

## Development of Student Worksheets Oriented to Problem Based Learning Integrated 21<sup>st</sup> Century Skills

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### ABSTRACT

The results of interviews and observations at the MA Pertanian of Madiun City show that the student worksheet used so far has not integrated 21<sup>st</sup> century skills. The development of 21<sup>st</sup> century skills of students can be done through student worksheets that integrate 21<sup>st</sup> century skills and the use of problem-based learning models. Analysis of these problems and potentials became the basis for researchers to carry out research on the development of problem-based learning-oriented worksheets integrated 21<sup>st</sup> century skills. This study aims to determine the validity, practicality, and effectiveness of problem-based learning-oriented student worksheets integrated 21<sup>st</sup> century skills. This development research uses the ADDIE model to achieve research purposes. The ADDIE model consists of 5 stages, namely the analysis stage, the design stage, the development stage, the implementation stage, and the evaluation stage. The subjects in this study were 11<sup>th</sup> grade students of the MA Pertanian of Madiun City in the even semester of the 2021/2022 academic year. The research subjects consisted of 2 types, namely, limited trial subjects and field trial subjects. The research instruments include material expert validation sheets, media expert validation, student response questionnaires, and learning outcomes tests. The results of this study are that the developed student worksheets meet the valid, practical, and effective criteria, so based on the research results it can be concluded that the developed student worksheets are feasible and appropriate to improve students' 21<sup>st</sup> century skills. The limitation in developing this student worksheet is that it has not been equipped with evaluation questions that can be accessed online. As for suggestions for further research, it is better to complete the student worksheet with evaluation questions that are integrated based on games as a medium for practicing student questions to increase students' motivation and understanding in studying derivatives of algebraic functions.

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**1. INTRODUCTION**

The 21<sup>st</sup> century is characterized by the interdependence of social, political, and economic systems coupled with competitive market rules resulting in the tremendous growth of knowledge, industry, and information and communication technology (ICT) (Chalkiadaki, 2017). These events had a profound effect on education providers who play a role in national development, the demands of changing the approach to skills needed for students to be able to achieve success both in terms of academics and in terms of life. Several educational and professional institutions offer frameworks that contain skills and sub-skills that are appropriate to the social and economic conditions of the 21<sup>st</sup> century. For example, the framework that was born from the view of the non-profit organization Partnership 21<sup>st</sup> Century Skills contains several demands for 21<sup>st</sup> century skills for students, including thinking skills. critical thinking, creativity, communication, collaboration, technology, information, and media literacy (Afandi et al., 2019). These skills have the final goal of cultivating a culture of peace and an attitude of respect for differences in every aspect of life and tolerance for conceptual change and conflict (Chalkiadaki, 2018). The development of 21<sup>st</sup> century skills is expected to create human resources who master technology that continues to develop rapidly and master the human aspect (Mardhiyah et al., 2021).

21<sup>st</sup> century skills are closely related to individual success in life. Social life, for example, is full of problems created by humans in relationships that exist both with the physical and non-physical environment, the more time goes on the problems will become more complex. Individuals who are successful in dealing with these problems with confidence are individuals who are equipped with critical thinking skills with a sense of responsibility, so that they can solve problems well without taking steps that can damage the future (Adeyemi, 2012). On the other hand, in today's economy, life is in a state of necessity for industrialization, Global CEO IBM 2010 revealed the results of his study, namely that the skill that is considered very important in today's business world is creativity. Furthermore, the positive impact of creativity on industrial performance is the ability to produce creative production (Anjaningrum & Sidi, 2018). Another skill that is no less vital in today's modern industrial world is communication which is often combined with collaboration, the target is skilled and effective oral and written communication in order to be able to face the challenges of collaborating with a heterogeneous environment (Dai, 2014; Chalkiadaki, 2018). However, in the 21<sup>st</sup> century, various aspects of life have been entered by the rapid development of ICT. It is further stated that what distinguishes 21<sup>st</sup> century skills from those of the previous century is related to the rapid emergence of technology, information and communication (Fatirul & As'ari, 2022). It is undeniable that technological advances in the 21<sup>st</sup> century trigger an explosion of information from various media. This condition raises the need for technology, information, and media management skills which are then categorized by the term technology, information and media literacy.

