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Development of Steam-C Integrated Student Worksheets to Improve Creative Thinking Ability on Flat Side Building Materials

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ABSTRACT

Creative thinking skills are important for the provision of students in the 21st century. This study aims to develop and produce STEAM-C integrated worksheets to improve students' creative thinking skills. This type of research is R&D with ADDIE model. The research was carried out at SMPN 10 Madiun, using 6 students in a limited trial and 24 students in a field trial. The results of this study are 1) The STEAM-C integrated student worksheets is declared valid with a validity percentage of 81%. 2) The STEAM-C integrated student worksheets is stated to be very practical based on the results of the calculation of the student response questionnaire in the field trial with a practicality level of 93%. 3) The STEAM-C integrated student worksheets is declared effective in the high category based on the calculation of the N - Gain value in the field trial of 71%. Thus the STEAM-C integrated student worksheets is feasible to be used in improving creative thinking abilities.

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1. INTRODUCTION

21st century learning is learning made in preparing students to be able to face the very rapid progress of science and technology (Marshel & Ratnawulan, 2020). Education aims to develop information based on new ideas to improve students' competence in using knowledge (A. Rashidov, 2020; AS Rashidov, 2022) . This of course must be accompanied by appropriate skills, especially for students. In line with this, Zulkarnain et al. (2020) emphasized that the current generation of young people must be formed to be skilled when solving problems, wise when making decisions, thinking creatively, being able to communicate ideas effectively, and being able to work efficiently in individuals and groups. Students must be equipped with skills for the 21st century, one of which is the ability to think creatively (Yulianti, Wiyanto, Rusilowati, & Nugroho, 2020; Zubaidah, 2019) . These skills can be given during learning activities at school, one of which is through mathematics lessons.

Mathematics is a basic science for every human being. This is in line with (Sirait, 2016) which states that mathematics is a necessity because mathematics is a lesson that provides benefits in everyday life. The purpose of learning mathematics in schools as stated by Meilani & Aiman (2021) is that students are expected to acquire sufficient knowledge for learning at the next level and can also find solutions to problems about mathematics. Likewise Mahendra (2017) which states that mathematics is taught to students with the hope that these students have the ability to think logically, systematically, analytically, critically, creatively and the ability to work together as a provision for life.

Based on the results of the 2018 PISA (Program for International Student Assessment) released on December 3, 2019 and presented by (Tohir, 2019) stating that Indonesia is ranked 7th from the bottom for the mathematics category with an average score of 379. The results of these figures when compared with the score in China it is much smaller with China's score being 591 and Malaysia getting 440. PISA itself is one of the international assessments to measure students' mathematical abilities, there are 76% of Indonesian children who cannot reach level 2 or the minimum level to pass the low category achievers and those who reach level 5 are only 0.3% of students (Mansur, 2018) . Based on the explanation, it can be concluded that students' mathematical abilities are still far from expectations. Whereas mathematics is one of the subjects that support students in acquiring 21st century skills.

The condition of learning mathematics at SMPN 10 Madiun based on the results of interviews conducted with mathematics teachers, got the results if mathematics is a subject that is not liked by students. This is reinforced by the statements of most students who say that mathematics is a difficult subject to understand. This ultimately has an impact on student learning outcomes. Based on the results of the Final Semester Assessment, the average student still scores between 40-60s. This figure does not meet the Minimum Completeness Criteria that has been set by the school, which is 75. This happens because students do not carry out learning optimally during the pandemic. Apriyanto & Herlina (2020) also stated that interest in learning and knowledge of mathematics decreased during the pandemic. With words as mentioned earlier, that the decline in students' mathematical abilities is the same as the decline in students' problem-solving, connection, communication and reasoning abilities (Meilani & Aiman, 2021)

