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

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Abstract: The innovation of this study lies in the investigation of students' creative abilities, which are implemented comprehensively in a mathematics learning media course and evaluated through digital assessment methodologies. The problem in this study was how to develop a digital assessment model to identify students' creativity in constructing mathematics learning media. This study aims to discuss the development of a digital assessment model to identify students' creativity in constructing mathematics instructional media. This study used a quantitative research method with a cross-sectional approach, involving lecturers and students from three different universities in East Java, Indonesia. The research instruments included observation guidelines, questionnaires, and focus group discussions (FGDs) to collect necessary data. Data analysis was performed using qualitative and quantitative methods. Validity was assessed through Pearson's correlation, while reliability was evaluated using Cronbach's alpha. The findings of this study 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 tended to modify and adapt existing instructional media. Furthermore, the implementation of mathematics instructional media constructed by students had a significant impact on their learning outcomes and motivation in schools. The results of the validity and reliability tests demonstrate that this digital assessment model is reliable and 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 assessing students' creativity in constructing mathematics instructional media.

Keywords: digital assessment; creativity; mathematics instructional media

数字化评估模型识别学生在构建数学教学媒体中的创造力

摘要：本研究的创新之处在于调查学生的创造能力，这些能力在数学学习媒体课程中得到全面实施，并通过数字评估方法进行评估。本研究的问题是如何开发一个数字评估模型来识别学生在构建数学学习媒体方面的创造力。本研究旨在讨论开发一个数字评估模型来识别学生在构建数学教学媒体方面的创造力。本研究采用横断面定量研究方法，涉及印度尼西亚东爪哇三所不同大学的讲师和学生。研究工具包括观察指南、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方法。通过皮尔逊相关性评估有效性，而使用克朗巴赫的阿尔法评估可靠性。本研究的结果表明，在构建数学教学媒体方面产生新想法的创造力水平很高。然而，问卷调查的结果表明，大多数受访者倾向于修改和调整现有的教学媒体。此外，学生构建的数学教学媒体的实施对他们在学校的学习成果和学习动机有显著的影响。有效性和可靠性测试的结果表明，该数字化评估模型是可靠的，可用作评估学生在构建数学教学媒体方面的创造力的工具。基于上述研究结果，可以得出结论，数字化评估模型是有效和可靠的，适合评估学生在构建数学教学媒体方面的创造力。

关键词：数字化评估，创造力，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. Learning is performed by creating a fun, inclusive, collaborative, creative, and effective learning atmosphere [1]. Undergraduate study programs must ensure the achievement of graduate competencies by implementing curricula centered on projects or other comparable approaches to learning and assessments that can demonstrate the achievement of graduate competencies. Digital assessment models must 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 three national educational standards. This elaboration attempts to develop students' 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 realizing national standards that have been set. The project-based learning model represents a viable pedagogical approach for fostering student creativity in the development of mathematics instructional media. Creativity is needed in instructional media courses, where students are directed to construct mathematics instructional media, as media play 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 is designed to result in the creation of tangible products [5].

Before delivering lectures, lecturers must prepare a Semester Learning Plan (RPS) and design assessments 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 required 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 a domain of soft skills [6].

In this context, creative thinking activities involve connecting students' knowledge and learning theories to the construction of mathematics instructional media. However, students have not fully mastered creativity because of the limited opportunities to explore their creative abilities. By participating in lectures, students can 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, analyzing 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 be creative. A creative teacher can generate innovative ideas and adopt new methods to educate, teach, guide, direct, train, assess, and evaluate students [7]. This study 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 student creativity. This digital assessment model can enhance the accuracy of assessments and provide useful feedback for the development of student learning outcomes [8]. Formative assessment and feedback through 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 the 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 to design or develop mathematics instructional media. The research question was how to develop a digital assessment model to identify students' creativity in constructing mathematics instructional media.

2. Literature Review

Sternberg [11] defined creativity as the ability to produce work that is both novel and appropriate within a specific context. The work is not only new or 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]. Various studies have explored the creativity of teachers and pre-service teacher students. Umar and Ahmad [14] examined the creative thinking abilities of pre-service teacher students in solving mathematics problems. Rezkia and Rivilla [15] focused on the creativity of mathematics teachers in conducting lessons based on children's characteristics. Kurniawan [16] investigated the effectiveness of the PjBL model in enhancing the creativity of pre-service teacher students in developing mathematics instructional media inspired by the local Cirebon culture. Ichwan et al. [17], Setiono and Rami [18], Slamet et al. [19], and Tristanti et al. [20] 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 TTCT, creative achievement questionnaire (CAQ), creative personality scale (CPS), and test of creative thinking-drawing production (TCT-DP). The 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 visual (drawing) formats [10]. The CAQ is a self-report instrument that measures creative achievement across various domains such as art, music, science, and writing [21]. The 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]. The TCT-DP measures creativity through drawing activities, in which participants are asked to complete unfinished drawings. The assessed aspects include originality, flexibility, and completeness [23].

