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Design Student Worksheet on the Topic of Ratio to Support Students' Computational Thinking Skills

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Abstract

One of the important skills in the 21st century is Computational Thinking (CT) skills. In PISA 2021, computational thinking aspect is one of the aspects measured in the field of mathematical assessment. But in reality, the computational thinking skill of Indonesian students is yet relatively low. This is shown from the results of the PISA (Programme for International Student Assessment) test in 2022 that Indonesian students got a score 366 which is the score is still below the average PISA score of 472. The lowest score is especially in the field of mathematical literacy or numeracy because in the test conducted by PISA, the question framework made has an element of computational thinking. To overcome this, a learning tool is needed, namely Student Worksheet. Learning through student worksheet can support students' computational thinking skills. The type of research is development study with the aim of producing student worksheet of ratio topic that is valid and practical and can support CT skills. The problems contained in the student worksheet can be solved according to the stages of CT indicators so that students are more directed and can develop their CT skills. Grade VII students at a junior high school in Palembang are the subjects in this study. This research uses the ADDIE development model through five stages, namely: (1) Analyze; (2) Design; (3) Development; (4) Implementation; (5) Evaluation. Data was collected and analyzed quantitatively using a table of validity and practicality criteria. The results of this study were obtained from the conclusion that the student worksheet was valid based on the comments and suggestions of the validator with an average percentage of validity of 84.86%. The average practicality of the student worksheet was 79.13%, which showed that the student worksheet were included in the practical criteria. In addition, the student worksheet developed contain problems that students solve in accordance with the stages of the computational thinking skills indicator.

Keywords: Student Worksheet; Computational Thinking Skill; Ratio.

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Abstrak

Salah satu kemampuan yang penting pada abad-21 adalah kemampuan Computational Thinking (CT). Pada PISA 2021, aspek computational thinking merupakan salah satu aspek yang diukur dalam bidang asesmen matematika. Tetapi faktanya, kemampuan computational thinking peserta didik Indonesia masih pada kategori rendah. Hal ini dibuktikan dari hasil tes PISA (Programme for International Student Assessment) tahun 2022 bahwasanya peserta didik Indonesia mendapatkan skor 366 yang mana skor tersebut masih di bawah rata-rata skor PISA sebesar 472. Skor terendah tersebut khususnya pada bidang literasi matematika atau numerasi sebab pada tes yang diadakan oleh PISA kerangka soal yang dibuat memiliki unsur computational thinking. Untuk mengatasi hal tersebut maka diperlukan perangkat pembelajaran yang digunakan yaitu Lembar Kerja Peserta Didik. Pembelajaran melalui lembar kerja peserta didik dapat menunjang kemampuan computational thinking peserta didik. Jenis penelitian ini adalah penelitian pengembangan dengan tujuan untuk menghasilkan lembar kerja peserta didik materi rasio yang valid dan praktis dan dapat mendukung kemampuan CT. Permasalahan yang terdapat pada lembar kerja dapat diselesaikan sesuai dengan tahapan indikator dari CT sehingga peserta didik lebih terarah dan bisa mengembangkan kemampuan CT. Peserta didik kelas VII di salah satu SMP di Palembang merupakan subjek pada penelitian ini. Penelitian ini menggunakan model pengembangan ADDIE melalui lima tahap, yaitu: (1) Analyze; (2) Design; (3) Development; (4) Implementation; (5) Evaluation. Data dikumpulkan dan dianalisis dengan kuantitatif sesuai tabel kriteria kevalidan dan kepraktisan. Hasil penelitian yang mendapatkan kesimpulan bahwa lembar kerja peserta didik valid berdasarkan komentar dan saran dari validator dengan persentase rata – rata kevalidan sebesar 84,86%. Rata-rata kepraktisan lembar kerja peserta didik yaitu sebesar 79,13% yang menunjukkan bahwa lembar kerja termasuk pada kriteria praktis. Selain itu, lembar kerja peserta didik yang dikembangkan memuat permasalahan yang diselesaikan peserta didik sesuai dengan tahapan indikator kemampuan computational thinking.

INTRODUCTION

In this 21st century which often referred to as the digital era, technology continues to evolve at a rapid pace. Among the essential competencies in this era is computational thinking (CT) ability (Christi & Rajiman, 2023; Li et al., 2020, Marchelin et al., 2022; Mulyono et al., 2023). CT is described as a mental process for identifying problems and designing solutions, which can then be executed by an information-processing device (Ye et al., 2023). In PISA 2021, computational thinking was one of the core domains assessed in mathematics (Zahid, 2020). Then, the government has also begun to be aware of the importance of the existence of computational thinking in the independent curriculum of Indonesian education (Megawati et al., 2023; Zahid, 2020). In addition to Indonesia, many countries have even officially included computational thinking in the curriculum, such as the European Union which has included computational thinking since 2016 (Bocconi et al., 2016) and Malaysia has also participated in integrating computational thinking in education starting in 2017 (Ung et al., 2018). So computational thinking have own importance role in learning.