21<sup>st</sup> century skills are known to be integrated with each other and cannot be separated from the real life of students. However, it was found that the 21<sup>st</sup> century skills were low in students, including Dhaki (2022) finding the low creativity of students, Susilawati et al. (2020) on the criteria for low and very low critical thinking skills of students, and (Sintiawati et al., 2021; Sidi, P., 2020; Junindra et al., 2021; Sartyka et al., 2021) found low communication, collaboration, and technology, information, and media literacy of students. The problem of the low 21<sup>st</sup> century skills of students is also found in the MA Pertanian of Madiun City. The causal factors obtained from interviews and observations are the learning model used by the teacher is a conventional model where learning tends to be teacher-centered and the LKPD used has not integrated 21<sup>st</sup> century skills.

Real conditions in the field show a discrepancy with the expected ideal conditions, so learning strategies are needed that can improve the 21<sup>st</sup> century skills of students. Previous research by Cahyani et al. (2021), Maridi et al. (2019) and Vera et al. (2019) acknowledge that problem-based learning can improve students' 21<sup>st</sup> century skills, because they can connect theory and practice and develop skills such as critical thinking, communication, and collaboration. The relationship between problem-based learning and 21<sup>st</sup> century skills is that it can improve technological literacy skills through the use of cognitive-based technology, effective communication in the investigation process, and creativity in making products from a project (Mayasari et al., 2016). Several studies that have been conducted previously stated that 21<sup>st</sup> century skills of students can be trained by applying a learning model with a constructivist approach, one of which is a problem-based learning model (Problem Based Learning).

Improving the 21<sup>st</sup> century skills of students through learning models can be supported by teaching materials. In line with Lusiana (2021) who said that to support the mathematics learning process, teaching materials are needed that provide opportunities for students to learn independently. One example of teaching materials that can be used in learning to support students to become independent learners is LKPD (Sari, 2020). LKPD contains a set of activities in the form of working steps both theoretical and practical that make it easier for students to learn independently and understand the material (Aprilianti 2020). The use of LKPD can also help realize an effective learning process, arouse students' interest in learning, and raise curiosity to increase students' learning motivation, as well as improve students' problem solving abilities (Pratiwi., 2021) The use of problem-based worksheets that integrate 21<sup>st</sup> century skills makes it possible to facilitate the achievement of 21<sup>st</sup> century skills of students.

Previous research by (Agmita et al., 2021) developed student worksheets capable of improving critical thinking skills, creativity, communication, and collaboration. The empty space that can be continued in the research is student worksheets by integrating 21<sup>st</sup> century skills on components of technology, information, and media literacy with Geogebra Classic online-assisted software. The difference between this research and previous research is on the media used in working on student worksheet and student worksheet formats. In addition, the developed student worksheets are also integrated into online media so as to facilitate student access to student worksheets. The purpose of this development research is to produce student worksheets oriented to problem-based learning integrated 21<sup>st</sup> century skills that are valid, practical, and effective, so that it is hoped that the developed student worksheets can optimize 21<sup>st</sup> century skills and learning outcomes for 11<sup>th</sup> grade student of MA Pertanian in Madiun City. MA Pertanian in Madiun City as research setting because based on the analysis of problems presented by class teachers and principals that the school is still minimal in developing teaching materials, learning models, and learning media that improve the skills needed by students in the 21<sup>st</sup> century. Due to the lack of learning innovation, especially mathematics students, student achievement is less than optimal.

