Mathematical Connections in Statistics Student Worksheets

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Abstract: This research is development research conducted with the ADDIE development model, which aims to develop Student Worksheets (LKS) based on mathematical connections on statistical material for seventh-grade junior high school students. Data was collected by using questionnaires, interviews, and tests. The research respondents were 10 students consisting of 5 boys and 5 girls from SMP Al Irsyad Banyuwangi. Data analysis was carried out quantitatively and qualitatively. The results showed that the LKS based on mathematical connections met the valid criteria with a value of 4,53. LKS is also said to be practically based on the average student response which reaches more than 3,25. While the effectiveness of LKS is shown from classical completeness which reaches 90%. So that the product is declared fit for use. Furthermore, it is necessary to conduct trials with respondents on a large scale to determine their practicality and effectiveness.

Abstrak: Penelitian ini merupakan penelitian pengembangan yang dilakukan dengan model pengembangan ADDIE, yang bertujuan untuk mengembangkan Lembar Kerja Siswa (LKS) berbasis koneksi matematis pada materi statistika untuk siswa SMP kelas VII. Pengumpulan data dilakukan dengan metode kuisioner, wawancara, dan tes. Responden penelitian adalah 10 orang siswa terdiri dari 5 laki-laki dan 5 perempuan dari SMP Al Irsyad Banyuwangi. Analisis data dilakukan secara kuantitatif dan kualitatif. Hasil penelitian menunjukkan bahwa produk LKS berbasis koneksi matematis memenuhi kriteria valid dengan hasil validasi sebesar 4,53. Produk juga dapat dikatakan praktis yang dapat diketahui dari rata-rata respon siswa yang mencapai lebih dari 3,25. Sedangkan efektivitas produk ditunjukkan dari ketuntasan klasikal yang mencapai 90%. Sehingga produk dinyatakan layak untuk digunakan. Lebih lanjut perlu dilakukan ujicoba dengan responden dalam skala besar untuk mengetahui kepraktisan dan efektivitasnya.

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A. Introduction

Mathematics is one of the subjects taught from elementary school to university level in the curriculum structure in Indonesia. Mathematics is a lesson that has abstract characteristics and gradual concepts and principles (Wiryanto, 2020). Abstraction of objects in mathematics requires a connection with concrete things so that they can be more easily understood. Gradual concepts and principles show a connection between one concept and principle with another. This is confirmed by Bakhril et al (2019) that mathematical concepts have a connection with other concepts so when studying certain concepts in mathematics, prerequisites are needed from other concepts.

Connections in mathematics are known as mathematical connections. Dwirahayu & Firdausi (2016) explain that mathematical connection ability is a person's ability to show internal relationships (relationships between topics in mathematics) and external relationships (relationships of mathematics with other knowledge or with everyday life). Suherman also defines mathematical connection as the ability to link between mathematical concepts or rules, between mathematical concepts and other subjects, or with applications in real life (Puteri & Riwayati, 2017).

NCTM states that the indicators of mathematical connection are: (1) recognizing and using the relationship between mathematical ideas; (2) understanding how mathematical ideas are connected and constructed so that they are fully connected; and (3) recognizing and using mathematics in contexts outside of mathematics (Puteri & Riwayati, 2017). Meanwhile, Sumarmo explained that the indicators of mathematical connection are: (1) looking for the relationship between various representations of concepts and procedures; (2) understanding the relationship between mathematical topics; (3) applying mathematics in other fields of study or daily life; (4) understand the equivalent representation of a concept; (5) look for the relationship of one procedure with another procedure in an equivalent representation; and (6) apply the relationship between topics and between topics and between mathematics and topics outside of mathematics (Lestari & Yudhanegara, 2017).

Mathematical connection is one of the basic skills that should be mastered by students so that they can see mathematics as the knowledge that has links between topics, is useful in learning other knowledge, and is useful in life (Sugiman, 2008). But unfortunately not all students have this ability, one of which is at SMP Al Irsyad Banyuwangi.

SMP Al Irsyad is one of the schools in Banyuwangi that has been affected by learning loss due to the COVID-19 pandemic. Interviews with mathematics teachers showed that during the COVID-19 pandemic, learning was conducted online and students had difficulty understanding the material provided. This is indicated by the learning outcomes of students whose completeness is less than 80%. One of the effects of learning loss conditions in learning mathematics is the inability of students to relate mathematical concepts to other subjects and real life.

Learning in the form of blended does not directly solve the problem. Students need teaching materials that can assist in the learning process and include connectedness. This

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needs to be done because the available teaching materials still do not meet the expected criteria. For this reason, it is necessary to develop teaching materials in mathematics learning that include connectedness, with language and materials that are easily understood by students.

Prastowo explained that teaching materials are a set of learning tools or tools that contain materials and methods to achieve the expected learning objectives (Zuriah et al., 2016). The Ministry of National Education stated that teaching materials are all forms of written and unwritten materials used to assist teachers in learning in the classroom (Arsanti, 2018). Setiawan said that teaching materials can be divided into two criteria, namely print and non-print (Heryani & Rustina, 2018).

Following the conditions and needs of the mathematics learning process at SMP Al Irsyad, printed teaching materials were developed. Heryani & Rustina (2018) explain that printed teaching materials can be used directly without using other tools. Research conducted by Gazali (2016) shows that the development of mathematics teaching materials on social arithmetic and statistics material gets very practical results. This means that the teaching materials are suitable for use. Research by Yogaswara et al (2019) shows that teaching materials oriented towards strengthening character education in mathematics learning on statistical materials are appropriate for use in more subjects.