However, current research shows that Indonesian students still exhibit relatively low levels of computational thinking (Fitrisyah et al., 2024; Hauda et al., 2024; Manullang et al., 2023), as shown in previous research that many students in Indonesia fail to meet the minimum competency standards (Jamna et al., 2022; Kamil et al., 2021). PISA test results, especially in the field of mathematical literacy or numeracy because in the test conducted by PISA, the question framework made has elements of computational thinking (Zahid, 2020). Numeracy is considered a field of science that is able to measure computational thinking skills because numeracy is able to train students to think logically, and is related to problem solving (Maharani et al., 2020). Based on the 2022 PISA (Programme for International Student Assessment) results also show that Indonesian students in mathematics obtained a score of 366 where the score is

still below the average PISA mathematics score of 472 (PISA 2022 Results (Volume I), 2023).

The low of students' computational thinking ability is due to the fact that students cannot developed abstract and algorithmic thinking skills in solving mathematical problems, only able to reach the stage of recognizing the patterns (Rosali & Suryadi, 2021; Supiarmo et al., 2021). The observation results Azizah et al (2022) as well show that computational thinking skills of students are still relatively low, because most students are incorrect in finding mathematical solutions. In addition, there is a lack of variation in the media or teaching materials used by teachers (Mulyani et al., 2018). Although the government has provided textbooks, there are shortcomings in terms of practice questions that are still limited and less interactive. Although the government has provided textbooks, there are shortcomings in terms of practice questions that are still limited and less interactive. The teaching materials used by teachers in the mathematics learning process that are often used are printed books. This printed book is used as the main source of learning. So, students still find it difficult to understand the material, because it does not contain a discussion of questions and answer keys that can be used as material for student evaluation. Therefore, the problem taken in this study is that there is no learning media in the content of ratio material with the right computational thinking approach to be used in improving students' computational thinking skills (Rahmania & Sulisworo, 2023). Beside that, mathematics learning still feels monotonous and does not involve students in its activities, so that it has an impact on low student learning outcomes (Nuursya'baani et al., 2022). This results in the value of student learning outcomes being difficult to increase. Thus, innovative approaches are necessary for designing effective learning tools to achieve targeted learning objectives. Learning becomes more efficient when these tools, such as student worksheets, are aligned with the intended competencies (Ali et al., 2022; Apriliyani & Mulyatna, 2021; Lisgianto & Mulyatna, 2021).

To overcome this, a learning tool is needed, namely student worksheet. Khumairoh & Hiltrimartin (2024) & Kurniasi et al (2022) mention that the existence of student worksheet can support students' computational thinking skill. Student worksheet is very suitable for used as a teaching material to accompany textbooks (Diani et al., 2019). According to Hasanah et al (2024), student worksheet is a type of printed educational resource that includes concise explanations and task instructions, guiding students toward achieving specified learning outcomes. According to Ayuningtiyas & Utomo (2023) that student worksheet it has been widely used, but the student workllsheet used is not designed by teachers, but uses student worksheet made by publishers. Student worksheet made by publishers is generally not in accordance with the characteristics and environment of students because it is less related to the real problems faced by students. In addition, the student worksheet available is only a short collection of questions. The images contained in the student worksheet are still limited and only in the form of black and white images which make it difficult for students to understand and less interesting. The student worksheet has not given encouragement to students to build their ideas independently. Accordingly, it is

required to develop a better student worksheet to be used as a supporting material that helps students succeed in learning (Tambunan, 2022).

Problem-solving in the topic of ratio is among the mathematical concepts most closely aligned with the development of computational thinking skills (Kadarwati et al., 2020). In understanding and solving ratio problems, students are trained to recognize patterns, make representations of data, break down problems into small pieces (decomposition), and apply logical and systematic steps (algorithmic thinking) all of which are key components of computational thinking. Ratio topic have many uses in daily life (Aini et al., 2020; Hamidah et al., 2018; Panjaitan et al., 2022; Sitanggang & Amry, 2022). Ratio consists of direct ratio and invers ratio (Herminingtyas, 2019). Therefore, it is very important for students to understand the topic. In fact, many students face difficulties in solving ratio problems (Purba et al., 2022; N. Maya. Sari, 2020; Sitanggang & Amry, 2022). The results of Herminingtyas (2019) study show that students cannot determine what is asked and know about the problem, students do not memorize multiplication and division, are not trained in solving ratio problems, and lack of creativity of teachers in providing supporting books and applying learning models. Therefore, the use of student worksheet is very appropriate to be used to create cooperation between students in solving problems of ratio topic.

