructional media must be known. All participants agree that the instructional media constructed must be able to be used by teachers and students during learning.

4.3 Validity and Reliability Test Results for the Feasibility of the Digital Assessment Model

Feasibility test of the digital assessment model, which was constructed by giving questionnaires to 62 respondents from 3 different universities in East Java, Indonesia, with the following results:

Tabel 8. Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X1	45.1935	23.667	.551	.869
X2	45.4839	24.024	.557	.869
X3	45.4032	24.277	.514	.871
X4	45.4677	23.335	.520	.872
X5	45.1774	23.394	**.695**	.862
X6	45.3548	23.085	.625	.865
X7	45.2903	24.603	**.418**	.876
X8	45.4032	24.015	**.462**	.875
X9	45.2742	24.530	.543	.870
X10	45.1290	24.508	.529	.870
X11	45.1129	24.266	.623	.867
X12	45.2742	24.137	**.667**	.865
X13	45.2258	24.309	.551	.869
X14	45.0645	25.307	**.464**	.873

Source: taken from SPSS output

Table 8 states **the Cronbach's Alpha if Item Deleted** value, showing how the Alpha coefficient will change if a particular item is deleted. All items show Alpha values above 0.86, indicating the scale has good reliability. X5 has the highest **Corrected Item-Total Correlation** (0.695), showing that these items were highly aligned with the total scale and contributed significantly to the internal consistency of the scale. Construct validity refers to how well a test or instrument measures the construct. The correlation between items and the total scale (Corrected Item-Total Correlation) shows how well individual items relate to the overall measured construct. Items with higher item-total correlations (e.g. X5, X12) indicate that these items better measure the construct. Items with lower correlations (e.g. X7, X8, X14) require review or modification to ensure greater construct validity. Overall, this scale is reliable and valid to measure student creativity in constructing mathematics instructional media.

Table 9 is a correlation table between items (X1 to X14) and the total variable using Pearson Correlation:

Table 9 Correlation Results

		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	TOTAL
X1	Pearson Correlation	1	.462**	.552**	.450**	.696**	.459**	.100	.160	.186	.356**	.401**	.344**	.190	.091	.636**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.440	.215	.147	.005	.001	.006	.139	.481	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X2	Pearson Correlation	.462**	1	.448**	.397**	.374**	.399**	.338**	.307*	.292*	.163	.212	.472**	.286*	.362**	.634**
	Sig. (2-tailed)	.000		.000	.001	.003	.001	.007	.015	.021	.206	.098	.000	.024	.004	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X3	Pearson Correlation	.552**	.448**	1	.382**	.519**	.321*	.114	.085	.170	.156	.359**	.505**	.351**	.277*	.596**
	Sig. (2-tailed)	.000	.000		.002	.000	.011	.377	.513	.186	.226	.004	.000	.005	.029	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X4	Pearson Correlation	.450**	.397**	.382**	1	.389**	.465**	.120	.328**	.296*	.224	.396**	.314*	.362**	.071	.620**
	Sig. (2-tailed)	.000	.001	.002		.002	.000	.351	.009	.020	.080	.001	.013	.004	.584	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X5	Pearson Correlation	.696**	.374**	.519**	.389**	1	.586**	.223	.207	.291*	.525**	.637**	.475**	.387**	.302*	.751**
	Sig. (2-tailed)	.000	.003	.000	.002		.000	.082	.106	.022	.000	.000	.000	.002	.017	.000

