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Development of STEAM-Based Assessment Instrument for Creative Thinking on Static Fluid Material

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Abstract: 21st-century learning emphasises the importance of creative thinking skills through the STEAM approach, including developing STEAM-based learning models and tools. This study aims to develop a STEAM-integrated assessment instrument to measure students' creative thinking skills, as well as to determine students' perceptions of the assessment instrument. The research and development (R&D) method produces effective and efficient educational products through improvement, development, and evaluation. The research was conducted at SMAN 1 Jambi City and SMA Adhyaksa 1 Jambi City, involving 40 students in class XI. The instrument was developed in the form of description questions on static fluid material. The results showed that students' perception was very positive, with an average assessment of 83.15% for the category 'Very Feasible'. Validation consists of 3 aspects, namely material, language, and evaluation aspects, which show most aspects of the instrument are in the 'very feasible' to 'feasible' category. Nine of the 11 questions tested were declared valid, while 2 needed revision. The difficulty level of the questions varied from 'moderate' to 'difficult'. These findings indicate that the instrument developed is feasible for measuring students' creative thinking skills in static fluid material with the STEAM approach. The novelty of this research lies in integrating STEAM components into assessment instruments that assess concept understanding and encourage the development of students' creativity.

Keywords: Borg and Gall Development Model; Creative Thinking; Instrument; Static Fluid; STEAM Approach.

Introduction

In education today, developing 21st-century skills is increasingly emphasised. These skills encompass a range of essential abilities to support effective learning. The 4Cs of critical thinking, problem-solving, metacognition, communication, collaboration, innovation and creativity are particularly important among these skills. These skills are also supported by information literacy, which helps in evaluating, understanding and processing information to improve overall learning outcomes [1].

The development of children's abilities focuses on enhancing their skills. Teachers must implement effective strategies to ensure that activities are successful. Introducing technological values from an early age is crucial as a foundation for their future. The STEAM method is expected to encourage children to develop an interest in learning [2].

The STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach is a pedagogical method that combines the five disciplines to hone critical thinking, problem-solving, and creativity. This approach has been used in physics learning in Indonesia[3]. STEAM learning is an innovative approach that integrates science, technology, engineering, art and mathematics. Initially known as STEM (Science, Technology, Engineering, and Mathematics), STEAM has evolved to encompass both a learning approach and a model due to the appealing advantages it offers [4].

The STEAM approach has been shown to facilitate active engagement in the learning process, thus enabling learners to find solutions to emerging problems. In addition, this approach has also been shown to guide learners in developing better problem-solving abilities, critical thinking skills, creative thinking skills and collaboration skills [5]. The STEAM approach has been identified as a potentially innovative learning strategy that can facilitate the development of creative ideas and solutions. To cultivate creative thinking skills, it is essential to address four fundamental aspects: fluency, flexibility, originality, and elaboration [6].

Critical and creative thinking skills develop optimally if teachers facilitate and encourage learners. However, these skills have not been taught optimally in schools. The Global Partnership for Education study points to integrating 21st-century skills into the curriculum. The STEAM approach incorporates the arts and can enhance creativity, innovation and problem-solving skills. STEAM also encourages active engagement of learners, making it an effective solution for developing critical and creative thinking [7].

Developing creative thinking skills is an integral component of higher-order thinking skills, which are developed through engagement in creative activities. To facilitate this development, it is crucial to stimulate imagination, broaden perspectives, and encourage the exploration of unconventional ideas [8]. This is consistent with the implementation of the new curriculum, the Merdeka Curriculum, which aims to ensure that all students have equal opportunities to participate in the learning process [9].

Creative thinking skills form a creative mindset, increase retention, produce optimal learning performance, and encourage divergent thinking. In other words, learners with creative thinking skills tend to have a better mindset and retention than those without. This allows creative learners to

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generate new ideas and overcome challenges. Therefore, creative thinking skills are very important in the context of learning [10].

Creative thinking skills shape creative thinking, improve comprehension, help achieve the best learning outcomes, and encourage diverse thinking. In other words, learners with creative thinking skills tend to have better thinking and comprehension skills than those without. This allows creative learners to generate new ideas and overcome challenges. Therefore, creative thinking skills are very important in the learning process, one of which is physics [11].