This study introduces a novel approach by comprehensively exploring students' creativity skills in mathematics instructional media courses, assessed through digital methods. This study focuses on the development and implementation of mathematics instructional media based on an initial needs analysis. The creative thinking process is divided into four stages: (1) exploring and identifying the objectives; (2) invention by reviewing various tools, techniques, and methods; (3) selecting by identifying and choosing the most feasible ideas; (4) implementation by determining how to make an idea actionable [24]. Creative thinking involves synthesizing, building, and applying ideas [25]. Creative thinking in mathematics encompasses flexibility, validity, and originality [26], [27]. The theory of creative thinking has been developed through various levels of creativity [28]. The creativity indicators that are developed through digital assessment models in constructing mathematics instructional media for LPTK students in East Java are (1) creating new ideas, (2) expanding basic ideas/concepts to improve and maximize creative efforts, and (3) applying creative ideas as a real contribution to life [29]. Slamet et al.'s [19] theory is limited to indicators of creativity in general, whereas this study develops aspects and indicators of creativity in constructing mathematics instructional media.

3. Methods

3.1. Research Design

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

3.2. Instruments

The research instruments included 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, were validated by expert validators to ensure that they were valid and credible for data collection.

3.3. Respondents

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

3.4. Data Collection Techniques

The research employed multiple data collection strategies: a) observational methods to examine information related to the SLP employed in instructional media courses and the learning process, complemented by student questionnaires to corroborate observational findings regarding the SLP and learning implementation; b) focus group discussions (FGDs); c) a survey instrument designed to evaluate the viability of a digital soft skills assessment framework for identifying creativity in mathematics instructional media development by LPTK students in East Java.

3.5. Data Analysis Techniques

The research data were analyzed using the following techniques:

1. Qualitative data from observations, student questionnaires, and FGDs were analyzed 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.
2. The questionnaire was analyzed 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 were conducted to assess the feasibility of the assessment model. Validity testing involves content validation, in which an expert in mathematics education evaluates the alignment of assessment items with predetermined indicators. Reliability testing aims to assess the consistency of assessment results. Internal consistency was measured by calculating Cronbach's alpha. In this study, a value above 0.7 indicates good reliability.

Research activities commence with an analysis of SLP observations and the learning process within mathematics instructional media courses. The next activity was a FGD with the lecturer, who taught the mathematics instructional media course to produce a draft digital assessment model to identify students' creativity in constructing mathematics instructional media to create an initial prototype. The research process continued with the verification and revision of the developed digital assessment model, followed by the administration of questionnaires to 62 respondents from three universities in the East Java region, Indonesia. The purpose of this survey was to evaluate the feasibility of the digital assessment model in identifying creativity during the construction of mathematics instructional media by LPTK students in East Java, Indonesia. The research instruments, comprising a questionnaire grid and observation sheet, were validated by expert evaluators to ensure their validity and credibility for data collection.

4. Results

4.1. Data from Learning Observations and Questionnaires Identifying Aspects and Indicators of Creativity

Observations were conducted during the mathematics instructional media course learning process, which adhered to the Semester Learning Plan, to identify emergent aspects and indicators of student creativity. Next, students completed a questionnaire regarding aspects and indicators to identify their creativity in constructing mathematics instructional media. Table 1 shows the results of the 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 (The authors' elaboration)

No.	Aspect	Indicator	Lecturer observation result, which shows the indicator	Occurrence %
1	Creating new ideas	1.1 The constructed instructional media has never existed.	3	100
		1.2 Constructing at least two instructional media for the same material	3	100
		1.3 The constructed instructional media has a difference of at least two items from existing media.	3	100
		1.4 The constructed instructional media can be used to convey two different materials.	3	100

Table 2. Respondent questionnaire recapitulation on the aspect of creating new ideas (The authors' elaboration)

No.	Aspect	Indicator	Student respondents who came up with the indicator	Occurrence %
I	Creating new ideas	1.1 The constructed instructional media has never existed.	19	31.66
		1.2 Constructing at least two instructional media for the same material	23	38.33
		1.3 The constructed instructional media has a difference of at least two items from existing media.	42	70
		1.4 The constructed instructional media can be used to convey two different materials.	39	65

The 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 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 occurrence percentage of only 31.66% indicates that not all respondents demonstrate originality in constructing instructional media. Indicators 1.2 and 1.3 indicate the ability to modify or create variations in existing instructional media ideas, which is also an essential aspect of creativity. Higher percentages for these indicators (38.33% and 70%, respectively) 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% indicates that many respondents were able to create flexible instructional media. Creativity is frequently conceptualized as the capacity to generate novel and original ideas of practical value.