	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X6	Pearson Correlation	.459**	.399**	.321*	.465**	.586**	1	.454**	.478**	.351**	.445**	.410**	.326**	.156	.085	.701**
	Sig. (2-tailed)	.000	.001	.011	.000	.000		.000	.000	.005	.000	.001	.010	.227	.511	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X7	Pearson Correlation	.100	.338**	.114	.120	.223	.454**	1	.495**	.520**	.127	.162	.301*	.205	.322*	.516**
	Sig. (2-tailed)	.440	.007	.377	.351	.082	.000		.000	.000	.324	.208	.018	.109	.011	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X8	Pearson Correlation	.160	.307*	.085	.328**	.207	.478**	.495**	1	.538**	.303*	.127	.294*	.260*	.188	.564**
	Sig. (2-tailed)	.215	.015	.513	.009	.106	.000	.000		.000	.017	.326	.020	.042	.144	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X9	Pearson Correlation	.186	.292*	.170	.296*	.291*	.351**	.520**	.538**	1	.452**	.276*	.394**	.327**	.342**	.612**
	Sig. (2-tailed)	.147	.021	.186	.020	.022	.005	.000	.000		.000	.030	.002	.009	.006	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X10	Pearson Correlation	.356**	.163	.156	.224	.525**	.445**	.127	.303*	.452**	1	.627**	.362**	.329**	.382**	.603**
	Sig. (2-tailed)	.005	.206	.226	.080	.000	.000	.324	.017	.000		.000	.004	.009	.002	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X11	Pearson Correlation	.401**	.212	.359**	.396**	.637**	.410**	.162	.127	.276*	.627**	1	.483**	.547**	.565**	.681**
	Sig. (2-tailed)	.001	.098	.004	.001	.000	.001	.208	.326	.030	.000		.000	.000	.000	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X12	Pearson Correlation	.344**	.472**	.505**	.314*	.475**	.326**	.301*	.294*	.394**	.362**	.483**	1	.751**	.504**	.719**
	Sig. (2-tailed)	.006	.000	.000	.013	.000	.010	.018	.020	.002	.004	.000		.000	.000	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X13	Pearson Correlation	.190	.286*	.351**	.362**	.387**	.156	.205	.260*	.327**	.329**	.547**	.751**	1	.569**	.624**
	Sig. (2-tailed)	.139	.024	.005	.004	.002	.227	.109	.042	.009	.009	.000	.000		.000	.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
X14	Pearson Correlation	.091	.362**	.277*	.071	.302*	.085	.322*	.188	.342**	.382**	.565**	.504**	.569**	1	.532**
	Sig. (2-tailed)	.481	.004	.029	.584	.017	.511	.011	.144	.006	.002	.000	.000	.000		.000
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62
TOTAL	Pearson Correlation	.636**	.634**	.596**	.620**	.751**	.701**	.516**	.564**	.612**	.603**	.681**	.719**	.624**	.532**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	62	62	62	62	62	62	62	62	62	62	62	62	62	62	62

Source: taken from SPSS output

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

All items (X1 to X14) have a significant positive correlation with the total variable, indicating that all items have a strong positive linear relationship with the total variable. Item X5 has the highest correlation (0.751**), indicating a solid relationship with the total variable. Item X7 has the lowest correlation (0.516**), although it still shows a significant and positive relationship with the total variable. Based on the r table value = 0.2075 with 62 respondents, it is clear that all the indicator items from the constructed digital assessment are valid because the value is above the r table (0.2075).

Tabel 10 Reliability Statistics

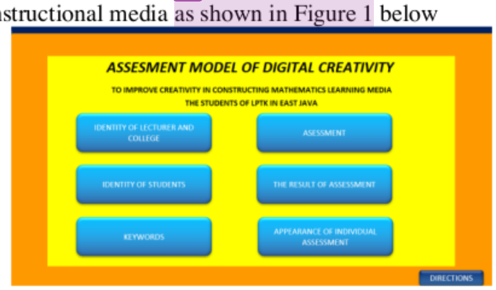
Cronbach's Alpha	N of Items
.878	14

Source: taken from SPSS output

Table 10 shows that the digital assessment model for identifying student creativity in constructing mathematics instructional media has very good reliability, with a Cronbach's Alpha value of .878. The Cronbach's Alpha value is higher than the reliability criteria set at 0.7, meaning that the digital assessment model is consistent and reliable. Thus, this digital assessment model is suitable as an effective and reliable tool for measuring student creativity in constructing mathematics instructional media.

4.4 Digital Assessment Construction Results

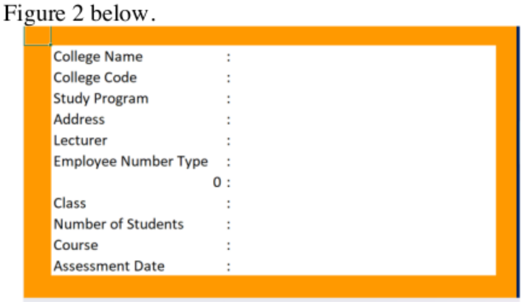
Digital Assessment Construction Results to identify student creativity in constructing mathematics instructional media as shown in Figure 1 below



Source: developed by the researchers

Figure 1 Front page of the Digital Assessment model

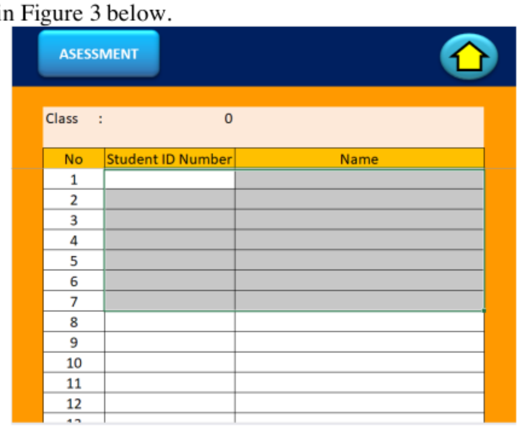
The front page contains the lecturer and university identity menu, student identity, keywords, evaluation, rating results, and display of individual assessment results, as well as an instructions menu that users can read before using the digital assessment model. Fill in the lecturer and university identity menu, as shown in Figure 2 below.