Physics is one of the branches of science that plays an important role in life, especially in science and technology (IPTEK), which is developing rapidly today. Physics makes a real contribution to the development of technology and educates students to have an intellectual and religious attitude in life. Therefore, students must be able to face changes in all fields, act based on logical thinking, and think critically, creatively and innovatively. One of them is studying physics [12].

Physics is important in everyday life and should be taught to equip learners with the knowledge, understanding and skills required for higher education. As a scientific discipline, physics aims to explore general knowledge by formulating theories, laws and principles. The inclusion of physics as an independent subject is very important, as it encourages the development of creative thinking skills that are essential in solving problems [13]. Learners are expected to have the ability to master physics concepts after undergoing an active learning process. One of the physics topics that often causes misconceptions in participants is static fluid material. Static fluid is closely related to everyday life, but in reality, it is still difficult for participants to understand due to initial misconceptions [14].

Researchers use instruments to collect data to make the research process more organised and easier. However, instruments cannot be directly used without testing. Before the research is conducted, the instrument must be tested for validity to ensure the tool can measure what it wants and is suitable for use. This validity test is important so that the research results are accurate and reliable [15]. A measuring instrument in the form of an instrument is a tool used as a tool to measure a measuring object or collect data from a variable [16].

The Mathematics and Natural Sciences Education curriculum highlights critical and creative thinking skills but lacks a valid and reliable assessment instrument. This study aims to develop an instrument that effectively measures these skills in both content and structure [17]. Assessment questions must be in accordance with the curriculum objectives so that the results can assess learning achievements. Tests are often used to assess learning outcomes, so item measurement is important. Invalid and unreliable instruments can affect research results. Therefore, validity and reliability tests are needed to ensure the instrument measures precisely and consistently. Previous research also emphasises the importance of instrument validity to obtain accurate data [18].

Critical and creative thinking through HOTS helps participants develop higher-level reasoning skills, preventing them from relying solely on memorization or fixed answer patterns. HOTS is a test instrument designed to assess advanced thinking abilities beyond remembering, repeating, or referencing information. [19]. In Bloom's taxonomy, the cognitive domain is one of the basic frameworks for categorising educational objectives, developing tests and curricula around the world [20]. The research [21] findings indicate that the STEAM-based thematic assessment instrument is appropriate for measuring creative thinking skills in elementary schools. These findings can serve as valuable input and insight for educators in implementing learning activities, particularly in developing instruments for STEAM-based thematic learning.

This study develops a STEAM-based creative thinking assessment instrument on static fluid material. It tests the perception of the instrument and its feasibility in expert validation, as well as its validity, reliability, difficulty level, and question differentiation.

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Research Methods

Research using the development method, or research and development (R&D), is a type of research that is often conducted. This is due to the importance of scientific development in facilitating the learning process [22]. The R&D method in research should produce effective and efficient products or services in the field of education. Through R&D, the development and evaluation of the education system are improved. One of the models used is the Borg & Gall model [23]. This research involves developing STEAM-based tools to improve creative thinking skills.

Test instruments can produce quantitative data in the form of descriptive responses or learner responses. These responses allow learners to explain their concept understanding or provide reasons for their answers. This quantitative data is used to assess the perception and feasibility of STEAM-based instruments in measuring creative thinking skills. In addition, the data will be used to evaluate the validity, reliability, difficulty, and discriminability of the questions on the instrument.

The test subjects in developing this assessment instrument were students from two different schools, namely SMA Adhyaksa 1 Jambi City and SMAN 1 Jambi City, each with 20 students from class XI MIPA, totalling 40. The sample determination used purposive sampling, which is the selection of samples based on certain considerations. The inclusion criteria in this study were students from one of these schools, currently studying grade XI MIPA, who had studied static fluid material in physics learning and were willing to participate in all stages of the study, including taking tests and filling out questionnaires. Meanwhile, the exclusion criteria included students who did not come from the two schools or not from class XI MIPA, were not present during the research process, did not complete the test or questionnaire for certain reasons, and the test results could not be analysed due to non-compliance with research procedures.