Participants capable of generating entirely novel instructional media (Indicator 1.1) may be classified as innovators. The finding that only 31.66% of respondents possess this capability suggests that significant innovation in instructional media may be limited in occurrence. 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 for improving learning.

The results of this study indicate that most respondents tend to modify and adapt existing instructional media rather than create completely new media. This aligns with creativity theory, which emphasizes the significance of divergent thinking, and innovation theory, which demonstrates that incremental innovation is more readily adopted 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 illustrated in Figure 1.

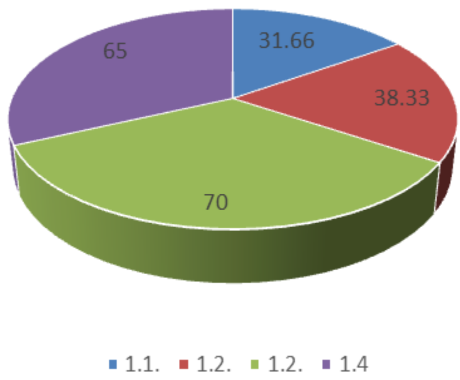

Figure 1. Respondent questionnaire recapitulation on the aspect of creating new ideas (Primary data from the research results)

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

Table 3. Observation results for expanding basic ideas/concepts to improve and maximize creative efforts (The authors' elaboration)

No.	Aspect	Indicator	Student respondents who came up with the indicator	Occurrence %
II	Expanding basic ideas/concepts to enhance and maximize 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 studied as a basis for constructing instructional media	3	100

Table 4. Respondent questionnaire recapitulation on expanding basic ideas/concepts to improve and maximize creative efforts (The authors' elaboration)

No.	Aspect	Indicator	Student respondents who came up with the indicator	Occurrence %
II	Expanding basic ideas/concepts to enhance and maximize 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 studied as a basis for constructing instructional media	58	96.67

Table 3 presents Indicators 2.1, 2.4, and 2.5, demonstrating that lecturers utilize diverse sources for the development of novel instructional media, which reflects cognitive flexibility and adaptability to varied contexts. The 100% occurrence of these indicators shows that lecturers consistently used different methods to facilitate creativity. Though Indicators 2.2 and 2.3 appear less often (66.66% and 33.33%, respectively), 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 emphasize using research results and community service.

According to Table 4, Indicators 2.1 and 2.5 reveal that an overwhelming majority of participants (96.67%) employed educational resources and previously studied coursework as the basis for creating instructional media materials. This aligns with constructivist principles that emphasize 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 used existing instructional media to construct new ones.

Indicator 2.2, with 61.67% occurrence, shows that most respondents used research results as a basis for constructing instructional media. This suggests that respondents saw 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 frequently than research results. This indicates that respondents are more likely to use empirical data from research than the results of community service activities.

Indicator 2.4 shows that 85% of the respondents used existing instructional media to develop new media. This aligns with the concept of incremental innovation, in which innovation occurs through the modification and improvement of existing products. This study 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 that is common in education. The explanation above can be interpreted as shown in Figure 2.

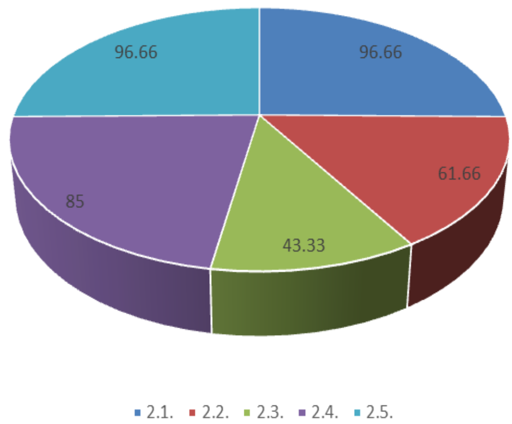

Figure 2. Respondent questionnaire recapitulation on the aspect of expanding basic ideas/concepts to improve and maximize creative efforts (Primary data from the research results)

Table 5 shows the results of the observations, and Table 6 shows the student questionnaire regarding the application of creative ideas as a contribution to life.

Table 5. Observation results on the application of creative ideas as a contribution to life (The authors' elaboration)

No.	Aspect	Indicator	Student respondents who came up with the indicator	Occurrence %
III	Applying creative ideas as a 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 on student learning outcomes after implementing instructional media	53	89.93
		3.4 Knowing the impact on interest and motivation after implementing instructional media	52	88.13
		3.5 The instructional media constructed	56	94.92

		must be able to be used by teachers and students during learning.		