Various printed teaching materials can be developed to assist the learning process. One of them is the student worksheet. Trianto said that the worksheet is a guide for students to carry out investigations or problem-solving activities (Norsanty & Chairani, 2016). Ardiani et al.(2017) explain that worksheets are media used by teachers to convey learning to students so that they can learn independently.

Wijayanti said that the function of the worksheet is as a teaching material that can minimize the teacher's role by activating the student's role; teaching materials that make it easier for students to understand the material; concise and rich teaching materials; and facilitate the implementation of learning (Ernawati et al., 2017). While Alan et. al mentioned that the advantages of worksheets are that they are learning media that can be used independently by students; can activate students in learning; affordable price; contain more concise material; can replace other media; does not require electricity in its use; can display words, numbers, musical notation, two-dimensional images, and diagrams (Ermi, 2017).

In previous studies, various worksheets in mathematics learning have been developed with various bases. Such as worksheets based on mathematical representations of statistical material (Setiyani, 2017), worksheets based on reciprocal teaching on circle material (Iriani & Marlina, 2015), worksheets based on contextual approaches to circle material (Gitriani et al., 2018), each of which gave valid and feasible results to use. The results of this research become the basis for developing worksheets with other bases such as mathematical connections. Statistics material is used as the basis for developing worksheets. This is done because students still do not understand the material when taught in online learning.

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Based on the above study, this research is aimed at developing student worksheets based on mathematical connections and statistical material. This research is important to do to overcome the lagging of students in learning and accommodate students' needs to be able to link concepts in mathematics, mathematics and other subjects, and mathematics with problems in everyday life.

B. Method

This study uses the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The analysis was carried out on the previous learning process, curriculum analysis, and analysis of teaching materials used previously. In the second stage, the design of lesson plans, worksheets, and evaluation instruments was carried out. Development is the stage to realize product design. Implementation is a learning trial process. While the final stage is an evaluation process of all stages that have been carried out.

The study was conducted on October 3 to 20, 2021. This study aims to develop worksheets based on mathematical connections and learning support tools, as well as determine product quality. The product validity test was carried out by two experts consisting of a mathematics lecturer and a mathematics teacher. The product practicality test is known through student response questionnaires. While the product effectiveness test is known from the results of the final learning test. The learning respondents were 10th graders of SMP Al Irsyad Banyuwangi, consisting of 5 boys and 5 girls who were randomly assigned. The limitation of respondents was carried out during the recovery period after the COVID-19 pandemic.

Data were collected by using the questionnaire, interviews, and tests. Questionnaire instrument contains 4 answer choices. Interviews were conducted with guidelines. While the test is made in the form of 3 description questions. The data were analyzed in combination using the determination of the validity value as described by Hobri (2010), the determination of the value of the student response questionnaire according to Sudjana's explanation (Nugraha et al., 2020), and the determination of individual and classical completeness according to the Ministry of National Education (Roi, 2014). So that the mathematical connection-based worksheet product is said to be of high quality if it meets the valid criteria with a minimum validity value $4 \leq V_a < 5$, practical with the results of the respondent's approval of at least $2{,}6 \leq X \leq 3{,}25$, and effective with an individual completeness percentage KKM reaches a minimum of 80%.

C. Result and Discussion

1) Results

The results of the study contain five stages carried out in the ADDIE development model.

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Analysis

The results at this stage indicate that the learning process at SMP Al Irsyad Banyuwangi already uses a blended learning system. Face-to-face learning is used to discuss material while online is used to deliver assignments. The curriculum used is the 2013 curriculum. The basic competencies used in the development of this worksheet are: (1) analyzing the relationship between data using presentation (tables, line charts, bar charts, and pie charts); and (2) presenting and interpreting data in the form of tables, line charts, bar charts, and pie charts.

The textbooks that have been used are books from the Ministry of Education and are accompanied by practice questions from one of the publishers. Based on interviews with teachers, it is known that the two books are difficult to understand in language, do not contain steps for making diagrams and are less than optimal in providing examples of questions. These conditions become the basis for designing worksheets and learning tools (learning plans and evaluation instruments).

Design

At this stage, a grid of worksheets based on mathematical connections is made as shown in Table 1 below.

Table 1. Student Worksheet Grid Based on Mathematical Connection

Expected Mathematical Connection	Basic Competencies	Development Indicator
1. Looking for relationships between various representations of concepts and procedures	(1)	1. Students can make a table from the plant sales data given in the form of a story following statistical rules
	(2)	2. Students can create line charts, bar charts, or pie charts from the data on the spread of COVID-19 in the form of tables and stories according to statistical rules
	(2)	3. Students can create tables, bar charts, or pie charts from book sales data in the form of line charts according to statistical rules
2. Understand the relationship between math topics	(1)	1. Students can make a table of a measurement problem in the form of a story according to statistical rules
	(2)	2. Students can make a diagram of a measurement problem in the form of a table according to statistical rules
	(2)	3. Students can make a table of a social arithmetic material problem in the form of a story according to statistical rules
	(2)	4. Students can make a table of a problem on social arithmetic material in pictograms according to statistical rules