Research on the development of student worksheet has been carried out by many researchers such as research conducted by(Darmawan et al., 2024; Fitriyani et al., 2023; Sakdiyah & Annizar, 2021) focuses on the development of student worksheet ratio topic, shown the student worksheet of the ratio developed meets the criteria of validity and practicality. The results of the study (Kurniasi et al., 2022; Ostian et al., 2023), focusing on the development of student worksheet to support students' computational thinking skills. The developed LKPD incorporates CT components such as decomposition, recognizing patterns, abstraction, and algorithmic reasoning. In addition, research related to the development of student worksheet based on proving APOS theory trigonometric function material also meets valid and practical criteria (Ardiansyah et al., 2024).

Related to the description above, it is necessary to have the latest research. What distinguishes this research from previous studies is its specific focus on the development student worksheet of ratio topic to support students' computational thinking skills. Therefore, this research will produce student worksheet ratio topic that meet the valid and practical categories to support students' computational thinking skills. Therefore, this research will produce student worksheet ratio topic that meet the valid and practical categories to support students' computational thinking skills. In this case, the ratio material was chosen because the characteristics of this material are closely related to the CT indicators, namely decomposition, pattern recognition, abstraction, and algorithms.

METHOD

This study is a design research type of development studies using the ADDIE model. The purpose of this study is to produce student worksheet of ratio topic that are valid and practical. The subjects in this study are grade VII students at a junior high school in Palembang in the 2024/2025 school year.

The development stages used in the ADDIE model are in accordance (Branch, 2009)with: (1) Analysis, which involves evaluating the curriculum, materials, and students needs; (2) Design, designs the initial product to be developed. This stage is divided into two stages, namely designing student worksheets and designing questions. The result get prototype 1 by focusing on three characteristics, namely content, construct, and language; (3) Development, researcher will improve the student worksheet prototype 1 based the validation results by 3 experts that have been stated valid and called prototype 2; (4) Implementation, products that have been stated valid by validators will then be tested on a one to one consist of 3 students and small group each group consist of 3 students. After testing the product, the researcher will distribute a questionnaire to determine the practical value of the product developed, so that practical worksheets are obtained for students; and (5) Evaluation, at the evaluation stage is used to determine the revision of the Student Worksheet which is produced based on comments from the previous stage.

Data collection was carried out using questionnaires—one for validating the product and another to measure its practicality from the users' perspective. The questions used were closed questionnaires. The analysis techniques carried out are validity analysis techniques and practicality analysis techniques. The results of the validity and practicality questionnaire, then calculations were carried out using a likert scale ranging from 1-4. The questionnaire used to see the validity of the product has several categories contained in Table 1.

Table 1. Validation Sheet Assessment Category

Score	Criterion
1	Not Good
2	Enough
3	Good
4	Excellent

Furthermore, to get the results of the student worksheet validation, use the following formula:

$$\text{Validity percentage} = \frac{Number\ of\ scores\ obtained}{Maximum\ score} \times 100\%$$

The data obtained is calculated as an average value which is then converted according to Table 2.

Table 2. Validity Criteria

Validity Level	Validity Criteria
85,1% - 100%	Highly valid, can be used without revision
70,1% - 85%	Quite valid, usable but needs minor revisions
50,1% - 70%	Less valid, recommended not to be used because it needs major revision
0,1%-50%	Invalid, unusable

Adapted from (Tuljannah & Khabibah, 2021)

The student worksheet is said to be valid if the average score of the quantitative assessment at this stage at least meets the criteria is quite valid. It will be revised again if there is a shortfall in the value obtained.

Furthermore, the practicality category can be seen in Table 3.

Table 3. Categories Assessment Practically Sheet

Statement of Attitude	Score	
	Positive	Negative
Strongly Agree (SS)	4	4
Agree(s)	3	3
Disagree (TS)	2	2
Strongly disagree (STS)	1	1

Next, determine the percentage of each statement on the questionnaire with the following formula:

$$N_p = \frac{Number\ of\ scores\ obtained}{Maximum\ score} \times 100\%$$

And determine the percentage of each statement on the questionnaire with the following formula:

$$N_a = \frac{Number\ of\ percentages\ obtained}{Lots\ of\ questions} \times 100\%$$

The average calculation results are converted according to Table 4.