Observations made at SMPN 10 Madiun also found that students' creative thinking skills were still very minimal. When learning takes place, students tend to be silent and less active in responding to teacher questions. This is also one of the causes of the low student learning outcomes. Maskur et al. (2020) states that students' creative thinking skills can be improved through proper learning. Learning at SMPN 10 Madiun has so far been centered on the teacher or teacher center by using the lecture method by giving sample questions and assignments to students. This is of course contrary to the concept of the 2013 curriculum, where learning is more directed at student center -based (Indrawati, Fiqi Annisa, & Wardono, 2019)

In addition to some of the facts in the field mentioned above, one of the factors that influence the learning process is the readiness of the teacher as outlined in the learning tools in the form of student worksheets. According to Putu, Krisna, Astawan, & Suarjana (2021) Teachers have a role in preparing the student worksheets that can increase the spirit of learning. The use of the student worksheets based on the right curriculum can also improve students' creative thinking skills (Prasadi, Wiyanto, & Suharini, 2020) . Based on interviews with mathematics teachers at SMPN 10 Madiun, there is no use of the student worksheets that directs students to develop creative thinking skills as 21st century skills. Teachers only use module books as learning resources and conventional learning approaches.

Responding to some of the problems above, the teacher should be more optimal in preparing tools for learning that will be applied in the classroom. The learning tools in question are learning tools that can optimize students' roles in the learning process. Moreover, it becomes very important when applied to mathematics. The application of mathematics that is connected to everyday life will make learning more meaningful for students. Many articles associate mathematics with culture to make learning more interesting for students (Arifin, 2018; Ghoyatul Muna, 2019; Mahendra, 2017; Sartika & Makmur, 2020). Besides that, one of the learning models that can be applied to improve 21st century skills is learning

through STEAM. STEAM stands for Science, Technology, Engineering, Arts, and Mathematics (Belbase et al., 2021; Lamichhane, 2021). Cholily (2020) states that learning using STEAM is the right solution to answer the challenges of education in the 21st century. Zubaidah (2019) suggests that STEAM is an approach to learning that gives students the opportunity to increase knowledge about science and humanities and at the same time develop. The skills needed to thrive in the 21st century include communication skills, leadership, critical thinking skills, teamwork, resilience, creativity, and other skills. In this study will use a combination of STEAM and culture in the development of learning tools for students. Lamichhane (2021) states that STEAM is a potential dimension in mathematics education that includes the environment, economy, and culture to support sustainable development.

Culture and education are a unity that supports and strengthens each other (Pratiwi & Pujiastuti, 2020) . Culture is something that must be preserved because it is a national identity that can foster noble values as character education for future generations. However, in the current era of modernization, there are many future generations including students who forget and do not know their culture. In line with Asrori et al. (2019) The loss of love for the homeland has caused the loss of knowledge about one's own culture. Teachers should also be able to facilitate this by incorporating cultural elements into learning. The integration of STEAM and cultural elements can be applied through the learning model used. One learning model that integrates STEAM and culture is a project-based learning model or PjBL. In accordance with the statement of Lavicza et al. (2021) that the direction of STEAM education can be developed through the project.

Project Based Learning (PjBL) is a learning model that gives assignments to students in the form of projects, so that students can produce a product. PjBL can be implemented systematically with the STEAM approach (Yulia, Zubainur, & Johar, 2019). According to Mahanal (2017) PjBL can be carried out individually or in groups by using problems as an initial part in compiling new knowledge on real projects. PjBL in mathematics can be applied to many materials. One of the materials that can be developed with this learning model is a block which is a three-dimensional or spatial shape.

Build space is one of the content tested on PISA. This is in line with the statement of Wulandari & Azka (2018) which states that the mathematical content in PISA 2018 is change and relationships, quantity and uncertainty , space and shape. So that building space is included in the material that must be mastered by students. Based on the results of the SMP/MTs National Examination in the city of Madiun in 2019 which was accessed through the Puspendik Kemdikbud website, the average score was 51.12 in geometry and measurement materials. This value is lower than the algebraic material which gets a score of 60.19 and statistics and probability material which gets a score of 66.22. Based on the research results of Ayuningrum et al. (2019) , students find it difficult to understand the material about building space because students do not understand the meaning of the question and students do not understand the basic concepts of the material. This was also experienced at SMPN 10 Madiun, based on the results of interviews conducted with mathematics teachers, students still had difficulty understanding and solving problems related to building specific spaces.