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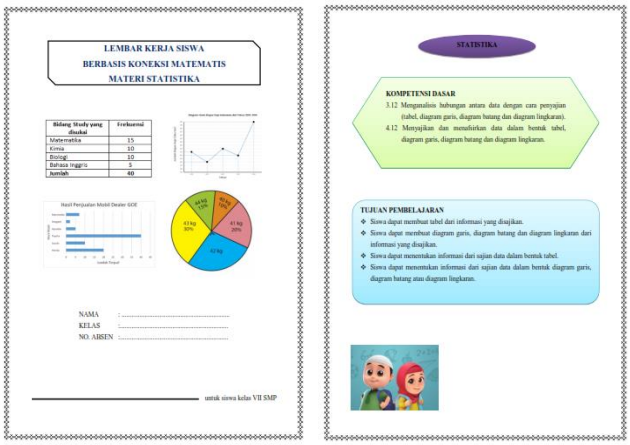
Expected Mathematical Connection	Basic Competencies	Development Indicator
3. Applying mathematics in other subjects or daily life	(1)	1. Students can make a table of a problem in everyday life in the form of a story according to statistical rules
	(2)	2. Students can make bar charts, line charts, or pie charts of a problem in everyday life in the form of stories according to statistical rules

Development

At this stage, a worksheet is developed according to the grid that has been made. The product contains a prefix, a core, and an ending. On the cover sheet, there are worksheet titles, supporting images, student identification columns, and the user's class level. The core of the product contains basic competencies, learning objectives, subject matter, supporting information work steps, as well as examples of question and their discussions. While the last part of the worksheet contains tests for students.



(a) (b)

Figure 1. (a) Cover sheet, (b) Initial Sheet Contains Basic Competencies and Learning Objectives

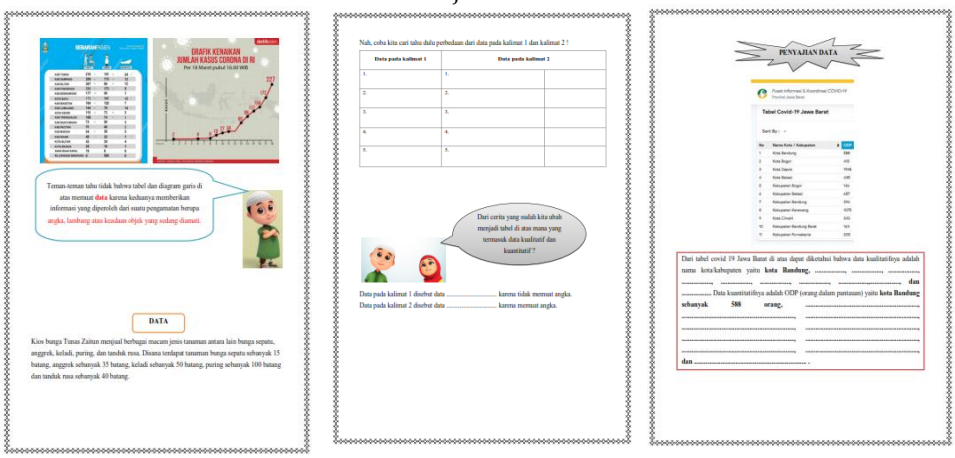


Figure 2. Core Sheet Loading Initial Data and Presentation of Data and Presentation

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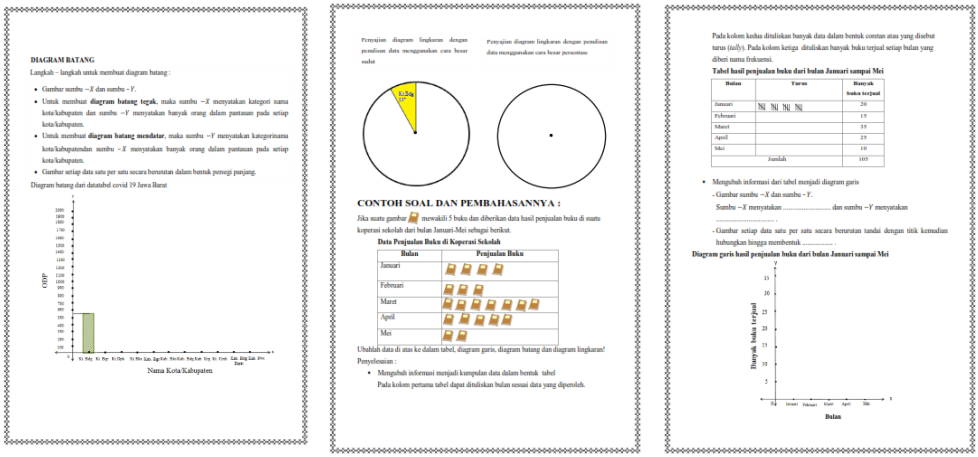

Figure 3. The Content Sheet Contains Example Problems and Discussions Related to Bar Charts, Pie Charts, and Line Charts

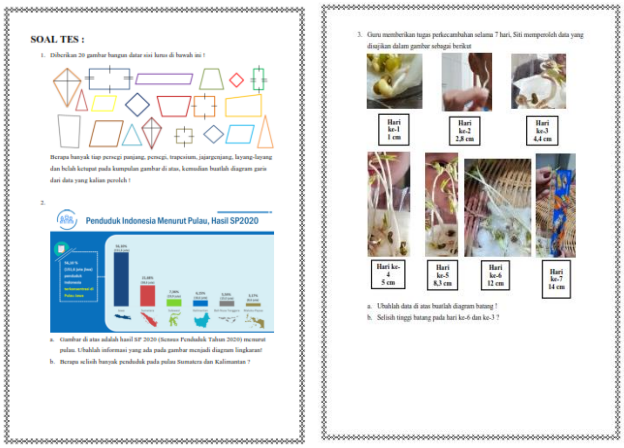

Figure 4. The End Contains the Test

Implementation

At this stage, validation and learning trials are carried out after the worksheet is declared valid. Worksheets and learning tools were assessed by 2 validators. The results are shown in Table 2 below.