## 2. METHODS

The research carried out is a type of research and development or commonly known as R&D research. This study aims to create and develop a product in the form of Student Worksheet. The student worksheet developed are student worksheets oriented to problem based learning integrated 21<sup>st</sup> century skills. The subjects in this study were 11<sup>th</sup> grade students of MA Pertanian in Madiun City in the even semester of the 2021/2022 academic year. The research subjects were divided into 2 types, namely, limited trial subjects and field trials subjects. This development research used the ADDIE model introduced by Reiser and Mollanda. The ADDIE model in this study includes the stages of analyzing, designing, developing, implementing, and evaluating (Almelhi, 2021). At the analysis stage, an analysis of the potential and problems contained in the research area includes an analyzing of the curriculum, student worksheet, learning process, students, learning outcomes, and 21<sup>st</sup> century skills of students. Collecting data using interview techniques, observation, questionnaires, 21<sup>st</sup> century skills observation sheet and learning outcomes tests to find out the aspects needed in developing student worksheet. At the designing stage, instruments were compiled including material expert validation

sheets, media expert validation, student response questionnaires, and learning outcomes tests, student worksheet selection, and initial design of student worksheet which was designed based on the specification of learning objectives. At the developing stage, validation of the initial design, revision of stage I, limited trial, revision of stage II, and field trials was carried out. The data analysis of the validation sheet used Likert Scale and questionnaire used the Guttman scale, while the data analysis of the learning outcomes test used the Normalized Gain Score (N-Gain) test.

### 3. FINDINGS AND DISCUSSION

The results of the research that has been carried out are described as follows:

#### *a. Analysis*

At this stage, an analysis of potential and problems is carried out through interviews and direct observations by researchers at the MA Pertanian of Madiun City. The observation activities carried out encountered several problems at the research site, namely offline learning activities were carried out with a conventional model that tended to be teacher-centered learning, because students only listened to material explanations in the form of mathematical material formulas from the teacher and were not guided to find out the concept of a material independently. While the student worksheet used is a type of compulsory mathematics practical learning guide book. The student worksheet used only presents formulas and practice questions which tend to be less likely to guide students to find a concept independently, so that students find it difficult to understand the material. The student worksheet used also has not integrated 21<sup>st</sup> century skills. The learning model and student worksheet currently used have an impact on the lack of efforts to develop 21<sup>st</sup> century skills of students through learning activities.

The results of the interviews showed that the learning outcomes of students in terms of mathematics test scores were low. The classroom teacher revealed the causal factors, namely the teaching materials used were not in accordance with the needs of students and had not integrated 21<sup>st</sup> century skills, thereby reducing students' curiosity and ability to solve mathematical problems. Based on the analysis of problems and needs, it was concluded that students need a teaching material that can help facilitate students' understanding of the material by finding concepts and applying concepts obtained independently, as well as developing students' 21<sup>st</sup> century skills, so that researchers will develop student worksheets oriented to problem based learning integrated 21<sup>st</sup> century skills.

#### *b. Design*

At this stage, the initial product design includes the initial design of problem based learning oriented worksheets integrated with 21<sup>st</sup> century skills and the design of research instruments which include material expert validation sheets, media expert validation, student response questionnaires, and learning outcomes tests. The results of this initial design are in the form of draft I. The initial framework for the student worksheet to be developed can be seen in Figure 1.