Borg & Gall model in research and development, the stages for field research related to instrumentation products to be developed with STEAM-based in creative thinking on static fluid material in class XI.

Table 1. Borg end Gall stages

Stages of the Borg & Gall Model	Process Stages
Research and information	In this study, the curriculum and learning objectives are analyzed. This concept will be developed into a description assessment tool in creative thinking that is well integrated with STEAM according to the needs of students on static fluid material at SMAN 1 Jambi City and SMA Adhyaksa 1 Jambi.
Planning of product	Data collection is carried out by reviewing relevant theories and making observations to schools to collect data on students who have studied static fluid material and the curriculum used. It is very important to carefully plan the use of integrated instruments that identify STEAM elements in the questions and have indicators of creative thinking. Create a plan that systematically guides the development steps.
Develop a preliminary form of the product	After collecting the data needed to develop question instruments with static fluid material and supporting tools in the form of teaching materials used and STEAM integrated assessment rubrics in students' creative thinking skills. The next step is to carefully create a description test assessment instrument and prepare a validation questionnaire to assess the feasibility of material, language, and evaluation.
Initial product validation	After that, the first and second stage validation is done, and then revisions are made according to the input from the validator to complete the deficiencies. Teacher validation is done 1 or 3 times until the tool is ready for school use.
Initial Product Revisions	Regarding stage 1 or 3 validation, make changes to the instrument. Consider the validator's input to improve the instrument in the material, language and evaluation questionnaires.
Product trial	If the instrument has been validated and revised, then conduct a trial to find out whether the instrument is suitable for use and has a good perception for students, then a questionnaire or conditioner about the instrument is distributed to the subject, namely students at ADHYAKSA 1 Jambi High School and SMAN 1 Jambi City.
Final Product Revision	The revision of the instrument is based on the results of the initial trial with the results of the field trial, which obtained quantitative information about the instrument developed, so it is necessary to carry out the same evaluation to have a feasible instrument and good perceptions as well as the validity of the questions, reliability, difficulty level and differentiating power to determine the feasibility of each item in numbers 1-11.

Instrument validation included three main aspects: content, linguistic, and presentation components. In evaluating the content and design elements presented in the study, the researcher considered the following relevant criteria [24]. This instrument is adjusted to the research objectives and the data collection type. All of these components are important in the preparation of research instruments. This study has four questionnaires: material validation questionnaires, language, evaluation and student perceptions.

Material Expert Validation

Based on the material feasibility, the tool lattice has been validated by the supervisor by adapting to the research needs in Table 2, as follows:

Table 2. Material Feasibility instrument lattice

No	Assessment Aspect	Assessment Items
1	Presentation	1. The conciseness of the concept. 2. presentation of questions according to KD with indicators. 3. Clarity of image presentation. 4. Use language that is easy to understand. 5. The suitability of the question category. 6. As a practical and efficient evaluation instrument.
2.	Content quality	7. Completeness of questions according to the material. 8. concept accuracy. 9. accuracy of questions. 10. accuracy of terms. 11. leads to measuring students' creative thinking. 12. has STEAM elements.
3.	Construction	13. Suitability of questions on the creative thinking ability of students. 14. order of presentation of the problem. 15. suitability of questions on the STEAM approach.
4.	Usage	16. Effectiveness of use.

17. Practicality of using STEAM-based creative thinking instruments.

Validation of Language Experts

Based on the grids of language feasibility instruments with adoption, because there are no changes and according to the research needs in Table 3, as follows:

Table 3. Language Feasibility Questionnaire Grid

No	Assessment Aspect	Assessment Items
1.	Straightforward	1. Accuracy of sentence structure
		2. sentence effectiveness
		3. standardization of terms
2.	Communicative	4. the question does not have a double meaning
		5. the sentences used are easy to understand
		6. ability to motivate students
3.	Appropriateness	7. suitability for intellectual development
		8. compatibility with learners' emotional development
4.	EBI rules	9. grammatical accuracy
		10. spelling accuracy

Evaluation Expert Validation

Based on the evaluation feasibility tool grids with the adoption because there are no changes and in accordance with the research needs in the questionnaire Table 4, as follows:

Table 4. Evaluation Feasibility instrument lattice

Instrument Type	Indicator
Evaluation Aspect Assessment Format	1. The formulation of the sentence is in the form of an interrogative sentence or command that demands a decomposed answer
	2. There are clear instructions on how to work on solving the problem.
	3. There are scoring guidelines
	4. Tables, graphs, diagrams, cases, or the like (the information is clear or relates to the problem being asked).