Table 2. Validation Results

Rated Aspect	Indicator	Average Indicator Value (I_i)	Average Aspect Value (A_i)
Worksheet Organization	1. Contains basic competencies	5	4,67
	2. Contains performance criteria	4	
	3. Contains problems or examples of questions that match the mathematical connection indicators	5	
Procedure	1. Contains steps to solve a problem according to the mathematical connection indicator	4,5	4,25
	2. The writing is clear and the language is easy to understand according to the level of students	4	

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Rated Aspect	Indicator	Average Indicator Value (I_i)	Average Aspect Value (A_i)
Questions/ problems	1. Following core competencies, basic competencies, and performance criteria	4,5	4,75
	2. The problems created are based on the material developed and following the mathematical connection indicators	5	

The product validity shows an average of $V_a = 4{,}53$, meaning that the worksheet is valid. The validator provides input to include the completion method/step in the example. It is also recommended to add an example of a table containing the tour and number of books sold in the original issue. The goal is to be able to develop students' mathematical connections in various related topics.

After the worksheet is corrected and declared suitable for use, then learning is carried out at the destination school. Learning is carried out in two meetings. Learning aims to determine the practicality and effectiveness of the product. At the end of the lesson, students are given a response questionnaire to find out students opinions on the products used in learning. The results are shown in Table 3 below.

Table 3. Respondents' Questionnaire Results

Respondent	Material Aspect			Writing and Language Aspects		Design Aspect	
	1	2	3	1	2	1	2
A	S	S	S	SS	SS	SS	S
B	S	S	S	S	S	S	S
C	SS	SS	SS	SS	SS	SS	SS
D	S	SS	SS	SS	SS	SS	SS
E	S	S	S	S	S	S	S
F	S	S	S	S	S	S	S
G	S	TS	SS	SS	TS	S	S
H	SS	SS	SS	SS	SS	SS	SS
I	S	S	SS	SS	SS	SS	SS
J	SS	SS	SS	SS	SS	S	SS

The data is then processed and the results are obtained as shown in Table 4 below.

Table 4. Processing of Respondents' Questionnaire Results

Rated Aspect	Indicator	Choice				Weight	Ave rage
		1	2	3	4		
Theory	1. Mathematical connection-based worksheets on statistics material that have been used are easy to understand	0	0	7	3	33	3,3
	2. Examples of questions and their discussions in the mathematical connection-based worksheet are easy to understand	0	1	5	4	33	3,3

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Rated Aspect	Indicator	Choice				Weight	Average
		1	2	3	4		
	3. The test questions in the mathematical connection-based worksheet can be done	0	0	4	6	36	3,6
Writing and Language	1. The writing in the mathematical connection-based worksheet is clear and legible	0	0	3	7	37	3,7
	2. The language used in the mathematical connection-based worksheet is easy to understand	0	1	3	6	35	3,5
Design	1. Attractive mathematical connection-based worksheet display	0	0	5	5	35	3,5
	2. The figures and symbols contained in the mathematical connection-based worksheet are clear and easy to understand	0	0	5	5	35	3,5

Based on the data above, the results obtained for each indicator show an average of $X > 3{,}25$. The test is given at the end of the lesson to determine the effectiveness of the product. The test results are shown in Table 5 below.

Table 5. Respondents' Test Results

Respondent	M/W	Results
A	M	91
B	M	91
C	M	89
D	M	77
E	M	53
F	W	77
G	W	77
H	W	85
I	W	77
J	W	100

on the test results in Table 5, it can be seen that the class completeness reaches 90%.

Evaluation

At this stage, an evaluation of the entire process is carried out. The design of the worksheet is based on the results of the analysis of student conditions, curriculum, previous learning, and previous teaching materials. Furthermore, the design is developed so that it becomes a worksheet product. Then the worksheet was validated by two validators and showed a result of 4,53. These results indicate that the worksheet is valid (Hobri, 2010).

The results of the questionnaire analysis show that the average value for each indicator is more than 3,25. This means that the worksheet is practical (Nugraha et al., 2020). Meanwhile, class completeness has reached 90% (Roi, 2014) which means that the worksheets are effective. So in general it can be said that mathematical connection-based worksheets have good quality and are feasible to use.

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2) Discussion

Based on the results, it can be seen that the mathematical connection-based worksheets on statistical materials and learning tools meet the criteria of being valid, practical, and effective. This is following the requirements for the quality of development products in education, which must meet valid, practical, and effective criteria (Gazali, 2016; Leton et al., 2021; Melindawati, 2016). However, it should be understood that the results obtained are a form of learning on a limited scale. So that trials on a larger scale can be a continuation of this research.

Several things that need to be observed from the results of this study are the respondents who stated that they did not agree with the indicators of understanding the examples of questions and their discussions as well as indicators of understanding the language in the worksheets. This shows that not all students can understand the material given in the written form. This is supported by the research of Farisia et al (2021) which shows that the ability of the class still relatively low.

In addition, it is also known that the average test results of male students are less than female students. This is supported by research by Ahmad & Sehabuddin (2017) which shows that female students' mathematics learning outcomes are better than male students in one MTs in Mataram. In addition, Hafidz (2019) also explained the results of his research which showed that the learning outcomes of male students in grade VII of one of the junior high schools in Waru in addition and subtraction of algebraic forms had an average of less than female students. These findings can be developed to determine the relationship with mathematical connections.