Based on the explanation of the problem, it is deemed necessary to develop student worksheets which is able to prepare students to master creative thinking skills. Through this research, an integrated STEAM-C student worksheets will be developed using PjBL to improve students' creative thinking skills on the flat-sided building material. This study also aims to determine the level of practicality, validity, and effectiveness of the worksheets developed.

2. METHODS

The type of research used in this study is Research and Development (R&D) with the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The purpose of this study was to create and develop a product in the form of student worksheets for class VIII students at SMPN 10 Madiun which was made to understand the material for building flat sides. The student worksheets created and developed is an integrated STEAM-C student worksheets using PjBL. The population in this study were students of SMPN 10 Madiun. While the samples taken were students of class VIII

SMPN 10 Madiun. The collection techniques used in this study were observation, interviews, tests, and questionnaires. The data sources used in this study are primary data sources and secondary data sources. Primary data sources are the results of project performance observations, test results, and interview results. Secondary data sources are school profiles, syllabus, and documentation of student test results. The stages of the ADDIE model in detail are as follows:

1. **Analysis**
   At the analysis stage, an analysis of the learning framework to be used, the learning approach used, and curriculum analysis was carried out (Ganefri, Zakir, Jama, Wahyuni, & Adri, 2020). The analysis carried out includes curriculum analysis, learning analysis and its tools, and analysis of student conditions during learning. Curriculum analysis was obtained through interviews with mathematics teachers at SMPN 10 Madiun. Analysis of learning and its tools was carried out by interviewing teachers and students.
2. **Design**
   This stage consists of the preparation of research instruments and the initial design of the student worksheets used. The instruments arranged were validation sheets, student questionnaire sheets, 4C observation sheets and test sheets. The validation sheet serves to determine the level of validity of the student worksheets that has been made. In accordance with Arikunto, in the analysis technique uses the average analysis technique (Febriana, Sulur, & Yudyanto, 2013). The following is the eligibility criteria according to (Febriana et al., 2013) according to table 1.1 below

   Table 1. Validation Criteria

Average	Criteria
3.26 – 4.00	Proper to use
2.51 – 3.25	Decent enough
1.76 – 2.50	Not worth it
1.00 – 1.75	Invalid

   Validators come from media experts, material experts, and practitioners. The student questionnaire sheet contains statements related to the application of the student worksheets used. The questionnaire here is in the form of a questionnaire. The 4C observation sheet is used to determine the condition of the students' 4C after the implementation of the developed student worksheets. The test sheet is used to determine the effectiveness of the student worksheets. The initial design of the student worksheets was based on the results of observations.
3. **Development**
   At this stage the process of making and testing the product is in the form of validation of the resulting product design. Assessment at the time of validation indicates the level of validity of the resulting product. Meanwhile, the directions and input from the validator are used as a reference for product improvement.
4. **Implementation**
   After going through validation and improvement, the product can be implemented on the selected research subjects. The implementation of this tool is based on the lesson plans that have been made.
5. **Evaluation**
   Researchers evaluate activities that have already taken place. Researchers evaluate these activities with the desired initial research objectives. If any problems are encountered, they can be recorded and a solution is sought. After that, researchers can see the quality of the learning tools developed based on the indicators mentioned on effective, valid, and practical.
   a. Validity analysis
      Validity analysis is carried out using a validation sheet where the aspects will be validated with a score range between 1-5. With information that 1 (very bad), 2 (not good), 3 (quite good), 4 (good), and 5 (very good). According to Sa'dun Akbar in (Murtafiah, Namiroh, Darmadi, Krisdiana, & Masfinatin, 2020) to determine the percentage level of validity (V) the following formula is used:

$$V = \frac{\text{Number of scores from validators}}{\text{Maximum number of scores}} \text{ x } 100\%$$

Because there are 3 validators, the level of validity needs to be calculated using the next formula, namely:

$$V = \frac{V_1 + V_2 + V_3}{3} \text{ x } 100\%$$

To determine whether the learning tools that have been made are valid or not, it can be seen based on the criteria in the table below stated by Sa'dun Akbar in (Murtafiah et al., 2020) .