Table 4. Practicality Criteria

Practicality Level	Practicality Criteria
81% - 100%	Very practical, can be used without revision
61% - 80%	Practical, can be used with minor revisions
41% - 60%	Less practical, it is recommended not to use it because it needs a major revision
21% - 40%	Impractical, unusable
0% - 20%	Very impractical, unusable

Adapted from (Irawan & Hakim, 2021)

The Student Worksheet is declared practical if the average student response is at least in the practical category

RESULT AND DISCUSSION

Results

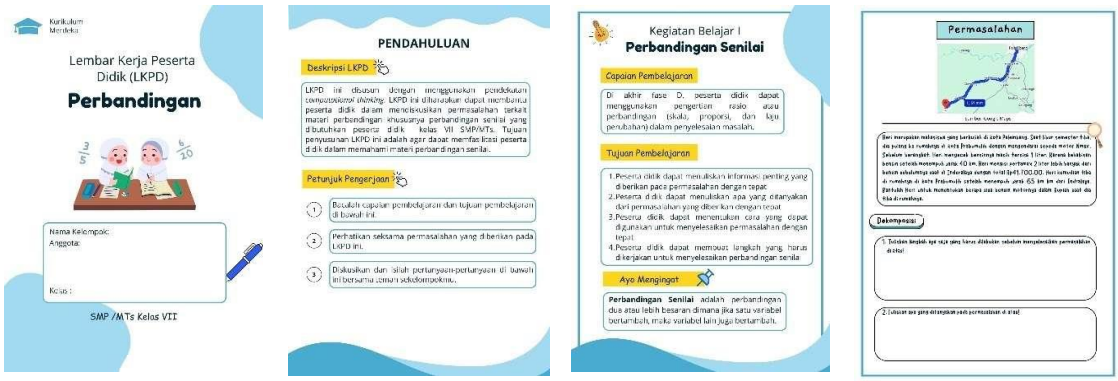
The description of the results of the development of the Student Worksheet on the ratio topic using the ADDIE model is as follows:

1. *Analyze Stage*

The results of the analysis of this study, the researcher conducted an assessment of the independent curriculum, the researcher mapped the learning outcomes as the basis in making learning objectives on ratio topic, especially in the direct ratio and the invers ratio. Because in general, students have difficulty distinguishing between the problem of direct ratio and invers ratio. Furthermore, the researcher also conducted interviews with mathematics teachers who teach in the research class. Interview results revealed that the use of student worksheets in classroom instruction is still uncommon. Teachers often rely on expository methods and are generally unfamiliar with computational thinking. Therefore, it is necessary to use student worksheet as a medium to support students' computational thinking skills.

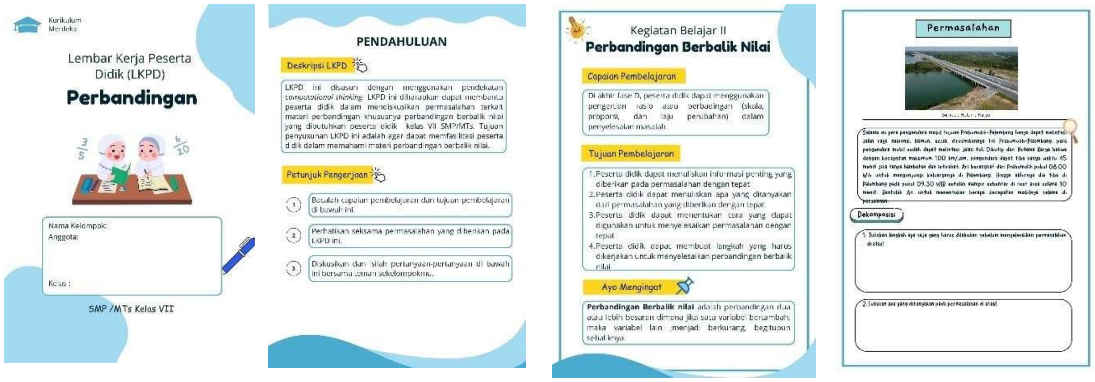
2. *Design Stage*

The researcher begins to design problems related to the material that will be included in the students' worksheets. Furthermore, the researcher designed a worksheet that contained: (1) the initial display of the worksheet including the title and identity of the learner (2) learning outcomes; (3) learning objectives; (3) material summary; (4) instructions for use; (5) problems that must be solved. There are 2 student worksheets designed with different sub-materials which are direct ratio and inverse ratio. Researchers create worksheets using the Canva app. The following is the result of the design of the student worksheet that was made called prototype 1 are shown in Figure 1 and Figure 2.