D. Conclusion

Student worksheets based on mathematical connections that were developed on statistical material in grade VII junior high school showed a validation result of 4.53, the average student response was > 3.25, and classical completeness reached 90%. This means that the product reaches the criteria of being valid, practical, and effective. So that the product has good quality and is feasible to use. However, it should be noted that the practicality and effectiveness of the new product are tested on a limited scale. So further testing is needed to determine the real feasibility of the product.

This study found that the respondents were not optimal in understanding the material, questions, and discussions presented in written form. Respondents consider the language used is still difficult to understand. In addition, it is known that the average test results of male students are lower than female students. This is an opportunity to develop further research to find out the relationship between mathematical connections with reading comprehension and student learning outcomes.

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Mathematical Connections in Statistics Student Worksheets

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Abstract: This research is development research conducted with the ADDIE development model, which aims to develop Student Worksheets (LKS) based on mathematical connections in statistical material for seventh-grade junior high school students. Data was collected by using questionnaires, interviews, and tests. The research respondents were 10 students consisting of 5 boys and 5 girls from SMP Al Irsyad Banyuwangi. Data analysis was carried out quantitatively and qualitatively. The results showed that the LKS based on mathematical connections met the valid criteria with a value of 4,53. LKS is also said to be practically based on the average student response which reaches more than 3,25. While the effectiveness of LKS is shown from classical completeness which reaches 90%. So that the product is declared fit for use. Furthermore, it is necessary to conduct trials with respondents on a large scale to determine their practicality and effectiveness.

Abstrak: Penelitian ini merupakan penelitian pengembangan yang dilakukan dengan model pengembangan ADDIE, yang bertujuan untuk mengembangkan Lembar Kerja Siswa (LKS) berbasis koneksi matematis pada materi statistika untuk siswa SMP kelas VII. Pengumpulan data dilakukan dengan metode kuisioner, wawancara, dan tes. Responden penelitian adalah 10 orang siswa terdiri dari 5 laki-laki dan 5 perempuan dari SMP Al Irsyad Banyuwangi. Analisis data dilakukan secara kuantitatif dan kualitatif. Hasil penelitian menunjukkan bahwa produk LKS berbasis koneksi matematis memenuhi kriteria valid dengan hasil validasi sebesar 4,53. Produk juga dapat dikatakan praktis yang dapat diketahui dari rata-rata respon siswa yang mencapai lebih dari 3,25. Sedangkan efektivitas produk ditunjukkan dari ketuntasan klasikal yang mencapai 90%. Sehingga produk dinyatakan layak untuk digunakan. Lebih lanjut perlu dilakukan ujicoba dengan responden dalam skala besar untuk mengetahui kepraktisan dan efektivitasnya.

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A. Introduction

Mathematics is one of the subjects taught from elementary school to university level in the curriculum structure in Indonesia. Mathematics is a lesson that has abstract characteristics and gradual concepts and principles (Wiryanto, 2020). Abstraction of objects in mathematics requires a connection with concrete things so that they can be more easily understood. Gradual concepts and principles show a connection between one concept and principle with another. This is confirmed by Bakhril et al (2019) that mathematical concepts have a connection with other concepts so when studying certain concepts in mathematics, prerequisites are needed from other concepts.

Connections in mathematics are known as mathematical connections. Dwirahayu & Firdausi (2016) explain that mathematical connection ability is a person's ability to show internal relationships (relationships between topics in mathematics) and external relationships (relationships of mathematics with other knowledge or with everyday life). Suherman also defines mathematical connection as the ability to link between mathematical concepts or rules, between mathematical concepts and other subjects, or with applications in real life (Puteri & Riwayati, 2017).

NCTM states that the indicators of mathematical connection are: (1) recognizing and using the relationship between mathematical ideas; (2) understanding how mathematical ideas are connected and constructed so that they are fully connected; and (3) recognizing and using mathematics in contexts outside of mathematics (Puteri & Riwayati, 2017). Meanwhile, Sumarmo explained that the indicators of mathematical connection are: (1) looking for the relationship between various representations of concepts and procedures; (2) understanding the relationship between mathematical topics; (3) applying mathematics in other fields of study or daily life; (4) understand the equivalent representation of a concept; (5) look for the relationship of one procedure with another procedure in an equivalent representation; and (6) apply the relationship between topics and between topics and between mathematics and topics outside of mathematics (Lestari & Yudhanegara, 2017).

Mathematical connection is one of the basic skills that should be mastered by students so that they can see mathematics as the knowledge that has links between topics, is useful in learning other knowledge, and is useful in life (Sugiman, 2008). But unfortunately not all students have this ability, one of which is at SMP Al Irsyad Banyuwangi.

SMP Al Irsyad is one of the schools in Banyuwangi that has been affected by learning loss due to the COVID-19 pandemic. Interviews with mathematics teachers showed that during the COVID-19 pandemic, learning was conducted online and students had difficulty understanding the material provided. This is indicated by the learning outcomes of students whose completeness is less than 80%. One of the effects of learning loss conditions in learning mathematics is the inability of students to relate mathematical concepts to other subjects and real life.

Learning in the form of blended does not directly solve the problem. Students need teaching materials that can assist in the learning process and include connectedness. This

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needs to be done because the available teaching materials still do not meet the expected criteria. For this reason, it is necessary to develop teaching materials in mathematics learning that include connectedness, with language and materials that are easily understood by students.