Table 6. Respondent questionnaire recapitulation on the aspect of applying creative ideas as a contribution to life (The authors' elaboration)

No.	Aspect	Indicator	Student respondents who came up with the indicator	Occurrence %
III	Applying creative ideas as a 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 on student learning outcomes after implementing instructional media	54	90
		3.4 Knowing the impact on interest and motivation after implementing instructional media	52	86.66
		3.5 The instructional media constructed must be able to be used by teachers and students during learning.	58	96.66

Table 5 presents Indicators 3.1 and 3.2, demonstrating that lecturers promote the utilization of instructional media developed by students in educational settings and provide guidance regarding their implementation. The remarkably high indicator (96.61%) suggests that educators successfully integrated their innovative ideas into the educational environment. The implementation of instructional media and the evaluation of its effects on learning outcomes and student motivation are encouraged by instructors, as evidenced by Indicators 3.3 and 3.4. Their high occurrence percentages (89.93% and 88.13%, respectively) indicate 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 the practical aspects and ease of use of the constructed instructional media.

Table 6 shows that Indicators 3.2 and 3.5 indicate that almost all respondents (96.66%) provided instructions regarding the use of the instructional media they constructed so that teachers and students could use them during learning. This reflects the principle of constructivism, in which instructional media are 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 assessed the impact of instructional media on learning outcomes and student motivation (90% and 86.66% occurrence, respectively).

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 emphasize the use of tools that can be applied in authentic learning contexts. Indicator 3.4 assessed the impact of instructional media on student motivation and interest (86.66% occurrence). This is in accordance with the motivation theory, which shows that interesting and relevant instructional media can increase students' motivation to learn.

This study demonstrates that the majority of participants successfully implemented instructional media developed in accordance with the prescribed curriculum. This is in line with the principles of constructivism, which emphasize contextual and relevant learning. Respondents also assessed the impact of the 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 emphasize practical applications in teaching and learning. The explanation above can be interpreted as shown in Figure 3.

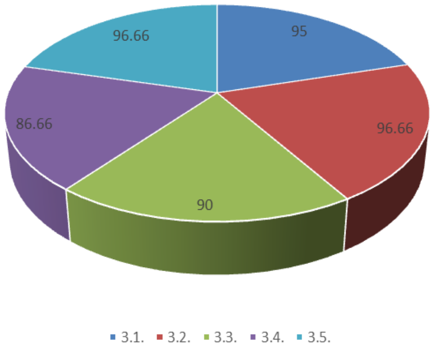

Figure 3. Respondent questionnaire recapitulation on the aspect of applying creative ideas as a contribution to life (Primary data from the research results)

4.2. FGD

FGDs were held at three universities in the Kediri, Jombang, and Mojokerto Regencies in East Java, Indonesia. The FGD participants comprised a research team of 14 people: seven lecturers in mathematics instructional media courses and seven student representatives taking mathematics instructional media courses. The FGD results are listed in Table 7.

Table 7. FGD results (The authors' elaboration)

No.	Aspect	Indicator	Opinions of FGD Participants		Agree %
			Agree	Disagree	
1	Creating new ideas	1.1 The constructed instructional media has never existed.	16	2	88.88
		1.2 Constructing at least two instructional media for the same material	18	0	100
		1.3 The constructed instructional media has a difference of at least two items from existing media.	18	0	100
		1.4 The constructed instructional media can be used to convey two different materials.	18	0	100
2	Expanding basic ideas/concepts to enhance and maximize 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 studied as a basis for constructing instructional media	100	0	100
3	Applying creative ideas as a 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 on student learning outcomes after implementing instructional media	100	0	100
		3.4 Knowing the impact on interest and motivation after implementing instructional media	100	0	100
		3.5 The instructional media constructed must be able to be used by teachers and students during learning.	100	0	100

The presentation in Table 7 can be interpreted in the form of Figures 4-6.

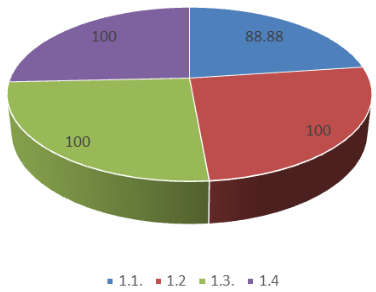

Figure 4. Creating new ideas (Primary data from the research results)

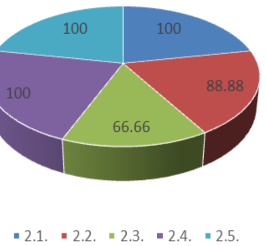

Figure 5. Expanding basic ideas/concepts to enhance and maximize creative efforts (Primary data from the research results)