Learner Perception Questionnaire

The grid of the learner perception questionnaire, which consisted of 10 questions using a 1-5 Likert scale and was validated by the supervisor to be adapted to the research needs, is shown in Table 5. The data analysis techniques in this research are as follows:

Instrument validation by experts

Validation is carried out by physics education lecturers at Jambi University to determine the feasibility of validating material, language and evaluation, then to calculate it using the following formula [25]:

$$D_P = \frac{n}{N}\, x\, 100\%$$

Learner Perception

The analysis of the results of students' perceptions in schools obtained previously is then processed using the percentage technique [26].

$$P = \frac{F}{N}\, x\, 100\%$$

Using validation criteria and learner perceptions with Table 6.

Table 5. Learner Perception Questionnaire Grid

No	Assessment Aspect
1	The test instrument presents according to the material that has been studied
2	The test instrument uses standardized, communicative language /does not cause multiple interpretations
3	The test instrument is easy to understand
4	The test instrument questions and images presented are interesting
5	The instructions for implementing the test instrument are clear and easy to understand
6.	The time provided is in accordance with the number of items available
7.	The creative thinking test instrument makes me excited to do it
8.	My curiosity increased about sound wave physics material after working on the creative thinking ability test instrument.
9.	I feel that the existence of this test instrument has fostered creative thinking skills on static fluid material
10	Test instruments that have STEAM components add to my insight into physics in creative thinking

Table 6. Category score of Learner Perception

Criterion of validity	Level
81.00 % -100.00 %	Very feasible
61.00 % - 80.00 %	Feasible
41.00 % - 60.00 %	Moderately Feasible
21.00 % - 40.00 %	Less Feasible
00.00 % - 20.00 %	Not feasible

Question validation

Test item validity: one of the techniques often used by researchers to test validity is the Pearson Bivariate correlation (Pearson Product Moment) [27].

$$r_{xy} = \frac{N.(\sum XY) - (\sum X)(\sum Y)}{\sqrt{\{N.\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

Using table 7 below to determine the interpretation of item validity:

Table 7. Item Validation Analysis

Coefficient	Interpretation
$0.81 \leq r_{xy} \leq 1.00$	Very High
$0.61 \leq r_{xy} \leq 0.80$	High
$0.41 \leq r_{xy} \leq 0.60$	Fair
$0.21 \leq r_{xy} \leq 0.40$	Low
$0.00 \leq r_{xy} \leq 0.20$	Very Low

Reliability

Reliability is often referred to as the level of consistency of a measuring instrument, which refers to the extent to which measurements made using the tool produce the same or close information when done repeatedly using the formula below [28]:

$$r_i = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum s_i^2}{s_t^2}\right)$$

Using table 8 below to determine the reliability of the questions:

Table 8. Reliability Value Analysis

Large r-value	Interpretation
0.80-1.00	Very High
0.60-0.81	High
0.40-0.61	Fair
0.20-0.39	Low
0.00-0.19	Very Low

Level of difficulty

The difficulty level of a set of questions or items (denoted by p) is the proportion of learners overall who answer correctly on that set of questions or items[27]:

$$\text{TK} = \frac{\text{Mean}}{\text{Skor Max}}$$

By

$$\text{Mean} = \frac{\text{sum of scores}}{\text{number of learners}}$$

Using table 9 below to determine the difficulty level of the questions:

Table 9. Item difficulty analysis

Price P	Problem Category
0.00-0.30	Difficult
0.31-0.70	Medium
0.71-1.00	Easy

Distinguishing Power

Determining the differentiating power of a question is a process to measure the extent to which a question in a test instrument can distinguish between test takers who have high and low abilities. By using the formula below [29]:

$$DP = \frac{(X_{KA} - X_{KB})}{Skor\ maksimal}$$

By using the table below to determine the differential power of the question:

Table 10. Analysis of item differentiation

Distinguishing power index	Category
0.00-0.19	Less
0.20-0.39	Enough
0.40-0.69	Good
0.70-1.00	Very Good

Results and Discussion

This research has not been carried out; only planning will be done at SMAN 1 Jambi City and SMA Adayaksa 1 Jambi City. This research develops test instruments to determine students' understanding of static fluid material assisted by the STEAM approach. So it can encourage students to think creatively when working on these questions. According to Munandar, who was followed by [30]. Creativity or creative thinking is the ability to see various possible solutions to a problem because educators tend to think creatively with the way of thinking that educators have. If given an exercise problem, students feel confused because they don't know where to start, so this can reduce the creative thinking ability of students. thinking skills are formulated as skills that reflect the following aspects [31]:

1. *Fluency* A factor that empowers a person to generate ideas, solutions, and responses to challenges or questions.
2. *Flexibility* allows you to develop various ideas, answers, or questions.
3. *Originality* enables a person to create new and unique expressions or to discover unusual combinations of ordinary elements.
4. *Elaboration* enables an individual to enhance and expand upon an idea.

In education, STEAM is an integrated method that combines science, technology, engineering, arts, and mathematics fields. It aims to develop inquiry, communication, creative thinking, and critical thinking skills in learners during the teaching-learning process. This approach is not only commonly used in universities that emphasize the formation of higher-order thinking Skills (HOTS) but also in various other levels of education [32]. This instrument has a HOTS taxonomy level to measure cognition at the C4-C6 level. The STEAM approach in Table 11 is as follows:

Table 11. STEAM approach

No	STEAM approach	STEAM Indicator
1	*Sains*	Learners in the learning process are required to understand the concept of material.
2	Technology	In the learning process, students are required to

		understand and use technology to facilitate learning activities.
3	Engineering	In the learning process, students are required to understand and use technology to facilitate learning activities.
4	Art	Learners can be creative in solving problems
5	Mathematics	In learning activities, students use calculations and formulas

An example of developing a description question instrument on static fluid material in class XI, with level C6 and originality creative thinking ability, namely after reading or hearing ideas, working to solve new ones, and containing STEAM elements, can be explained as follows: This problem focuses on Archimedes' principle, which states that an object dipped in a fluid will experience a buoyant force equal to the weight of the displaced fluid. This principle is the basis for determining the density of a liquid using a hydrometer (Science). Hydrometers, as technological tools, utilise physics principles to measure the density of liquids (Technology). The working principle of a hydrometer applies Archimedes' law according to the density of liquid (Engineering). To help understand this concept, a drawing of a hydrometer is presented (Art). Maths calculates the density by dividing the object's mass by the volume of the displaced liquid (Maths). All these STEAM elements are involved in the problem, from scientific concepts to mathematical calculations that help provide a thorough understanding.

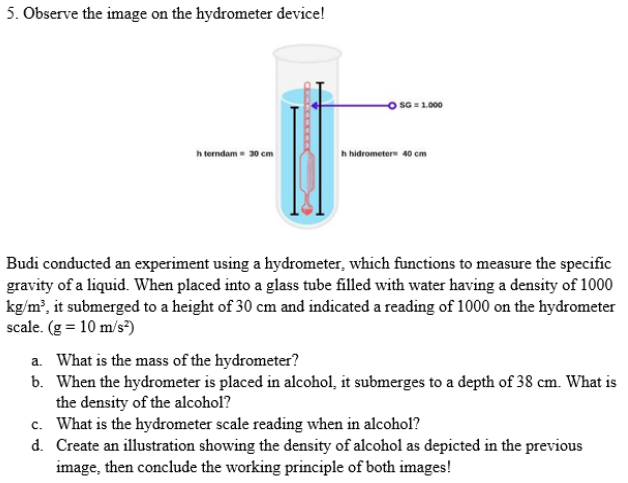

Figure 1. Sample Question Instrument

The results of the expert validity stage were obtained from two physics education lecturers from the University of Jambi. further analysis of the results of the validity of the assessment instrument to determine whether the instrument is suitable for use in schools can be seen in Table 12 as follows:

Table 12. Lecturer Validation

Validator	Expert Validity	Percentage	Category
Validator 1	Material	82.2%	very feasible
	Language	80.0%	Feasible
	Evaluation	85.0%	very feasible
Validator 2	Material	83.3%	very feasible
	Language	84.0%	very feasible
	Evaluation	85.0%	very feasible

The results of instrument validation show that the instrument is suitable for use in schools. For the first validator, Mr. M. Furqon, M.Pd, the material expert validation obtained a score of 82.2% with the category "very feasible", the linguist validation obtained a score of 80.0% with the category "feasible", and the evaluation validation obtained a score of 85.0% with the category "very feasible". For the second validator, Mrs. Dian Pertiwi Rasmi, S.Pd, M.Pd, the material expert validation obtained a score of 83.3% with the category "very feasible", the linguistic expert validation obtained a score of 84.0% with the category "very feasible", and the evaluation validation obtained a score of 85.0% with the category "very feasible". Thus, the instrument is ready for use in schools.

The next step is to analyze the results of student perceptions to find out the instrument after working on static fluid description questions. This can be seen in Table 13, as follows.

Table 13. Learner Perception

Learner Perception				
School	Total Score	Max Score	Percentage	Criteria
SMA 1 Jambi City	818	1000	81.80%	Very Feasiblek
Adhyaksa 1 Jambi	845		84.50%	Very Feasible
Results			83.15%	Very Feasible

Based on the product test conducted at SMAN 1 Jambi City and SMA Adhyaksa 1 Jambi, involving 20 students each, the overall perception average was 83.15%. This indicates that the instrument is effective and suitable for use in the learning process. The next stage of validity and reliability can be seen in Table 14.

Table 14. Validity test results

		Validity test results				
No. Question	Question Indicator	Coefficient		Average	Category	Status Validasi
		XI-F6	XI MIPA 1			
1	Learners can explain the factors that affect hydrostatic pressure and apply the concept of Archimedes' law.s	0.50	0.72	0.61	High	Valid

2	Learners apply mathematics and physics concepts to solve problems related to static fluids.	0.46	0.53	0.49	Enough	Valid
3	Learners can apply Archimedes' principle to determine the minimum mass of a hot air balloon so that it can float.	0.25	0.38	0.32	Low	needs revision
4	Learners can apply Archimedes' principle to determine the total volume of a shipyard cavity.	0.02	0.42	0.22	Low	needs revision
5	Learners can use experimental data to determine density and can illustrate a hydrometer.	0.54	0.49	0.52	Enough	Valid
6	Learners can apply the buoyancy force formula to calculate the maximum load weight and analyse the effect on the drum to hold the load.	0.69	0.86	0.78	High	Valid
7	Learners can use understanding to create. understand the concept of buoyant force and how Archimedes' principle can be used to calculate the density of objects.	0.46	0.62	0.54	Enough	Valid
8	Learners can calculate the force required to operate a hydraulic jack, analyse the relationship between small and large pistons, and determine pressure equivalence based on the principles of Pascal's law.'	0.53	0.55	0.54	Enough	Valid
9	Learners can understand Pascal's principle in hydraulics, which is about fluid pressure, and compare the cross-sectional area of large and small tubes.	0.62	0.82	0.72	High	Valid
10	Learners can apply Pascal's law to hydraulic brake problems to calculate the force a large piston generates in a hydraulic brake system. They can analyse the relationship between pressure and pressure.	0.62	0.83	0.72	High	Valid
11	Learners can understand the concept of capillarity, explain the function of capillary pipes, calculate the gravitational force on water in them, and analyse its effect.	0.50	0.54	0.52	Enough	Valid

Reliability Test			
Coefficient		Average	Category
XI.F6	XI.MIPA 1		
0.653	0.825	0.739	High

The item validity test is carried out to get a valid question. Acquisition of data by analysing if the value of $r_{count} > r_{table}$, then it can be said to be valid. With a value of $r_{tabel} = 0.444$, The validity test can be compared with the following results: If rcount> rtable, then the item is declared valid. If $r_{count} < r_{table}$, then the item is declared invalid.