Prastowo explained that teaching materials are a set of learning tools or tools that contain materials and methods to achieve the expected learning objectives (Zuriah et al., 2016). The Ministry of National Education stated that teaching materials are all forms of written and unwritten materials used to assist teachers in learning in the classroom (Arsanti, 2018). Setiawan said that teaching materials can be divided into two criteria, namely print and non-print (Heryani & Rustina, 2018).

Following the conditions and needs of the mathematics learning process at SMP Al Irsyad, printed teaching materials were developed. Heryani & Rustina (2018) explain that printed teaching materials can be used directly without using other tools. Research conducted by Gazali (2016) shows that the development of mathematics teaching materials on social arithmetic and statistics material gets very practical results. This means that the teaching materials are suitable for use. Research by Yogaswara et al (2019) shows that teaching materials oriented towards strengthening character education in mathematics learning on statistical materials are appropriate for use in more subjects.

Various printed teaching materials can be developed to assist the learning process. One of them is the student worksheet. Trianto said that the worksheet is a guide for students to carry out investigations or problem-solving activities (Norsanty & Chairani, 2016). Ardiani et al.(2017) explain that worksheets are media used by teachers to convey learning to students so that they can learn independently.

Wijayanti said that the function of the worksheet is as a teaching material that can minimize the teacher's role by activating the student's role; teaching materials that make it easier for students to understand the material; concise and rich teaching materials; and facilitate the implementation of learning (Ernawati et al., 2017). While Alan et. al mentioned that the advantages of worksheets are that they are learning media that can be used independently by students; can activate students in learning; affordable price; contain more concise material; can replace other media; does not require electricity in its use; can display words, numbers, musical notation, two-dimensional images, and diagrams (Ermi, 2017).

In previous studies, various worksheets in mathematics learning have been developed with various bases. Such as worksheets based on mathematical representations of statistical material (Setiyani, 2017), worksheets based on reciprocal teaching on circle material (Iriani & Marlina, 2015), worksheets based on contextual approaches to circle material (Gitriani et al., 2018), each of which gave valid and feasible results to use. The results of this research become the basis for developing worksheets with other bases such as mathematical connections. Statistics material is used as the basis for developing worksheets. This is done because students still do not understand the material when taught in online learning.

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Based on the above study, this research is aimed at developing student worksheets based on mathematical connections and statistical material. This research is important to do to overcome the lagging of students in learning and accommodate students' needs to be able to link concepts in mathematics, mathematics and other subjects, and mathematics with problems in everyday life.

B. Method

This study uses the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The analysis was carried out on the previous learning process, curriculum analysis, and analysis of teaching materials used previously. In the second stage, the design of lesson plans, worksheets, and evaluation instruments was carried out. Development is the stage to realize product design. Implementation is a learning trial process. While the final stage is an evaluation process of all stages that have been carried out.

The study was conducted on October 3 to 20, 2021. This study aims to develop worksheets based on mathematical connections and learning support tools, as well as determine product quality. The product validity test was carried out by two experts consisting of a mathematics lecturer and a mathematics teacher. The product practicality test is known through student response questionnaires. While the product effectiveness test is known from the results of the final learning test. The learning respondents were 10th graders of SMP Al Irsyad Banyuwangi, consisting of 5 boys and 5 girls who were randomly assigned. The limitation of respondents was carried out during the recovery period after the COVID-19 pandemic.

Data were collected by using the questionnaire, interviews, and tests. Questionnaire instrument contains 4 answer choices. Interviews were conducted with guidelines. While the test is made in the form of 3 description questions. The data were analyzed in combination using the determination of the validity value as described by Hobri (2010), the determination of the value of the student response questionnaire according to Sudjana's explanation (Nugraha et al., 2020), and the determination of individual and classical completeness according to the Ministry of National Education (Roi, 2014). So that the mathematical connection-based worksheet product is said to be of high quality if it meets the valid criteria with a minimum validity value $4 \leq V_a < 5$, practical with the results of the respondent's approval of at least $2{,}6 \leq X \leq 3{,}25$, and effective with an individual completeness percentage KKM reaches a minimum of 80%.

C. Result and Discussion

1) Results

The results of the study contain five stages carried out in the ADDIE development model.

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Analysis

The results at this stage indicate that the learning process at SMP Al Irsyad Banyuwangi already uses a blended learning system. Face-to-face learning is used to discuss material while online is used to deliver assignments. The curriculum used is the 2013 curriculum. The basic competencies used in the development of this worksheet are: (1) analyzing the relationship between data using presentation (tables, line charts, bar charts, and pie charts); and (2) presenting and interpreting data in the form of tables, line charts, bar charts, and pie charts.

The textbooks that have been used are books from the Ministry of Education and are accompanied by practice questions from one of the publishers. Based on interviews with teachers, it is known that the two books are difficult to understand in language, do not contain steps for making diagrams and are less than optimal in providing examples of questions. These conditions become the basis for designing worksheets and learning tools (learning plans and evaluation instruments).

Design

At this stage, a grid of worksheets based on mathematical connections is made as shown in Table 1 below.