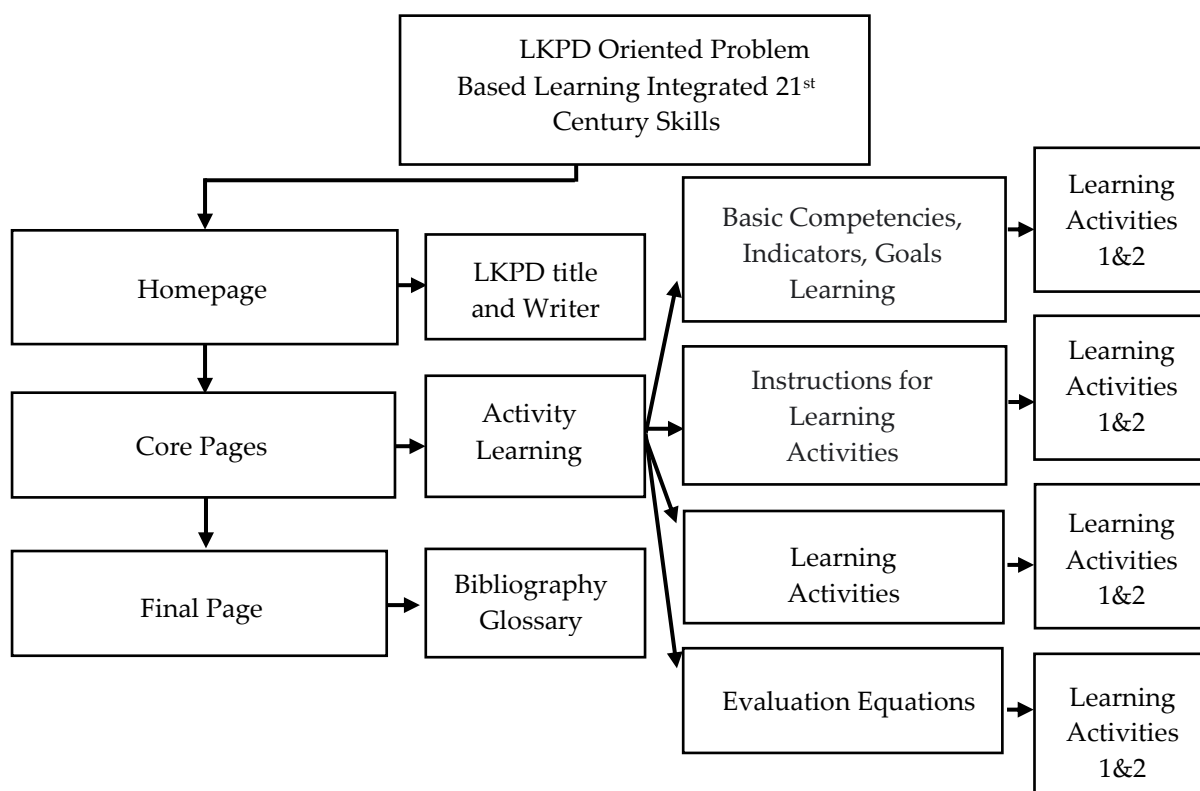


Figure 1. Schematic of The Student Worksheet Preliminary Framework

The explanation of each section in the student worksheet is described in Table 1.

Table 1. Student Worksheet Section

Number	LKPD Section	Contents	Description
1	Homepage	Cover	Contains the title of the student worksheet, the identity of the student worksheet, and the identity of the author.
		Introduction	Contains a preface, student worksheet description, instructions for using student worksheet, problem-based learning syntax, components of 21 <sup>st</sup> century skills.
2	Core Pages	Activity Learning	Contains parts of learning activities 1 & 2 which consist of basic competencies, indicators, learning objectives, instructions for learning activities, learning activities, and evaluation questions. Each of the learning activities contains research development which integrates 21 <sup>st</sup> century skills with problem-based learning syntax.
3	Final Page	Bibliography Glossary	Contains a list of references for writing references and terms contained in the student worksheet.

**c. Development**

At this stage, product development is carried out, namely student worksheets oriented to problem based learning integrated 21<sup>st</sup> century skills. The activities carried out are student worksheet validation, student worksheet revision, and student worksheet trials. Validation was carried out by material experts as validator I and media experts as validator II. After the student worksheet obtains a valid statement from validators I and II, then the student worksheet trial is carried out to see the

practicality and effectiveness of the developed student worksheet.

1) Development of Student Worksheet

The illustration of the initial design of the student worksheet can be seen in Figure 2 and Figure 3.