Source: developed by the researchers

Figure 2 Lecturer and College Identity Menu

Next, the student identity menu contains student data as in Figure 3 below.



Source: developed by the researchers

Figure 3. Student Identity Menu

The Keyword menu contains aspects and indicators students can fulfil when constructing mathematics instructional media, as in Figure 4.

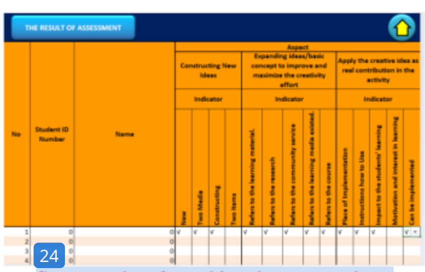
IDENTITY OF LECTURER AND COLLEGE | IDENTITY OF STUDENTS

NO	Creativity Aspect		Indicator	Keywords	Score
1	Constructing New Ideas	1	Learning media constructed has not been found out before and it is real brand new.	New	6
		2	Learning media constructed has not been found out before and it is real brand new.	Two Media	2
		3	Constructing at least two kinds of learning media for the same material.	Constructing	2
		4	Learning media constructed has difference at least two items with the exist learning media.	Two items	2
2	Expanding ideas/basic concept to improve and maximize the creativity effort.	1	Learning media constructed refers to the learning material.	Refers to the learning material.	2
		2	Learning media constructed refers to the research findings.	Refers to the research	2
		3	Learning media constructed refers to the community service.	Refers to the community service	2
		4	Learning media constructed refers to the learning media existed.	Refers to the learning media existed.	2
		5	Learning media constructed refers to the course which has ever been	Refers to the course	2
3	Apply the creative idea as real contribution in the activity	1	Learning media constructed is implemented at school (Elementary School, Junior High School, Senior High School) or Tutoring Agency	Place of Implementation	2
		2	The students give instruction how to use mathematics learning media constructed.	Instructions how to Use	2
		3	Learning media constructed gives positive impact to the students' learning result after it is implemented.	Impact to the students' learning	2
		4	Learning media constructed gives positive impact to the students' motivation and interest in learning.	Motivation and interest in learning	2
		5	Learning media constructed can be implemented by teachers and students in learning process.	Can be implemented	2

Source: developed by the researchers

Figure 4 Keyword Menu.

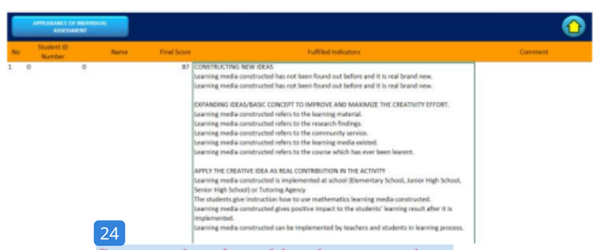
The assessment menu, as shown in Figure 5, contains a detailed display of the assessment completed by the lecturer in the form of a checklist of the aspects and indicators successfully identified by the lecturer for the construction of mathematics instructional media produced by students.



Source: developed by the researchers

Figure 5 Assessment menu

The Result of Assessment menu contains the results of the lecturer's assessment given to students, as shown in Figure 6 below.



Source: developed by the researchers

Figure 6. The Result of Assessment

The Appearance of Individual Assessment menu contains the final results of aspects and indicators that have been successfully identified by the lecturer for the construction of mathematics instructional media produced by students with approval from the course lecturer, as in Figure 7 below.

PROGRESS REPORT

Student Creativity in Construction Mathematics Learning Media

0 Class:

0

0

Course:

GRADE CODE

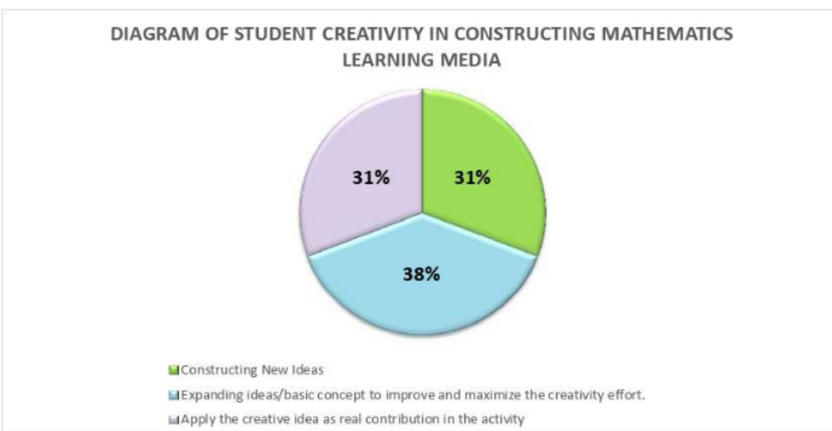
87

CREATIVE DEVELOPMENT

CONSTRUCTING NEW IDEAS
Learning media constructed has not been found out before and it is real brand new.
Learning media constructed has not been found out before and it is real brand new.