(a) (b) (c) (d)

Figure 2. Student Worksheet 1 Prototype 1



(a) (b) (c) (d)

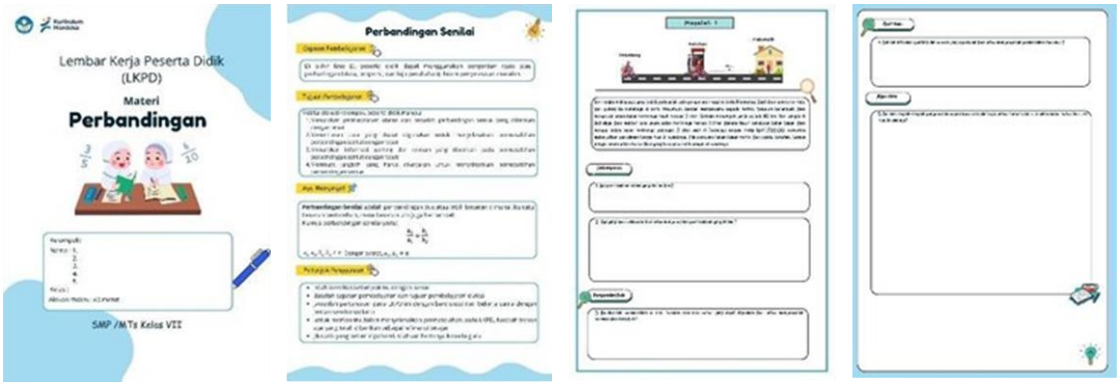
Figure 1. Student Worksheet 2 Prototype 1

On display (a) it contains the homepage of the student worksheet that designed including the title, material, and identity of the students. On display (b) contains a description of the student worksheet and instructions for working on the worksheet. On display (c) contains sub-material along with definitions, learning outcomes, and learning objectives. Next, the display (d) contains problems that students must solve according to the stages of the indicator of computational thinking skill, such as: (1) decomposition, related to what the main problem is and what must be done to solve the main problem, (2) pattern recognition, related to what formula or method is used to solve the problem, (3) abstraction, related to what important and relevant information is needed to solve the problem, and (4) algorithm, related to the steps to solve the problem in a sequential and logical manner. The goal is for students to be more directed in solving problems in accordance with CT ability indicators, so that students' CT abilities can emerge.

To evaluate the product, the researcher prepared validation and practicality instruments. The validation sheet allowed experts to assess the content, content, and language, along with providing suggestions for improving the student worksheet. Next is a practicality questionnaire given by students which aims to assess the statements given to find out the level of practicality of the student worksheet.

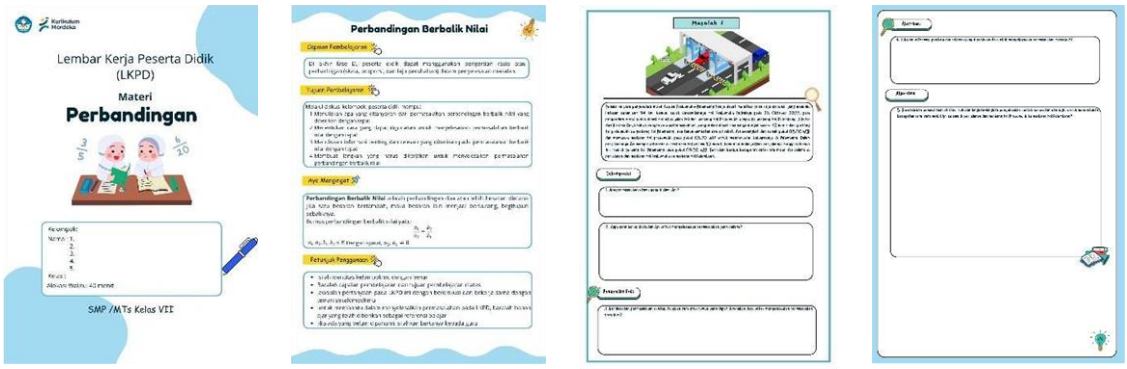
3. Development Stage

After the initial product is produced, the researcher conducts a validation process. Validation was carried out to 3 validators, namely 2 mathematics education lecturers and 1 mathematics teacher at the research site. The validation process was carried out 2 times and revised according to comments and suggestions from validators. The results of the revision of the student worksheet based on the direction of the validator called prototype 2 are shown in Figure 3 and Figure 4.