Table 2 Criteria for the validity of learning tools

Validity Criteria	Validity Level
85.01% - 100%	Very valid, or can be used without revision
70.01% - 85.00%	Fairly valid, usable with minor revisions
50.01% - 70.00%	Not valid, it is recommended not to use because it needs a major revision
01.00% - 50.00%	Invalid, or should not be used

b. Practical analysis

Practical analysis was obtained based on the results of student response questionnaires. The student response questionnaire sheet uses the Guttman scale with positive statements and negative statements with alternative answers agree and disagree. Based on (Anisa & Mitarlis, 2020) states that on the Guttman scale, a negative question score is 0 (agree) and 1 (disagree). Meanwhile for positive questions score is 1 (agree) and 0 (disagree). (Kumalasari, 2018) states that the formula for calculating practicality values is as follows:

$$Vp = \frac{TSEp}{S - max} \text{ x } 100\%$$

Information: Vp = practicality validity; TSEp = Total practicality empirical score; S-max = Maximum expected score

Then to describe the results of the practicality calculations, the criteria can be seen through the following table:

Table 3 Practical criteria for learning tools

Validity Criteria	Validity Level
75.01% - 100%	Very practical, can be used without revision
50.01% - 75.00%	Practical, usable with minor revisions
25.01% - 50.00%	Not practical, it is recommended not to use
00.00% - 25.00%	Impractical, unusable

c. Effectiveness analysis

The effectiveness analysis according to (Anisa & Mitarlis, 2020) can be calculated using the N-Gain formula as follows

$$N - Gain = \frac{\text{skor post test} - \text{skor pre test}}{\text{skor max} - \text{skor pre test}} \text{ x } 100\%$$

Meanwhile, to determine the level of effectiveness can be seen through the following criteria:

Table 4 Criteria for the effectiveness of learning tools

Percentage	Information
N-Gain > 70	Tall
$30 \leq N - Gain \leq 70$	Currently
N-Gain < 30	Low

3. FINDINGS AND DISCUSSION

This study aims to develop an integrated STEAM-C student worksheets using PjBL to improve creative thinking. The culture used is Pendem Fortress. The type of research used is Research & Development using the ADDIE model.

a. Stage of Analysis (analysis)
   1) Curriculum Analysis
      The curriculum used by SMPN 10 Madiun is the relaxation curriculum. The relaxation curriculum is a curriculum that is applied during new normal conditions, this curriculum provides flexibility for the school to determine the process of teaching and learning activities.
   2) Learning Analysis and Tools
      Learning at SMPN 10 Madiun uses a blended learning system , where students are already learning offline but the teacher still provides some material or practice questions online through Microsoft Teams managed by the school. Microsoft Teams is an e-learning medium that can be used to communicate through comments, work conversations, and file storage features. Teams can also be used to conduct video conferencing.
      The mathematics learning model applied by teachers at SMPN 10 Madiun still uses the lecture system and assignment. The lecture system is used to explain the material in the textbook through the blackboard media in front of the class, then students are asked to take notes. After that, students are given examples of questions that are worked on together with the teacher. As an exercise, the teacher gives some questions that students do independently, either through writing on the blackboard, questions in textbooks, or sometimes using Teams media. Students have also never been given student worksheets to support their learning activities.
   3) Analysis of the characteristics and creative thinking abilities of students
      The characteristics of students at SMPN 10 Madiun when learning mathematics, based on the narrative of the tutor during unstructured interviews, were varied. Some students can actively participate in learning mathematics in class, but there are still many students who have not focused their attention during learning. SMPN 10 Madiun students tend to be superior in non-academic fields, this is in accordance with the results of observations and narratives from teachers who stated that students were more enthusiastic when participating in futsal competitions, choir training, and drumband activities.
      The creative thinking abilities of SMPN 10 Madiun students tend to be in the low to moderate category, this is based on observations made in class 8F, totaling 24 students. On the indicator of creative thinking ability, there are 6 students or 25% in the low category, 12 students or 50% in the medium category, and 6 students or 25% in the high category.