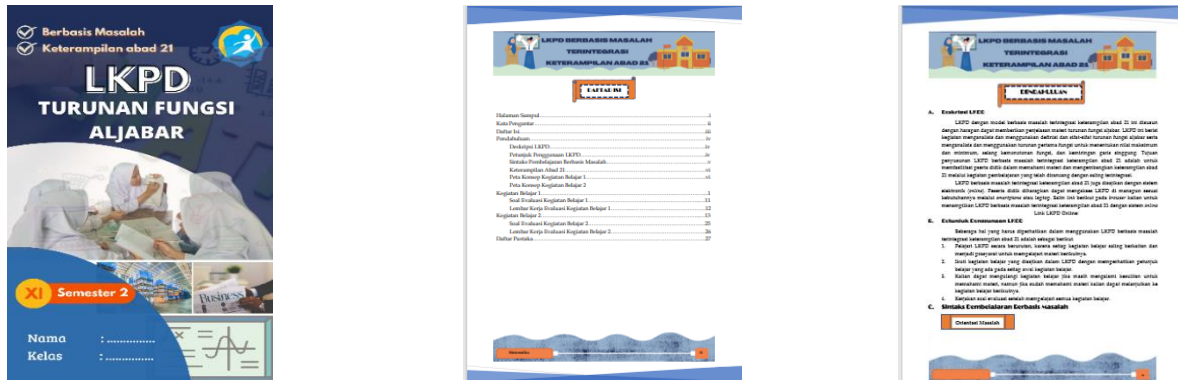


Figure 2. Cover Page, Table of Contents, and Introduction



Figure 3. Learning Activities, Learning Activities, and Evaluation Questions

2) Validity Test

The validity test was carried out to determine the feasibility of the developed student worksheet. From the results of the validation obtained suggestions and input by validators I and II to then be used as researchers as material for improving the draft I student worksheet. In this study, there are two validators, namely from material experts as validator I and media experts as validator II. The results of the data analysis of material expert validation and media expert validation can be seen in Table 2 and Table 3.

Table 2. Results of Material Expert Analysis

Number	Assesment Aspect	Percentage (%)	Criteria
1	Contents	85	Valid
2	Construct	82,50	Valid
3	Language	80	Valid
<b>Average</b>		<b>82,50</b>	<b>Valid</b>

The results of the analysis of the material validation data obtained the percentage of validity of the content aspect of 85%, the construct aspect of 82.50%, and the language aspect of 80%, so that the average percentage of validity was 82.50%. The results of the average percentage of material expert validation are more than 70%, so that according to Akbar (2013) the LKPD developed obtained a valid category with minor revisions.

While the results of the analysis of the validation of the problem-based LKPD integrated 21st century skills by media experts are presented in Table 3.

Table 3. Media Expert Validation Results

Number	Assesment Aspect	Percentage (%)	Criteria
1	LKPD Size	80	Valid
2	Cover Design	85	Valid
3	Content Illustration	86,67	Very Valid
4	LKPD Content Design	80	Valid
	<b>Average</b>	<b>82,92</b>	<b>Valid</b>

Based on the results of the media validation data analysis, the percentage of the validity of the module size aspect is 80%, the cover design aspect is 85%, the content illustration aspect is 86.67%, and the LKPD content design aspect is 80%, so that the average percentage of media expert validity is 82.92%. . The results of the average percentage of media expert validation are more than 70%, so that according to Akbar (2013) the LKPD developed obtained a valid category with minor revisions.

Based on the validation data analysis of material experts and media experts of problem-based LKPD integrated 21<sup>st</sup> century skills, the accumulated validity percentage is shown in Table 4.

Table 4. Accumulated Percentage of Validity Test Results

Number	Description	Percentage (%)	Criteria
1	Material expert validation	82,50	Valid
2	Media expert validation	82,92	Valid
	<b>Average</b>	<b>82,71</b>	<b>Valid</b>

Based on the accumulated percentage of the validity test of material experts and media experts, an average percentage of 82.71% was obtained, so that the student worksheet developed got a percentage of more than 70% and met the valid criteria with minor revisions (Akbar, 2013). The suggestions and inputs given by validators I & II can be seen in Table 5.