(a) (b) (c) (d)

Figure 4. Student Worksheet 1 Prototype 2



(a) (b) (c) (d)

Figure 4. Students Worksheet 2 Prototype 2

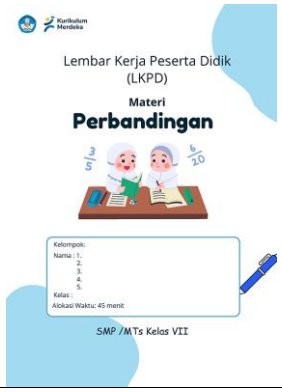
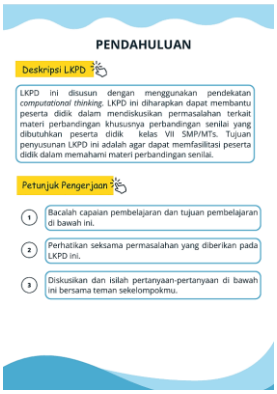
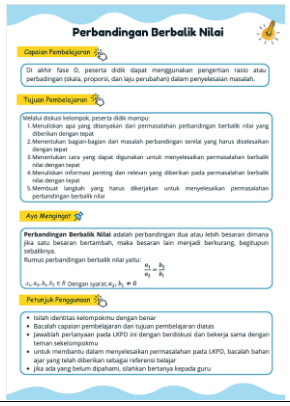
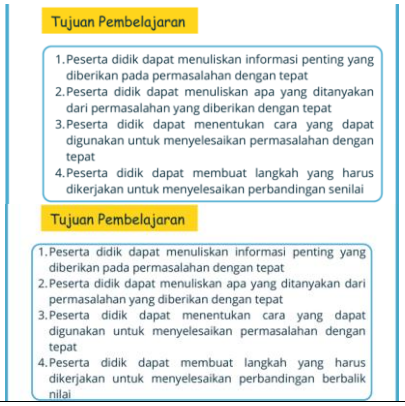
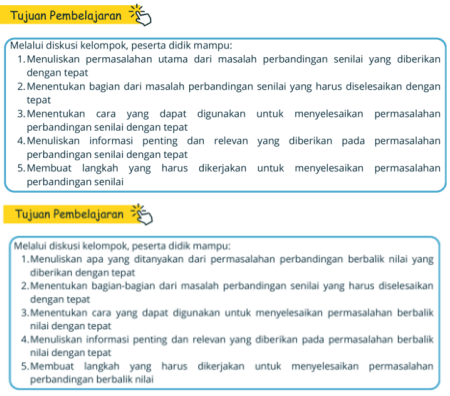
Furthermore, calculations are carried out from the validation results by validators which can be seen in Table 5.

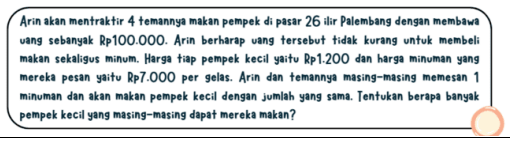
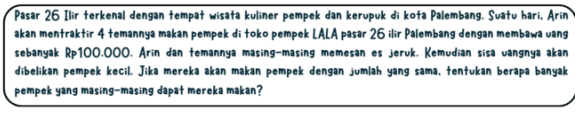
Table 5. Analysis of Expert Validation Results

Aspect	Average	Criterion
Content	81,25%	Quite Valid
Construct	83,33%	Quite Valid
Language	90%	Highly Valid
Total	84,86%	Quite Valid

Relevanced on the results presented in Table 5. above, it is concluded that the student worksheets developed have met the category of being quite valid with an overall average of aspects of 84,86% and suitable for use. However, there are a few things that should be revised based on comments and suggestions from validators, the results of which can be seen in Table 6.

Table 6. Result of Revision of Student Worksheet at the Validation Stage

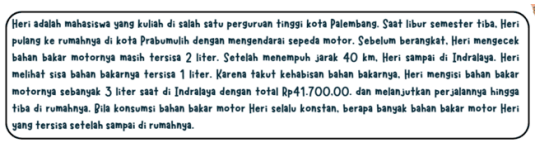
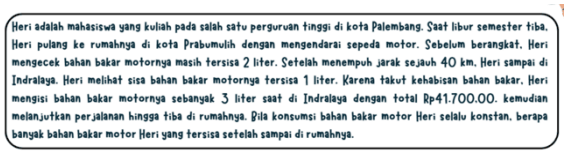
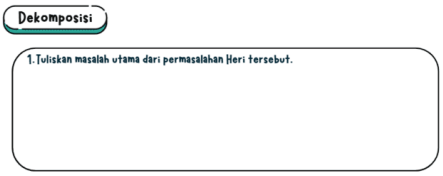
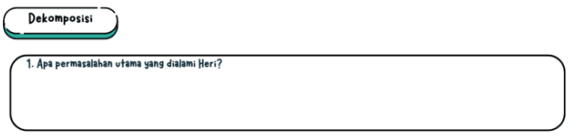
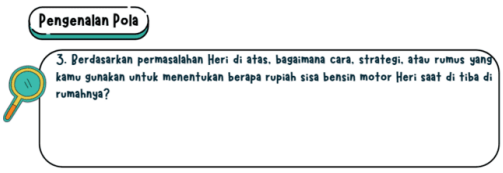
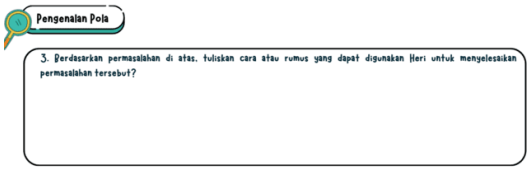
Initial Plan	Revision Resulta
There is no time allocation for working on student worksheet.	Time allocation has been added to the homepage of the student worksheet.
	