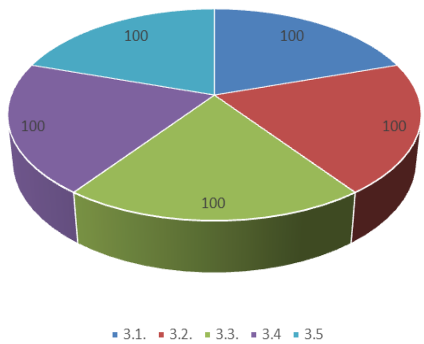

Figure 6. Applying creative ideas as a contribution to life (Primary data from the research results)

Table 7 and Figure 4 show that most FGD participants agreed (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 agreed that the construction of instructional media should differ by at least two items from the existing media. All participants agreed that the constructed instructional media must be able to convey two different materials.

Table 7 and Figure 5 show that all participants agreed that learning materials must be used to construct instructional media. The majority of the 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 agreed 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 agreed that the constructed instructional media must be implemented in schools. All participants agreed that students must provide instructions regarding the instructional media they created. Clear and effective instructions are essential for the use of instructional media. All participants agreed that the impact on students' learning outcomes after the implementation of instructional media must be known. All participants agreed that the motivational effect of interest after implementing the instructional media must be known. All participants agreed that the constructed instructional media 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

The feasibility test of the digital assessment model, which was constructed by administering questionnaires to 62 respondents from three universities in East Java, Indonesia, yielded the following results:

Table 8. Item-total statistics (SPSS output)

	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

Continuation of Table 8				
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

Table 8 shows the Cronbach 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 that 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 the extent to which a test or instrument measures a construct. The correlation between the items and 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 and X12) indicate that these items better measure the construct. Items with lower correlations (e.g., X7, X8, and X14) require review or modification to ensure greater construct validity. Overall, this scale is reliable and valid for measuring student creativity in constructing mathematics instructional media.

Table 9 shows the correlation between items (X1-X14) and the total variables using Pearson's correlation.

Table 9. Correlation results (SPSS output)

		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	Total
X1	Pearson's 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's 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's 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's 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's 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's 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's 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's 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's 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's 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's 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's 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's 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's 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

** The correlation is significant at the 0.01 level (2-tailed).
* The correlation is significant at the 0.05 level (2-tailed).

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

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 alpha value is higher than the reliability criterion set at 0.7, indicating that the digital assessment model is consistent and reliable. Thus, this digital assessment model is an effective and reliable tool for measuring student creativity in constructing mathematics instructional media.

Table 10. Reliability statistics (SPSS output)

Cronbach's Alpha	N of Items
.878	14

4.4. Digital Assessment Construction Results

Digital assessment construction results to identify student creativity in constructing mathematics instructional media are shown in Figure 7.

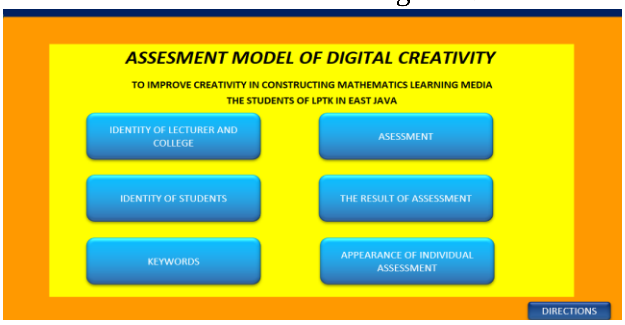

Figure 7. Front page of the digital assessment model (The authors' elaboration)

The front page contains the lecturer and university identity menu, student identity, keywords, evaluation, rating results, individual assessment results, and an instruction menu, which users can read before using the digital assessment model. Users are required to fill in the lecturer and university information using the provided menu, as illustrated in Figure 8.

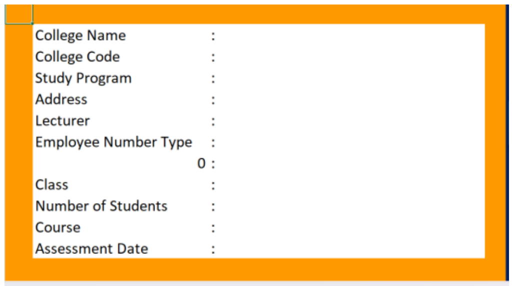

Figure 8. Lecturer and college identity menu (The authors' elaboration)

Next, the student identity menu contains student data, as shown in Figure 9.