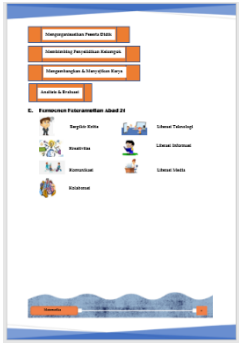
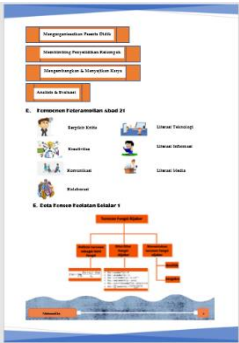

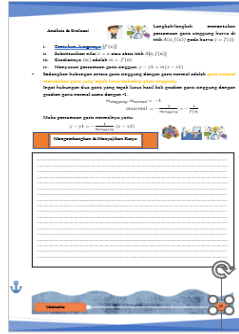
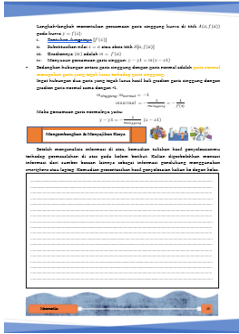


Table 5. Suggestions from Student Worksheet Validators

Number	Suggestion	Action
1	Add a concept map to the introduction to provide an overview to students regarding the material to be studied.	Add a concept map in the introduction to provide an overview to students regarding the material to be studied.
2	Write the source of the quote in the image used as an illustration.	Write the source of the quote on the image used as an illustration.
3	Add instructions to make it easier for students to understand.	Add instructions to make it easier for students to understand.
4	Add QR Code scan instructions, video tutorials on using Geogebra Classic software online.	Added QR Code scan instructions, video tutorials on using the Geogebra Classic software online.
5	Change the evaluation questions at the end of the learning activities in the student worksheet to be in the form of multiple choice.	Changing the evaluation questions at the end of the learning activities in the student worksheet to be in the form of multiple choice.

### 3) Design Revision

The revision of the initial student worksheet design was carried out based on suggestions for improvement from the material expert validators and media experts. Student worksheet will be tested after revision. The student worksheet section before and after the revision based on the suggestions of the validators can be seen in Table 6.

Table 6. Student Worksheet Revised Results

Number	Form	Physical Results		Description
		Initial	Final	
1	Initial design preliminary and final design preliminar			Add a concept map in the introduction to provide an overview to students regarding the material to be studied.
2	Material preliminary design and material final design			Write the source of the quote on the image used as an illustration.
3	Material preliminary design and material final design			Add instructions to make it easier for students to understand.
4	Initial design scan QR Code and final design scan QR Code			Added QR Code scan instructions, video tutorials on using the Geogebra Classic software online.

#### 4) Student Worksheet Trial

The LKPD that has been declared valid by the validator is then tested in a limited trial with 6 respondents and a field trial with 15 respondents. Students after carrying out learning activities by applying problem-based learning-oriented worksheets integrated 21<sup>st</sup> century skills then fill out student response questionnaire sheets and continue to take learning outcomes tests to see the practicality and effectiveness of the developed worksheets. The results of the analysis of the limited trial data which include the analysis of practicality and effectiveness can be seen in Table 7 and Table 9.

Table 7. Results of Student Worksheet Practicality Data Analysis in Limited Trials

Results	Learners					
	DN	AY	RD	HE	DA	AZ
Total Empirical Score	10	9	9	11	10	9
Total Expected Score	12	12	12	12	12	12
Validation Percentage	83,33%	75,00%	75,00%	91,67%	83,33%	75,00%
<b>Combined Percentage</b>	<b>80,56%</b>					

Based on the analysis of the student response questionnaire data in the limited trial, it showed that 100% of the 6 respondents gave a positive response with an average percentage of 80.56% so that it was included in the very practical category because the practicality percentage was more than 70% (Akbar, 2013). The suggestions from correspondents on the limited trial used as material for improvement of the Phase II student worksheet revision can be seen in Table 8.

Table 8. Comments and Suggestions from Respondents

Number	Responden	Comments and Suggestions
1	AY	Evaluation questions should be made in the form of multiple choice questions to make it easier to check answers.
2	RD	Regarding contextual problems, the sentences should be simplified so that they are easy to understand.