Reliability testing was conducted using Excel to ensure consistency and reliability of the assessment instrument. The higher the reliability, as measured by the alpha coefficient, the more accurate and consistent the instrument is in measuring learners' abilities. The measurement results become more stable and reliable, thus more accurately describing the learners' abilities. 11 questions will be tested to find the validity and reliability of the questions.

The results show that the assessment instrument is valid and reliable in measuring students' abilities. Of the 11 questions tested, nine proved valid with a "high" or

"sufficient" category, indicating the instrument's effectiveness. The instrument's reliability was also rated high, with an average coefficient of 0.739, indicating good consistency. However, there were 2 questions (Questions 3 and 4) with low coefficients that needed to be evaluated and revised to improve the overall quality of the instrument. The next stage was carried out, and the difficulty level can be seen in Table 15.

Based on the results, most of the questions tested had a difficulty level of "medium" to "difficult," with difficulty values ranging from 0.10 to 0.59. This indicates that the questions are challenging enough for students to develop creative thinking and higher-order thinking skills (HOTS) at the C4-C6 level. The absence of "easy" questions is due to the instrument's focus on developing creativity, critical thinking and complex problem-solving, which require a higher level of challenge to measure these skills effectively. The next stage of differentiating power can be seen in Table 16.

Table 15. Difficulty Level

Question No.	Average Coefficient	Category
1	0.54	Medium
2	0.48	Medium
3	0.50	Medium
4	0.59	Medium
5	0.53	Medium
6	0.43	Medium
7	0.19	Difficult
8	0.31	Medium
9	0.27	Difficult
10	0.18	Difficult
11	0.10	Difficult

Table 16. Distinguishing Power

Question No.	Average Coefficient	Category
1	0.23	Enough
2	0.16	Less
3	0.10	Less
4	0.11	Less
5	0.23	Enough
6	0.56	Good
7	0.20	Less
8	0.27	Enough
9	0.37	Enough
10	0.32	Enough
11	0.07	Less

Based on the results obtained from the 11 questions tested, 6 questions had a differentiating power of "sufficient" to "good," indicating an effective ability to distinguish between high and low-ability participants. However, there were 5 questions with a discriminating power of "less," meaning that they were less effective in differentiating between participants' abilities. Therefore, these less effective questions need to be evaluated and corrected to improve the overall quality of the test.

Based on the analysis results, the STEAM integrated instrument to measure students' creative thinking skills on Static Fluid material has been declared feasible after revisions and feasibility tests. This instrument, which consists of 11 items, is effective as a tool for educators in evaluating learning. However, items with low or poor values of validity, reliability, difficulty level, and differentiating power require further evaluation to ensure the quality and effectiveness of the instrument are maintained.

Conclusion

Students from SMAN 1 Jambi City and SMA Adhyaksa 1 Jambi were involved in developing STEAM-integrated assessment tools for static fluid materials, with each group comprising 20 students. Their perception of the instrument was measured through a questionnaire, which showed an average perception of 83.15%, including the "Very Appropriate" category. This indicates that the instrument effectively supports students' creative thinking skills. From the results of expert validation, most aspects of the instrument were in the "very feasible" or "feasible" category, with positive results from material, language, and evaluation experts. However, some questions need improvement. Of the 11 questions tested, 9 were declared valid, but 2 questions had low coefficients and needed to be revised. The tested questions varied in difficulty, most falling into the "medium" to "difficult" category, appropriate for measuring creative thinking and problem-solving skills. Some questions must also be re-evaluated to improve their discriminatory power and measure learners' abilities more effectively. Based on the conclusions above, suggestions that can be submitted are as follows: the researchers then proceeded to the implementation and evaluation phase through large group trials. Future researchers are also expected to develop assessment instruments on different topics aligned with the learning materials and students' abilities.

Author's Contribution

Dian Pertiwi Rasmi. Menza Hendri. Akrom Mardatila also made the same contribution to this development journal.

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