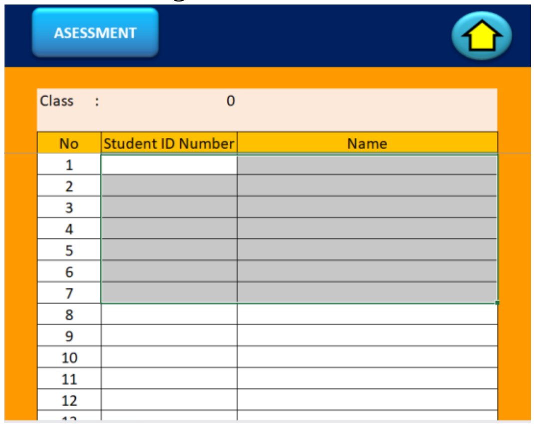

Figure 9. Student identity menu (The authors' elaboration)

The Keywords menu contains aspects and indicators that students can fulfill when constructing mathematics instructional media, as shown in Figure 10.

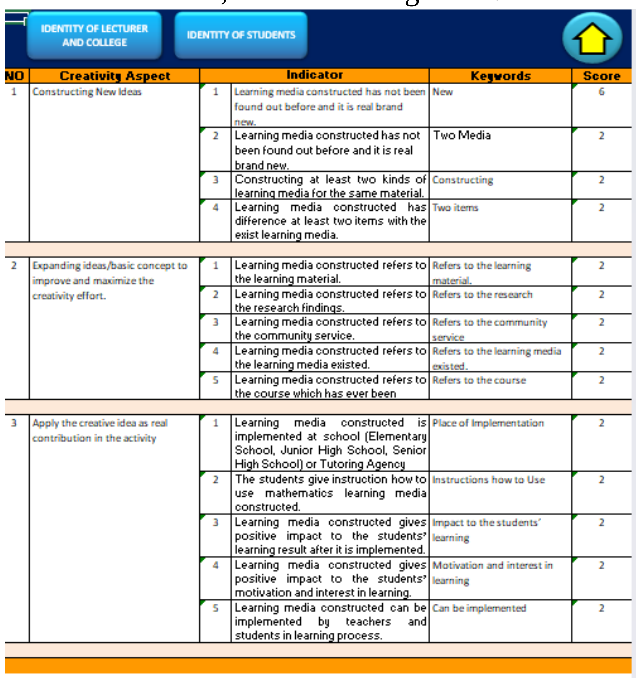

Figure 10. Keyword menu (The authors' elaboration)

As shown in Figure 11, the assessment menu 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.