Testing the effectiveness of the developed student worksheet was carried out using pretest and posttest learning outcomes test data, then the data was analyzed using the Normalized Gain Score (N-Gain) test to determine the effectiveness of the student worksheet developed in a limited trial. The results of the effectiveness data analysis are in Table 9.

Table 9. Results of Effectiveness Data Analysis in Limited Trials

Learners	Pretest	Posttest	Posttest-Pretest	Max Score-Pretest Score	N-Gain Score	N-Gain Score (%)
DN	50	70	20	50	0,40	40,00%
AY	70	90	20	30	0,67	66,67%
RD	30	50	20	70	0,29	28,57%
HE	50	80	30	50	0,60	60,00%
DA	60	80	20	40	0,50	50,00%
AZ	40	60	20	60	0,33	33,33%
<b>Mean</b>	50	71,7	21,67	50	0,46	46,43%

Based on the results of the data analysis of the effectiveness of the limited trial, it was obtained an N-Gain score of 46.43% so that the developed student worksheet obtained a moderate effectiveness category because it was in the range of  $30 \leq \text{N-Gain} \leq 70$ . After a limited trial was carried out, product improvements were made based on suggestions from respondents, Then a field trial was carried out

with 15 students to see the practicality of using student response questionnaire data analysis and the effectiveness of the LKPD which was developed by analyzing learning outcomes test data. The results of the field trial data analysis which includes the analysis of practicality and effectiveness tests can be seen in Table 10 and Table 11.

Table 10. Results of Practical Data Analysis in Field Trials

Learners	Total Empirical Score	Total Expected Score	Validity Percentage	Combine Percentage
M	10	12	83,33%	
WK	10	12	83,33%	
A	10	12	83,33%	
NH	11	12	91,67%	
BN	9	12	75,00%	
SP	10	12	83,33%	
FT	10	12	83,33%	
Learners	Total Empirical Score	Total Expected Score	Validity Percentage	Combine Percentage
HN	11	12	91,67%	
EC	9	12	75,00%	
ES	9	12	75,00%	
IO	10	12	83,33%	83,33%
FI	10	12	83,33%	
IK	10	12	83,33%	
F	10	12	83,33%	
R	11	12	91,67%	

Based on the data analysis of the results of filling out the student response questionnaires in the field trial with 15 respondents, it shows that the average percentage is 83,33% so that it gets a very practical category because the practicality percentage is more than 70% (Akbar, 2013). Table 11 presents the results of pretest and posttest data analysis in field trials to determine the effectiveness of LKPD.

Table 11. Results of Effectiveness Data Analysis in Field Trials

Learners	Pretest	Posttest	Posttest-Pretest	Max Score-Pretest Score	N-Gain Score	N-Gain Score (%)
M	30	70	40	70	0,57	57,14%
WK	60	90	30	40	0,75	75,00%
A	40	80	40	60	0,67	66,67%
NH	50	80	30	50	0,60	60,00%
BN	50	70	20	50	0,40	40,00%
SP	40	80	40	60	0,67	66,67%
FT	30	70	40	70	0,57	57,14%
HN	60	90	30	40	0,75	75,00%
EC	50	70	20	50	0,40	40,00%
ES	40	70	30	60	0,50	50,00%
IO	40	70	30	60	0,50	50,00%
FI	30	60	30	70	0,43	42,86%

IK	60	80	20	40	0,50	50,00%
F	50	80	30	50	0,60	60,00%
R	40	70	30	60	0,50	50,00%
<b>Mean</b>	44,67	75,33	30,67	55,33	0,56	56,03%

Based on the results of the data analysis of the effectiveness of the field trial, it was obtained an N-Gain score of 56.03% so that the developed student worksheet obtained a moderate effectiveness category because it was in the range of  $30 \leq \text{N-Gain} \leq 70$ .