b. Design Phase (Design)
   The design stages in this study include the preparation of instruments, namely validation sheets, student questionnaire sheets, and test sheets. This stage also includes the initial design of the student worksheets.
   1) Instrument Arrangement
      a) Student worksheets validation sheet
         The student worksheets validation sheet consists of 11 statements. The statement contained in the validation sheet contains aspects of content, aspects of constructs, and aspects of language with an assessment score of 1-5 with details score: 5 (very good), 4 (good), 3 (quite good), 2 (not good), 1 (not very good). At the end of the validation sheet assessment, the validator can provide input and suggestions that can be used as evaluations in improving the learning tools that are being developed.
      b) Student response questionnaire
         The student response questionnaire sheet consists of 10 statement items that are used to view and assess several aspects related to student responses in the implementation of the STEAM-C integrated worksheet that was developed. Statements consist of positive statements and

negative statements. Students are asked to give their opinion by putting a check mark in one of the opinion columns (agree or disagree) that suits them.

c) Student's creative thinking ability observation sheet
This student's creative thinking ability observation sheet was made to determine students' skills related to creative thinking according to predetermined indicators. In the aspect of creative thinking has 3 indicators. In this observation sheet there are 3 scales that can be used by researchers, 3 (students have good abilities according to indicators), 2 (students have sufficient abilities according to indicators), 1 (students have abilities that do not match indicators).

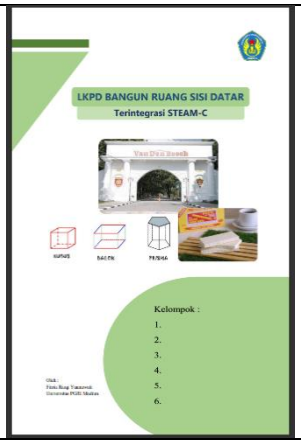
d) Test sheet
The test sheet is prepared to determine the effectiveness of the developed student worksheets as well as to determine student learning outcomes after using the student worksheets. The questions consist of multiple choice questions and description questions. There are ten multiple choice questions with options A, B, C, and D which have easy and medium difficulty levels. There are two description questions in the difficult category.

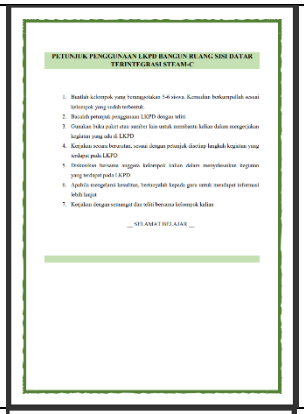
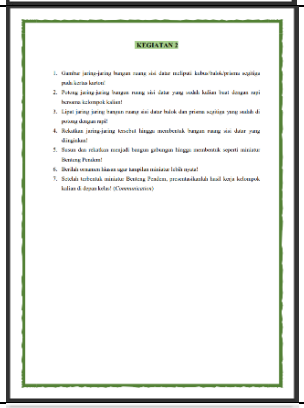
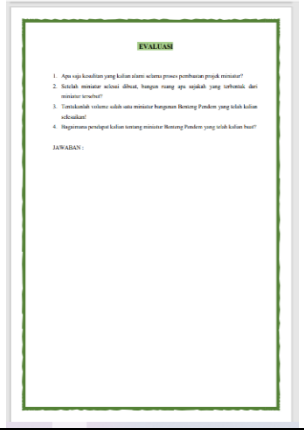
2) The student worksheets preliminary design
The activity at this stage is designing the contents of the student worksheets. The initial design was validated and made improvements according to the suggestions given by the validator. The student worksheets was created as a guide for students in doing project assignments. The student worksheets that was made integrated with STEAM-C with the culture used was Pendem Fortress. The selection of Pendem Fortress was based on the suitability of the material and culture in the Madiun residency area.