After the front page, immediately focus on the learning achievements and objectives, so that the description does not need to be included.	After the front page, go directly to the learning outcomes, learning objectives, material summary, and instructions for using student worksheet.
	
In the learning objectives, it is further clarified and adjusted to the problem in question, whether it is direct ratio problem or invers ratio problem. The font size is also too large.	The learning objectives have been clarified again in accordance with the sub-topic on the student worksheet. The font size has been adjusted.
	
The image on the issue was readjusted. The picture is expected to show the problem situation to students to know what is meant in the question.	The picture on the problem has been corrected to show the problem situation
It is recommended that in each student worksheet there are three problems that contain the scale, proportion, and rate of change in the sub-material.	There are already three problems in the student worksheet that contain the scale, proportion, and rate of change.

Fixed the problem of 2 worksheet 1 so that the results obtained are integer.	Problem 2 has been fixed so that the calculation result is in the form of an integer.
 Arin akan mentraktir 4 temannya makan pempek di pasar 26 ilir Palembang dengan membawa uang sebanyak Rp100.000. Arin berharap uang tersebut tidak kurang untuk membeli makan sekaligus minum. Harga tiap pempek kecil yaitu Rp1.200 dan harga minuman yang mereka pesan yaitu Rp7.000 per gelas. Arin dan temannya masing-masing memesan 1 minuman dan akan makan pempek kecil dengan jumlah yang sama. Tentukan berapa banyak pempek kecil yang masing-masing dapat mereka makan?	 Pasar 26 Ilir terkenal dengan tempat wisata kuliner pempek dan kerupuk di kota Palembang. Suatu hari, Arin akan mentraktir 4 temannya makan pempek di toko pempek LALA pasar 26 ilir Palembang dengan membawa uang sebanyak Rp100.000. Arin dan temannya masing-masing memesan es jeruk. Kemudian sisa uangnya akan dibelikan pempek kecil. Jika mereka akan makan pempek dengan jumlah yang sama, tentukan berapa banyak pempek yang masing-masing dapat mereka makan?

4. *Implementation Stage*

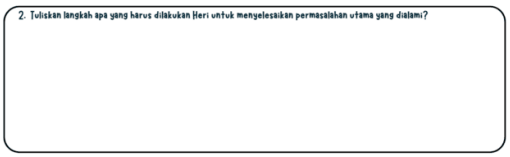
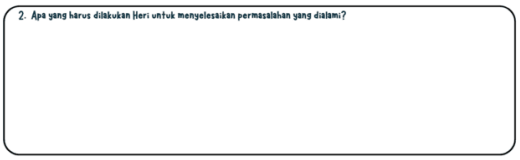
The student worksheet has been stated valid and suitable for use in the learning process. This implementation is carried out on one to one and small group trials. The students who were the subjects for the one-to-one trial consisted of three people. The purpose of this implementation is to observe the thinking process and students' response to the practicality of using the developed student worksheet. In the observation process carried out, it was found that students had difficulties in questions number 1 and 3. This is an input for researchers to revise the problems in the students' worksheets that will be tested in small groups. The researcher conducted the trial the one-on-one stage to make revisions, specifically correcting the sentences in questions 3 and 4 as shown in Table 7.