EXPANDING IDEAS/BASIC CONCEPT TO IMPROVE AND MAXIMIZE THE CREATIVITY EFFORT.
Learning media constructed refers to the learning material.
Learning media constructed refers to the research findings.
Learning media constructed refers to the community service.
Learning media constructed refers to the learning media existed.
Learning media constructed refers to the course which has ever been learent.

APPLY THE CREATIVE IDEA AS REAL CONTRIBUTION IN THE ACTIVITY
Learning media constructed is implemented at school (Elementary School, Junior High School, Senior High School) or Tutoring Agency
The students give instruction how to use mathematics learning media constructed.
Learning media constructed gives positive impact to the students' learning result after it is implemented.
Learning media constructed can be implemented by teachers and students in learning process.



COMMENT

Lecturer

Source: developed by the researchers

Figure 7. Menu Appearance of Individual Assessment

5. Conclusion

This research shows that developing a digital assessment model is very important in evaluating students' creativity identification in constructing mathematics instructional media. Students can develop ideas, design, and implement creative mathematics instructional media through project-based approaches. This assessment model significantly contributes to strengthening higher education in Indonesia, especially in meeting the national education standards that have been set. This research suggests further development to integrate digital technology into a more inclusive and effective learning process.

This research confirms that creativity in mathematics instructional media construction can be measured through students' ability to create new ideas and adapt existing ones. Although radical innovations are less common, modifications and adaptations of existing media occur frequently, reflecting a preference for incremental innovation in education. Implementing the constructed instructional media shows that students can apply their creative ideas in real situations at school, with positive effects on student learning and motivation. This research supports constructivism theory in mathematics learning, emphasising the importance of constructing new knowledge based on experience and social interaction.

This digital assessment model has a Cronbach's Alpha value of 0.878. This value exceeds the minimum standard of reliability usually expected (0.8), indicating that this model is consistent in measuring student creativity. The correlation of items with the total scale (Corrected Item-Total Correlation) shows that most items have a significant correlation with the total scale, with the highest values for items X5 (0.751) and X12 (0.719). This indicates that these items are strong in measuring the construct in question. This digital assessment model is reliable and valid for use as an evaluation tool to identify student creativity in the context of mathematics instructional media construction

There is a need for further development of this digital assessment model to broaden its scope and deepen the measurement of students' creativity. Future research could explore how integrating other elements, such as collaboration and interactive technology, could enhance the effectiveness of this assessment. Training for lecturers is necessary to understand and effectively implement this digital assessment model in the learning process. Students also need orientation and training on using digital technology to develop creative instructional media, so they can make optimal use of this assessment. This research highlights the importance of integrating digital technology into education. The implication is that technology should not only be used as a learning aid but also as an evaluation tool that can provide deeper insights into students' abilities and creativity.

This article offers a contribution in the form of a digital assessment model designed to measure students' creativity in the specific context of developing mathematics learning media. This is an innovation as traditional assessment tools may be less adaptive to various aspects of creativities.

The originality and innovation of the literature in this article lie in adding a new dimension to the creativity assessment literature, particularly in the field of mathematics education, by developing a digital assessment model. While creativity assessment has long been discussed in the literature, the application of digital methods to assess creativity in the context of constructing mathematics learning media is an innovative step. This differs from traditional assessment methods, which are typically based on direct observation or written tests.

Future research recommendations from the article titled 'Digital Assessment Model for Identifying Student Creativity in Developing Mathematics Learning Media' may include several areas. One focus could be on testing this digital assessment model in other subjects beyond mathematics to evaluate its effectiveness in identifying creativity across various disciplines. This is important to determine whether the model can be adapted and applied more broadly in education. Another recommendation is to deepen the assessment model by adding more specific indicators related to aspects of creativity, such as divergent thinking, design innovation, or problem-solving abilities in the context of learning media. Further research could explore a broader dimension of creativity and how this model can effectively measure those elements.

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Declaration of interest: The authors declare that no competing interests exist

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Digital Assessment Model to Identify Student Creativity in Constructing Mathematics Instructional Media

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