c. Development Phase (Development)
The development stage in this study consisted of making the student worksheets and validating the STEAM-C integrated student worksheets. The activities at this development stage are as follows:

1) The STEAM-C integrated student worksheets used in the study can be seen in the following table:

Table 5 Student Worksheets Design

No	Picture	Information
1		Cover of student worksheets integrated STEAM-C

2				Instructions for using the student worksheets
3				Activity part 1 that must be completed by students in groups
4				Activity part 2 is about making projects in groups
5				Evaluation section on the student worksheets

Overall, this student worksheets consists of eight pages, starting from the cover page to the evaluation page. This student worksheets is also equipped with core competencies, basic competencies and indicators of competency achievement, as well as learning objectives. In the first activity students are directed to design tools and materials that will be used in the project as well as to make flat-sided wake-up webs that will be used. In the second activity, students were directed to

make a project with the preparations they had made in the first activity. All of these activities were carried out in groups. In the evaluation section, students are asked to work on problems related to the volume of the project they have made and give their opinion on the activities they are doing.

2) Validation of STEAM-C integrated worksheets

This Step aims to find out whether the student worksheets is really valid. If the student worksheets developed is valid, it can be said that the research carried out is also valid. The student worksheets design be validated by the 3 validators using the instrument validation sheet. The validator of learning tools in this research is lecturer of the mathematics education as an expert on learning tools as well as material expert, mathematics teacher at SMPN 10 Madiun as media expert as well as practitioner, and mathematics teacher at SMPN 12 Madiun as material expert as well as practitioner. The results of the student worksheets validation are as follows:

Table 1The student worksheets validation results

Validation Results	**Validator**		
	I	**II**	**III**
Total Empirical Score (Tse)	44	45	45
Total Expected Score (TSh)	55	55	55
Validation percentage	80%	82%	82%
Combined Validation		81%	

The results of the student worksheets validation based on table 6 are 81%. The validation results are included in the fairly valid category.

3) Test questions validation results

The Validation of test questions in this study was to determine the accuracy of the test questions carried out by class VIII students of SMPN 10 Madiun

Table 2Validation results of test questions

Validation Results	**Validator**		
	I	**II**	**III**
Total Empirical Score (Tse)	28	28	28
Total Expected Score (TSh)	35	35	35
Validation percentage	80%	80%	80%
Combined Validation		80%	

The results of the validation of the test questions based on table 7 are 80%. The validation results are included in the fairly valid category.

4) The results of the validation test of student response questionnaires to the STEAM-C integrated student worksheets

The validation of the student response questionnaire sheet aims to determine the level of accuracy of the response questionnaire distributed to class VIII students of SMPN 10 Madiun.

Table 3Validation results of student response questionnaires

Validation Results	Validator		
	I	II	III
Total Empirical Score (Tse)	24	24	24
Total Expected Score (TSh)	30	30	30
Validation percentage	80%	80%	80%
Combined Validation		80%	

The results of the validation of the student response questionnaire based on table 8 are 80%. The validation results are included in the fairly valid category.

5) The results of the validation test of the student's creative thinking ability observation sheet

The validation of the observation sheet for students' creative thinking abilities aims to determine the level of accuracy of aspects on the observation sheet used for class VIII students of SMPN 10 Madiun.

Table 4The results of the validation of the student's 4C observation sheet

Validation Results	Validator		
	I	II	III
Total Empirical Score (Tse)	16	16	16
Total Expected Score (TSh)	20	20	20
Validation percentage	80%	80%	80%
Combined Validation		80%	

The results of the validation of the student's creative thinking ability observation sheet based on table 9 are 80%. The validation results are included in the fairly valid category.

d. Implementation Stage (Implementation)

1) Limited trial

The limited trial of this study involved 6 students from grade 8D at SMPN 10 Madiun. The trial was carried out using the STEAM-C integrated student worksheets . Limited trials were carried out during mathematics learning in class. This limited trial begins with the introduction of the researcher to the students involved, followed by working on the pretest questions. Furthermore, the researchers did apperception by using learning media in the form of PPT that had been prepared previously. Students seemed enthusiastic by responding to answers when the researcher asked questions. Then, the researcher provided material on the flat side of the building that was integrated with STEAM-C with . After that, students are formed into one group to carry out the project together with the guidance from the student worksheets that has been provided.