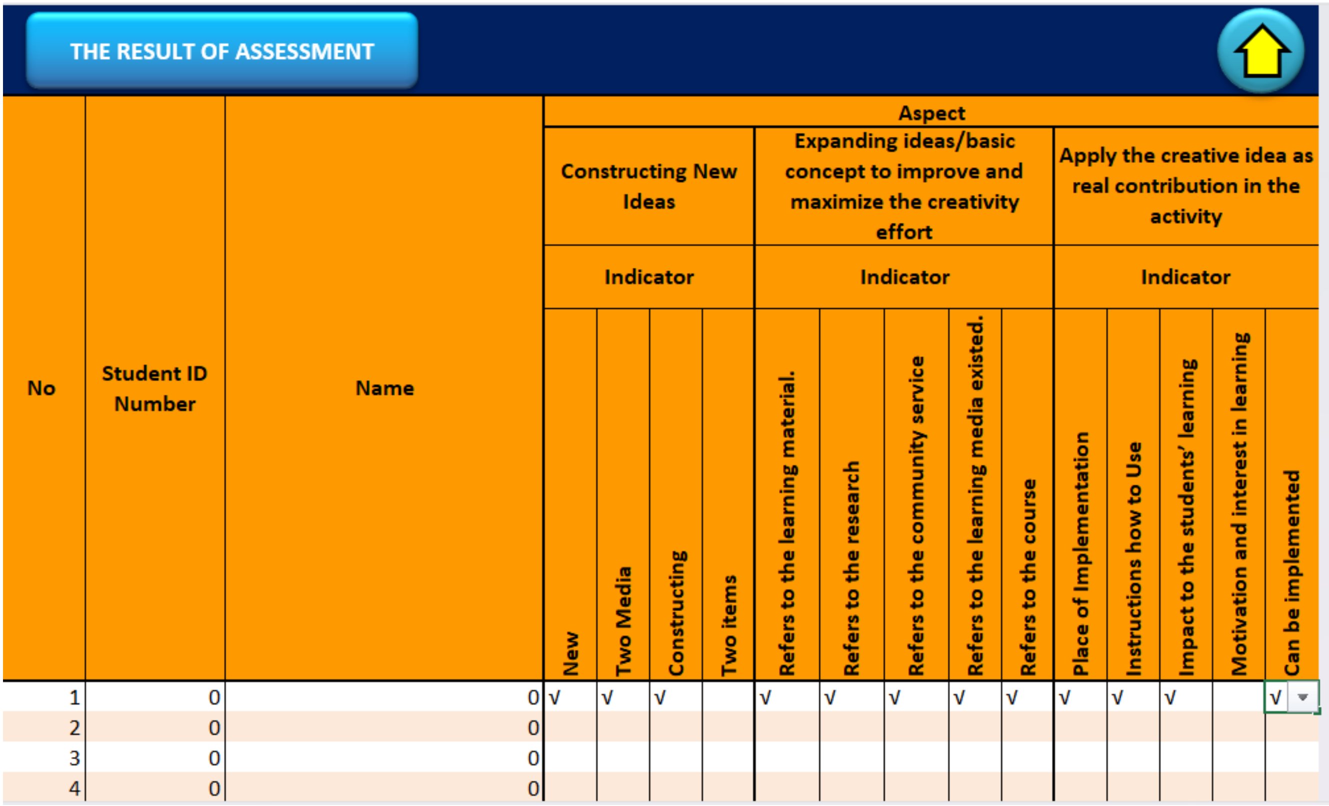

Figure 11. Assessment menu (The authors' elaboration)

The Result of Assessment menu presents the outcomes of the lecturer's evaluation, provided to the students, as illustrated in Figure 12.

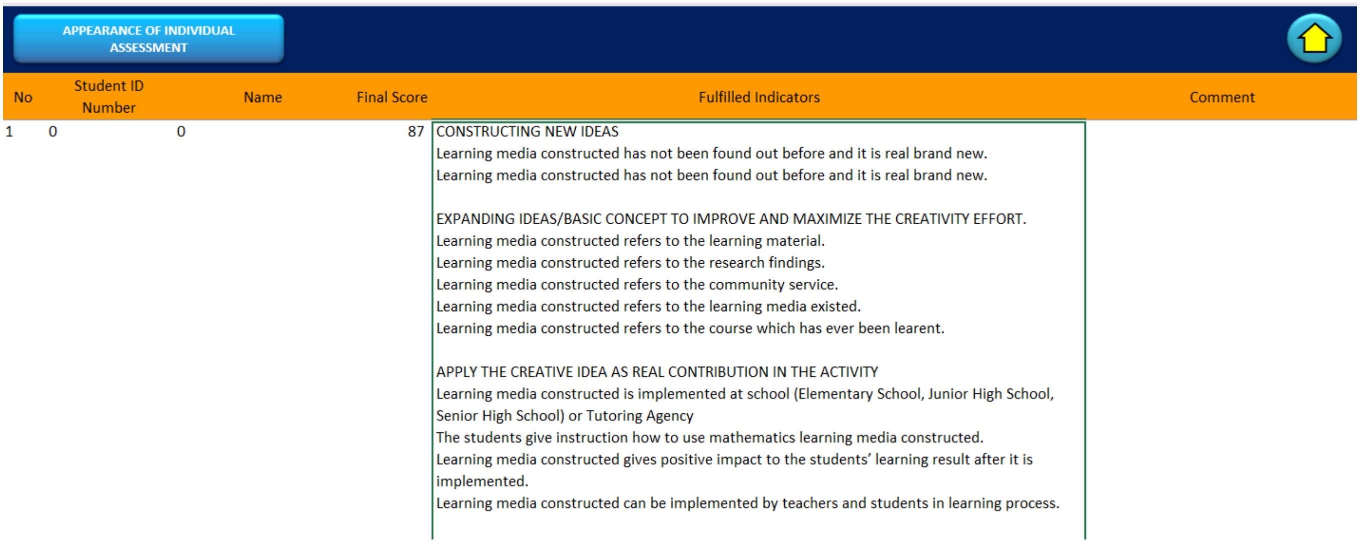

Figure 12. Result of assessment (The authors' elaboration)

The Individual Assessment menu presents the final results pertaining to aspects and indicators identified by the instructor for the development of mathematics instructional media by students, with approval from the course instructor, as illustrated in Figure 13.