Table 1. Student Worksheet Grid Based on Mathematical Connection

Expected Mathematical Connection	Basic Competencies	Development Indicator
1. Looking for relationships between various representations of concepts and procedures	(1)	1. Students can make a table from the plant sales data given in the form of a story following statistical rules
	(2)	2. Students can create line charts, bar charts, or pie charts from the data on the spread of COVID-19 in the form of tables and stories according to statistical rules
	(2)	3. Students can create tables, bar charts, or pie charts from book sales data in the form of line charts according to statistical rules
2. Understand the relationship between math topics	(1)	1. Students can make a table of a measurement problem in the form of a story according to statistical rules
	(2)	2. Students can make a diagram of a measurement problem in the form of a table according to statistical rules
	(2)	3. Students can make a table of a social arithmetic material problem in the form of a story according to statistical rules
	(2)	4. Students can make a table of a problem on social arithmetic material in pictograms according to statistical rules

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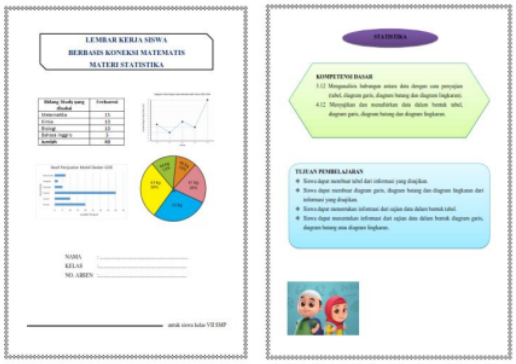
Expected Mathematical Connection	Basic Competencies	Development Indicator
3. Applying mathematics in other subjects or daily life	(1)	1. Students can make a table of a problem in everyday life in the form of a story according to statistical rules
	(2)	2. Students can make bar charts, line charts, or pie charts of a problem in everyday life in the form of stories according to statistical rules

Development

At this stage, a worksheet is developed according to the grid that has been made. The product contains a prefix, a core, and an ending. On the cover sheet, there are worksheet titles, supporting images, student identification columns, and the user's class level. The core of the product contains basic competencies, learning objectives, subject matter, supporting information work steps, as well as examples of question and their discussions. While the last part of the worksheet contains tests for students.



(a) (b)

Figure 1. (a) Cover sheet, (b) Initial Sheet Contains Basic Competencies and Learning Objectives

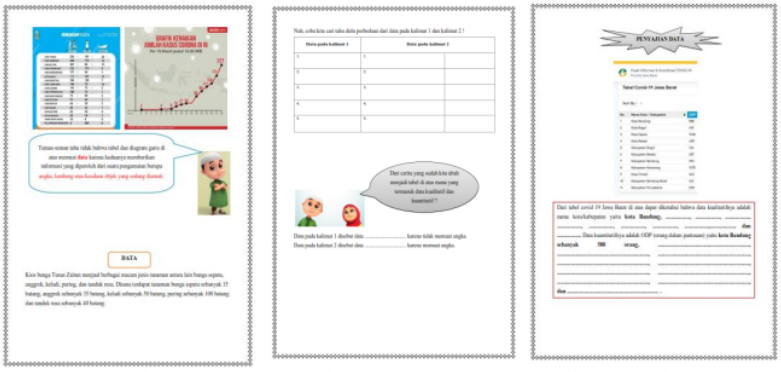


Figure 2. Core Sheet Loading Initial Data and Presentation of Data and Presentation

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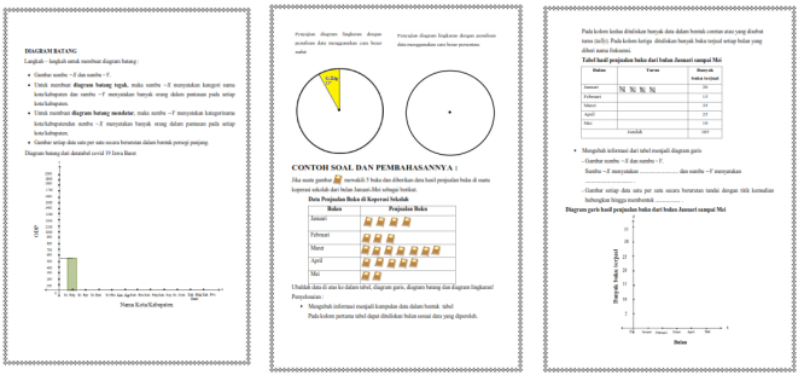

Figure 3. The Content Sheet Contains Example Problems and Discussions Related to Bar Charts, Pie Charts, and Line Charts

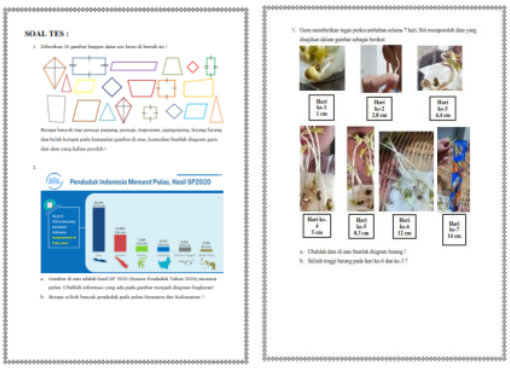

Figure 4. The End Contains the Test

Implementation

At this stage, validation and learning trials are carried out after the worksheet is declared valid. Worksheets and learning tools were assessed by 2 validators. The results are shown in Table 2 below.

Table 2. Validation Results

Rated Aspect	Indicator	Average Indicator Value (I_i)	Average Aspect Value (A_i)
Worksheet Organization	1. Contains basic competencies	5	4,67
	2. Contains performance criteria	4	
	3. Contains problems or examples of questions that match the mathematical connection indicators	5	
Procedure	1. Contains steps to solve a problem according to the mathematical connection indicator	4,5	4,25
	2. The writing is clear and the language is easy to understand according to the level of students	4	

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Rated Aspect	Indicator	Average Indicator Value (I_i)	Average Aspect Value (A_i)
Questions/ problems	1. Following core competencies, basic competencies, and performance criteria	4,5	4,75
	2. The problems created are based on the material developed and following the mathematical connection indicators	5	

The product validity shows an average of $V_a = 4{,}53$, meaning that the worksheet is valid. The validator provides input to include the completion method/step in the example. It is also recommended to add an example of a table containing the tour and number of books sold in the original issue. The goal is to be able to develop students' mathematical connections in various related topics.