Research on the development of problem-based learning-oriented worksheets with integrated 21<sup>st</sup> century skills is carried out with the aim of producing student worksheets that are suitable for use in the learning process. Hamzah (2019) & Nindiawati et al. (2021) stated that the development and evaluation of a product must be able to meet three criteria, namely valid, practical, and effective. Problem-based worksheets based on integrated 21<sup>st</sup> century skills are declared valid, this is based on the average data analysis results from material experts and media experts which show a percentage of validity of 83.57%, so that according to Akbar (2013) the student worksheets developed obtained a valid category. The assessment from the validator shows that problem-based worksheets that integrate 21<sup>st</sup> century skills are suitable for students to use to find concepts independently and facilitate understanding of the material. The student worksheet developed is easy to use by students because it is equipped with material, practice questions, video tutorials, and solutions using both analytical methods and with the help of Geogebra Classic online software. Rahayu (2019) said that the use of contextual problems through problem-based learning activities to help students find concepts had a positive influence on learning outcomes. Wondo et al. (2020) and Afridiani et al. (2020) also said that the student worksheet which is equipped with the help of Geogebra software and supports independent learning activities can improve students' ability to understand mathematical concepts, so that students' interest and learning outcomes increase.

Problem-based worksheets based on integrated 21<sup>st</sup> century skills are stated to be practical, because based on the results of the questionnaire analysis of student responses in a limited trial with 6 respondents and a field trial with 15 respondents, it shows that the percentage of student worksheet practicality levels is 80.56% and 83,33%, so that according to Akbar (2013) the developed student worksheet obtained very practical criteria. Based on the results of the student response questionnaire, information was obtained that the student worksheet developed had the value of making it easier for students to find concepts through contextual problem solving and applying concepts obtained independently using analytic methods or with the help of Geogebra Classic online software. These results are in accordance with the research of Ruiz et al. (2021) that the process in the form of a guide to using the Geogebra Classic online software has a positive impact. Rahmi et al. (2019) said that to increase students' motivation in learning, one of them is using student worksheet which involves interactive multimedia. Meanwhile, according to students with integrated problem-based learning 21<sup>st</sup> century skills can learn mathematics easily and carry out investigations into problems in everyday life to find material concepts and learn to operate the Geogebra Classic online mathematics learning media software to help solve mathematical problems. This is reinforced by the research of Susbiyanto et al. (2019) that problem-based learning is effective in increasing students' conceptual understanding by starting with contextual problem orientation. In addition, students' understanding of mathematical concepts also increases through the use of Geogebra software (Wondo et al., 2020).

Problem-based worksheets based on integrated 21<sup>st</sup> century skills were declared effective in the medium category, because based on the analysis of the respondents' pretest and posttest results in limited trials and field trials, the N-Gain scores were 46.43% and 56.03%, respectively. Student learning outcomes test shows that after implementing problem-based learning-oriented worksheets integrated 21<sup>st</sup> century skills can improve student learning outcomes. In line with Lusiana et al. (2021) who conveyed the effectiveness of problem-based learning on mathematics learning achievement. Shodiqin & Zuhri (2017) reveal that innovative student worksheet based learning provides a higher

level of effectiveness than learning without innovative student worksheet based.

#### 4. CONCLUSION

Based on the results of the study, it was concluded that this research resulted in problem-based learning-oriented worksheets with integrated 21<sup>st</sup> century skills that meet the valid, practical, and effective criteria. The student worksheet developed met the criteria for validity of 83.57%, practicality of limited trials of 80.56% and field trials of 83.33%, as well as the effectiveness of limited trials of 46.43% and field trials of 56.03%. So that the developed worksheets are suitable for use in classroom learning. As for suggestions for further research, it is better to complete the student worksheet with evaluation questions that are integrated based on games as a medium for practicing student questions to increase students' motivation and understanding in studying derivatives of algebraic functions. The limitation in developing this student worksheet is that it has not been equipped with evaluation questions that can be accessed online.

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**Conflicts of Interest:** I report that I am a researcher from the PGRI Madiun University institution who conducts research at the MA Pertanian of Madiun City, a private school that can be influenced by the research reported in the attached paper with no financial interest whatsoever. These interests should be disclosed even though this may not constitute a conflict of interest.

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