Figure 1 Working on projects and worksheets by students

Next, students work on the posttest questions and then fill out the student response questionnaire that has been provided.

a) STEAM-C integrated learning device

STEAM-C integrated learning device was obtained based on the results of the calculation of the response questionnaires filled out by the students involved during the limited trial. The results of the analysis of the practicality of learning devices are as follows

Table 10. The results of the practical analysis of the limited trial

No	Student's name	Ts	S-Max	Vp (%)
1	RFD	8	10	80%
2	MRF	10	10	100%
3	DP	10	10	100%
4	EMP	10	10	100%
5	NAS	10	10	100%
6	STAMP	10	10	100%
	Amount	58		
	Average	9,667		97%
	Information		Very Practical	

Based on the results of table 10, it shows that the integrated STEAM-C student worksheets developed has a practicality percentage of 97%. This value is included in the very practical category.

b) STEAM-C integrated student worksheets

STEAM-C integrated worksheets can be seen from the N-Gain values in the pretest and posttest. Calculation of the value of N-Gain is done using Microsoft Excel. The results of the calculation of the N-Gain value in the limited trial can be seen in the following table

Table 11 Results of N-Gain calculations in limited trials

No	Name	Pre test	Post test	post - pre	S-Max-Pre	N-Gain
1	RFP	53	97	43	47	93%
2	MRF	53	97	43	47	93%
3	DP	53	100	47	47	100%
4	EMP	53	97	43	47	93%
5	NAS	53	90	37	47	79%
6	STAMP	53	80	27	47	57%
Average		53.3	93.3			86%
Information						Tall

Based on the analysis in table 11 shows that the developed STEAM-C integrated student worksheets has a combined percentage of 86%. This shows that the STEAM-C integrated learning tool is effective in the high category.

2) Field trial

The field trial in this study involved all 24 students from class 8F at SMPN 10 Madiun. The trial was carried out using the STEAM-C integrated student worksheets and. Field trials were carried out during mathematics learning in class. This field trial begins with the introduction of the researcher to the students involved, followed by working on the pretest questions . Next, the researchers conducted apperception and flat-sided building materials that were integrated with STEAM-C and by using learning media in the form of PPT that had been prepared previously.

Figure 2 Material presentation activities using PPT in field trials

After that the students were formed into 4 groups with each group consisting of 5-7 students to carry out the project together with the guidance from the student worksheets that had been provided. Next, students work on the posttest questions and then fill out the student response questionnaire that has been provided.

a) STEAM-C integrated student worksheets

Practicality of the STEAM-C integrated worksheets was obtained based on the results of the calculation of the response questionnaires filled out by the students involved during the field trial.

Table 12 Practicality test results in field trials

student worksheets practicality	
Combined T-Sep	223
Combined S-Max	240
Combined Percentage	93%

The results of the practicality analysis of student worksheets in this field trial get a percentage of 93%. This shows that student worksheets is included in the very practical category.

b) Analysis of the results of the effectiveness of the STEAM-C integrated student worksheets
STEAM-C integrated worksheets can be seen from the N-Gain values in the pretest and posttest. Calculation of the value of N-Gain is done using Microsoft Excel.

Table 13 Effectiveness test results in field trials

student worksheets Effectiveness	
Total pre-test score	620
Total post-test score	1875
N-Gain Percentage	71%

The results of the calculation of the N-Gain value in the field trial got a percentage of 71%. This shows that the STEAM-C integrated student worksheets is effective in the high category.

e. Stage of Evaluation (Evaluation)
The evaluation phase consists of an analysis of the quality of the developed STEAM-C integrated student worksheets. The analysis covers aspects of the validity, practicality, and effectiveness of the STEAM-C integrated student worksheets .