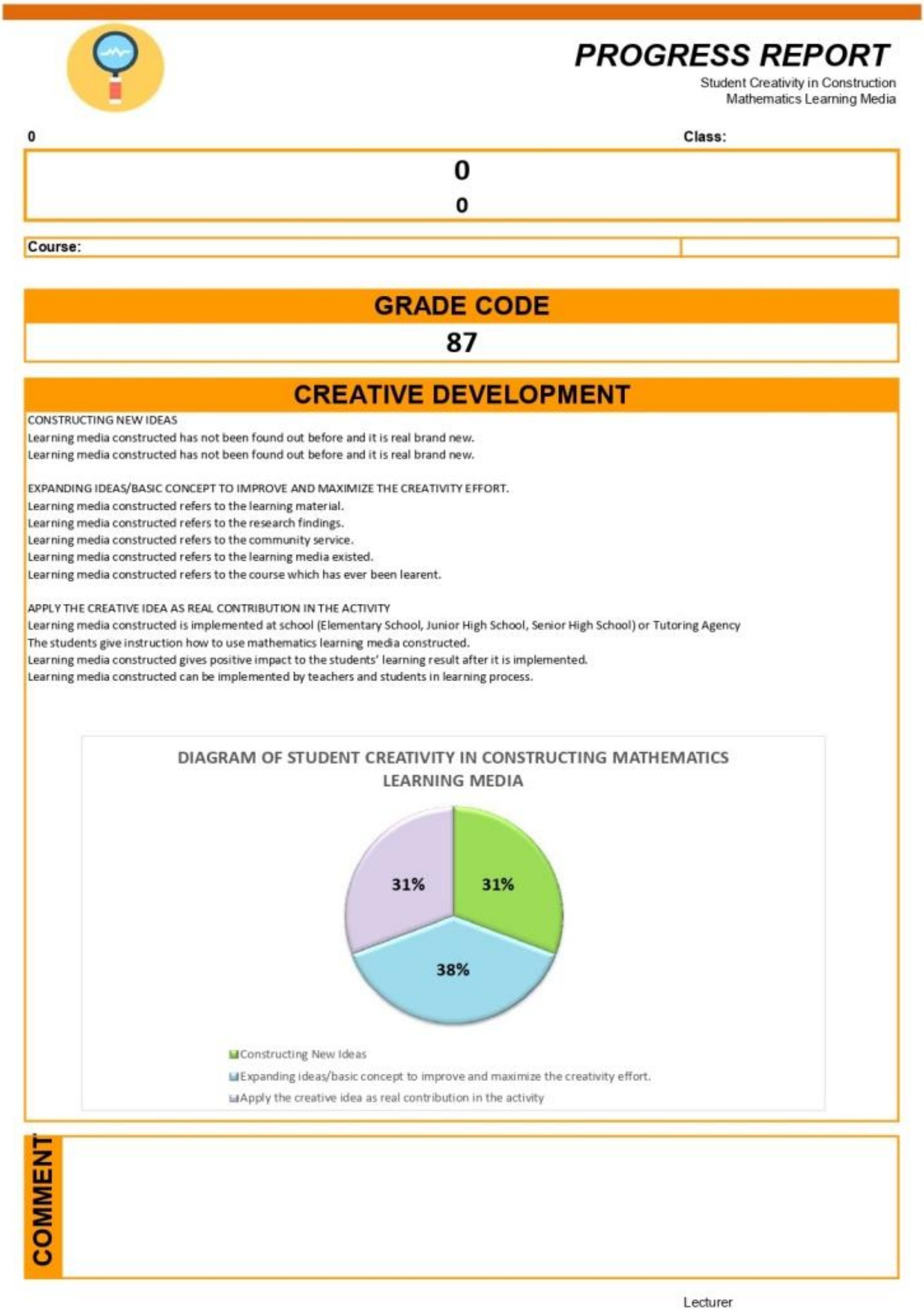

Figure 13. Individual assessment menu (The authors' elaboration)

5. Conclusion

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

This study 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 innovations in education. Implementing the constructed instructional media shows that students can apply their creative ideas in real school situations, with positive effects on student learning and motivation. This research supports constructivist theory in mathematics learning, emphasizing the importance of constructing new knowledge based on experience and social interaction.

This digital assessment model has a Cronbach's alpha 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 as an evaluation tool to identify student creativity in the context of mathematics instructional media construction.

Further development of this digital assessment model is needed 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 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 that they can make optimal use of this assessment. This study highlights the importance of integrating digital technology into education. The implication is that technology should be used not only as a learning aid but also as an evaluation tool that can provide deeper insights into students' abilities and creativity.

This article contributes 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 because traditional assessment tools may be less adaptive to various aspects of creativity.

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. Although 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 directions may encompass multiple areas of investigation. One potential avenue of inquiry could involve evaluating the efficacy of this digital assessment model in disciplines beyond mathematics to ascertain its capacity for identifying creativity across various academic fields. This is important for determining 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, and problem-solving abilities, in the context of learning media. Further research should explore a broader dimension of creativity and how this model can effectively measure these elements.

Declarations

Author Contributions

Conceptualization, W.S.H.; methodology, J.D.N.I.; software, L.B.T.; validation, W.S.H.; formal analysis, L.B.T.; investigation, A.N.; resources, J.D.N.I.; data curation, A.N.; writing—original draft preparation, all authors contributed equally; writing—review and editing, A.N.; visualization, L.B.T.; supervision, W.S.H.; project administration, J.D.N.I.; funding acquisition, W.S.H. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

The data presented in this study are available in this article.

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Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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