After the worksheet is corrected and declared suitable for use, then learning is carried out at the destination school. Learning is carried out in two meetings. Learning aims to determine the practicality and effectiveness of the product. At the end of the lesson, students are given a response questionnaire to find out students opinions on the products used in learning. The results are shown in Table 3 below.

Table 3. Respondents' Questionnaire Results

Respondent	Material Aspect			Writing and Language Aspects		Design Aspect	
	1	2	3	1	2	1	2
A	S	S	S	SS	SS	SS	S
B	S	S	S	S	S	S	S
C	SS	SS	SS	SS	SS	SS	SS
D	S	SS	SS	SS	SS	SS	SS
E	S	S	S	S	S	S	S
F	S	S	S	S	S	S	S
G	S	TS	SS	SS	TS	S	S
H	SS	SS	SS	SS	SS	SS	SS
I	S	S	SS	SS	SS	SS	SS
J	SS	SS	SS	SS	SS	S	SS

The data is then processed and the results are obtained as shown in Table 4 below.

Table 4. Processing of Respondents' Questionnaire Results

Rated Aspect	Indicator	Choice				Weight	Average
		1	2	3	4		
Theory	1. Mathematical connection-based worksheets on statistics material that have been used are easy to understand	0	0	7	3	33	3,3
	2. Examples of questions and their discussions in the mathematical connection-based worksheet are easy to understand	0	1	5	4	33	3,3

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Rated Aspect	Indicator	Choice 1	2	3	4	Weight	Average
	3. The test questions in the mathematical connection-based worksheet can be done	0	0	4	6	36	3,6
Writing and Language	1. The writing in the mathematical connection-based worksheet is clear and legible	0	0	3	7	37	3,7
	2. The language used in the mathematical connection-based worksheet is easy to understand	0	1	3	6	35	3,5
Design	1. Attractive mathematical connection-based worksheet display	0	0	5	5	35	3,5
	2. The figures and symbols contained in the mathematical connection-based worksheet are clear and easy to understand	0	0	5	5	35	3,5

Based on the data above, the results obtained for each indicator show an average of $X > 3{,}25$. The test is given at the end of the lesson to determine the effectiveness of the product. The test results are shown in Table 5 below.

Table 5. Respondents' Test Results

Respondent	M/W	Results
A	M	91
B	M	91
C	M	89
D	M	77
E	M	53
F	W	77
G	W	77
H	W	85
I	W	77
J	W	100

On the test results in Table 5, it can be seen that the class completeness reaches 90%.

Evaluation

At this stage, an evaluation of the entire process is carried out. The design of the worksheet is based on the results of the analysis of student conditions, curriculum, previous learning, and previous teaching materials. Furthermore, the design is developed so that it becomes a worksheet product. Then the worksheet was validated by two validators and showed a result of 4,53. These results indicate that the worksheet is valid (Hobri, 2010).

The results of the questionnaire analysis show that the average value for each indicator is more than 3,25. This means that the worksheet is practical (Nugraha et al., 2020). Meanwhile, class completeness has reached 90% (Roi, 2014) which means that the worksheets are effective. So in general it can be said that mathematical connection-based worksheets have good quality and are feasible to use.

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2) Discussion

Based on the results, it can be seen that the mathematical connection-based worksheets on statistical materials and learning tools meet the criteria of being valid, practical, and effective. This is following the requirements for the quality of development products in education, which must meet valid, practical, and effective criteria (Gazali, 2016; Leton et al., 2021; Melindawati, 2016). However, it should be understood that the results obtained are a form of learning on a limited scale. So that trials on a larger scale can be a continuation of this research.

Several things that need to be observed from the results of this study are the respondents who stated that they did not agree with the indicators of understanding the examples of questions and their discussions as well as indicators of understanding the language in the worksheets. This shows that not all students can understand the material given in the written form. This is supported by the research of Farisia et al (2021) which shows that the ability of the class still relatively low.

In addition, it is also known that the average test results of male students are less than female students. This is supported by research by Ahmad & Sehabuddin (2017) which shows that female students' mathematics learning outcomes are better than male students in one MTs in Mataram. In addition, Hafidz (2019) also explained the results of his research which showed that the learning outcomes of male students in grade VII of one of the junior high schools in Waru in addition and subtraction of algebraic forms had an average of less than female students. These findings can be developed to determine the relationship with mathematical connections.

D. Conclusion

Student worksheets based on mathematical connections that were developed on statistical material in grade VII junior high school showed a validation result of 4.53, the average student response was > 3.25, and classical completeness reached 90%. This means that the product reaches the criteria of being valid, practical, and effective. So that the product has good quality and is feasible to use. However, it should be noted that the practicality and effectiveness of the new product are tested on a limited scale. So further testing is needed to determine the real feasibility of the product.

This study found that the respondents were not optimal in understanding the material, questions, and discussions presented in written form. Respondents consider the language used is still difficult to understand. In addition, it is known that the average test results of male students are lower than female students. This is an opportunity to develop further research to find out the relationship between mathematical connections with reading comprehension and student learning outcomes.

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Mathematical Connections in Statistics Student Worksheets

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