1) Validity of STEAM-C integrated student worksheets
of the STEAM-C integrated student worksheets is seen if the combined validation results from each validator exceed 70.01 %. The student worksheets that was developed got a validity percentage of 81%. From the results of the validity, it can be categorized that the STEAM-C integrated student worksheets that was developed meets the criteria of being quite valid. By taking an approach using local culture, students can apply the mathematics they have learned to problems in everyday life. This is in line with Hartanti & Ramlah (2021) statement that learning mathematics with local culture makes students seem closer to mathematics, so that mathematics is no longer a separate subject from students' daily lives.

2) Practicality of STEAM-C integrated worksheets
of the STEAM-C integrated student worksheets that was developed can be seen through the results of filling out student response questionnaires to the student worksheets. In a limited trial, the results of filling out the student response questionnaires got a percentage of 97%. While in the field trial, the results of filling out the student response questionnaires got a percentage of 93%. The results of the two response questionnaires have exceeded the minimum value in the practicality test , which is 75.01 %. Based on the comments given on the response questionnaire sheet, when learning students feel fun, cool, fun, easier to accept and understand the material, and can work together with friends. This shows that the STEAM and Culture integrated learning tools developed received a good response from teachers and students.

3) Effectiveness of the STEAM-C integrated student worksheets
of the STEAM-C integrated student worksheets can be known through the calculation of the N-Gain value in the pretest and posttest tests . In a limited trial, the combined N-Gain scores of the students involved got a percentage of 86%. Meanwhile, in the field trial, the combined N-Gain scores of all 8F graders got a percentage of 71%. The two results of the N-Gain value have exceeded the minimum value in the effectiveness test, which is 30%. So it can be concluded that the developed STEAM-C integrated student worksheets is effective in the high category. Projects made in this study also make students creative to complete projects according to their respective groups. Thus, PjBL can develop student creativity in this 21st century learning era. This is in line

with the statement of Sidar, Hasri, & Auliah (2022), namely through the application of the PjBL model it can develop students' creative abilities in solving given problems.

4) Analysis of the results of observations of students' creative thinking skills
Observations of students' creative thinking skills were carried out to determine students' creative thinking abilities after using the STEAM-C integrated learning tool . This observation was carried out on 8F grade students who were involved in field trials. In this creative thinking ability, the indicators used are students can develop creative ideas, realize creative ideas in life, and create innovations.

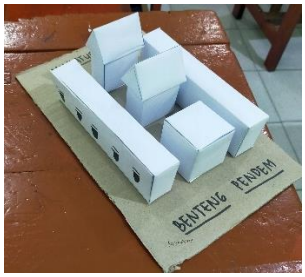


Figure 3 project results from group 3

The ability to think creatively in grade 8F students got results of 13% or 3 students in the low category, 29% or as many as 7 students in the medium category, and 58% or as many as 14 students in the high category.

4. CONCLUSION

The conclusion from the research on the development of the STEAM-C integrated student worksheets that was carried out was that the STEAM-C integrated student worksheets was feasible to be used and applied in the learning process as one of the innovations in learning activities in improving students' creative thinking skills. The details of the results obtained are:

a. The STEAM-C integrated student worksheets is declared valid with a validity percentage of 81%.
b. integrated STEAM-C student worksheets that was developed has a very practical category based on the results of calculating student response questionnaires. In a limited trial the practicality level is 97% and in a field trial the practicality level is 93%.
c. The STEAM-C integrated student worksheets that was developed is effective in the high category based on the calculation of the N-Gain value on the pretest and posttest results. The percentage of N-Gain in the limited trial was 86%. Meanwhile, the percentage of N-Gain in field trials is 71%.

This research is limited to the material of the flat side of the space. Recommendation for further research is the development of LKPD using other materials.

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