Table 7. Results of Revision of Student Worksheets in the One-to-One Stage

Before the Revision	After the Revision
Simplify problems.	
 Heri adalah mahasiswa yang kuliah di salah satu perguruan tinggi kota Palembang. Saat libur semester tiba, Heri pulang ke rumahnya di kota Prabumulih dengan mengendarai sepeda motor. Sebelum berangkat, Heri mengecek bahan bakar motornya masih tersisa 2 liter. Setelah menempuh jarak 40 km, Heri sampai di Indralaya. Heri melihat sisa bahan bakarnya tersisa 1 liter. Karena takut kehabisan bahan bakarnya, Heri mengisi bahan bakar motornya sebanyak 3 liter saat di Indralaya dengan total Rp41.700.00. dan melanjutkan perjalannya hingga tiba di rumahnya. Bila konsumsi bahan bakar motor Heri selalu konstan, berapa banyak bahan bakar motor Heri yang tersisa setelah sampai di rumahnya.	 Heri adalah mahasiswa yang kuliah pada salah satu perguruan tinggi di kota Palembang. Saat libur semester tiba, Heri pulang ke rumahnya di kota Prabumulih dengan mengendarai sepeda motor. Sebelum berangkat, Heri mengecek bahan bakar motornya masih tersisa 2 liter. Setelah menempuh jarak sejauh 40 km, Heri sampai di Indralaya. Heri melihat sisa bahan bakar motornya tersisa 1 liter. Karena takut kehabisan bahan bakar, Heri mengisi bahan bakar motornya sebanyak 3 liter saat di Indralaya dengan total Rp41.700.00. kemudian melanjutkan perjalanan hingga tiba di rumahnya. Bila konsumsi bahan bakar motor Heri selalu konstan, berapa banyak bahan bakar motor Heri yang tersisa setelah sampai di rumahnya.
Sentence correction in question number 1.	
 Dekomposisi 1. Tuliskan masalah utama dari permasalahan Heri tersebut.	 Dekomposisi 1. Apa permasalahan utama yang dialami Heri?
Sentence correction in question number 3.	
 Pengenalan Pola 3. Berdasarkan permasalahan Heri di atas, bagaimana cara, strategi, atau rumus yang kamu gunakan untuk menentukan berapa rupiah sisa bensin motor Heri saat di tiba di rumahnya?	 Pengenalan Pola 3. Berdasarkan permasalahan di atas, tuliskan cara atau rumus yang dapat digunakan Heri untuk menyelesaikan permasalahan tersebut?

After a one-to-one trial, a small group trial was carried out. The small group trial consisted of 9 people, each group consisted of three people. The students are different people in the one-to-one trial, but at the same school. In small groups, researchers give worksheet to students where they work in groups. In this case, the researcher accompanies students in working on worksheet.

Table 8. Results of Revision of Student Worksheets in the Small Group Stage

Before the Revision	After the Revision
Sentence correction in question number 2.	
	

After the students complete the worksheet, the researcher provides questions that students must fill in. The questions given are listed in a practicality questionnaire with a Likert scale. The results of the questionnaire sheets were calculated quantitatively which were then categorized to see the practicality of the student worksheet which can be seen in Table 9.

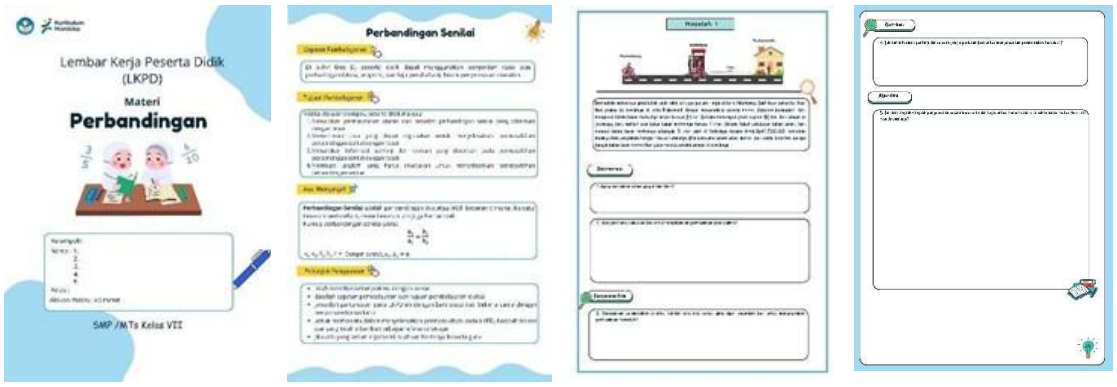
Table 9. Practical Result Analysis

Question	Percentage (%)	Criterion
1	80,6%	Practical
2	83,3%	Very Practical
3	77,8%	Practical
4	69,4%	Practical
5	94,4%	Very practical
6	88,9%	Very Practical
7	88,9%	Very Practical
8	66,7%	Practical
9	63,8%	Practical
10	91,7%	Very Practical
Average percentage	**79,13%**	**Practical**

Based on Table 9. The average percentage of the practicality questionnaire obtained from the calculation of 10 statement points was 79.13%. These results show that the student worksheets developed by the researcher are included in the practical criteria. This shows that the student worksheet that are designed and developed can be implemented well.

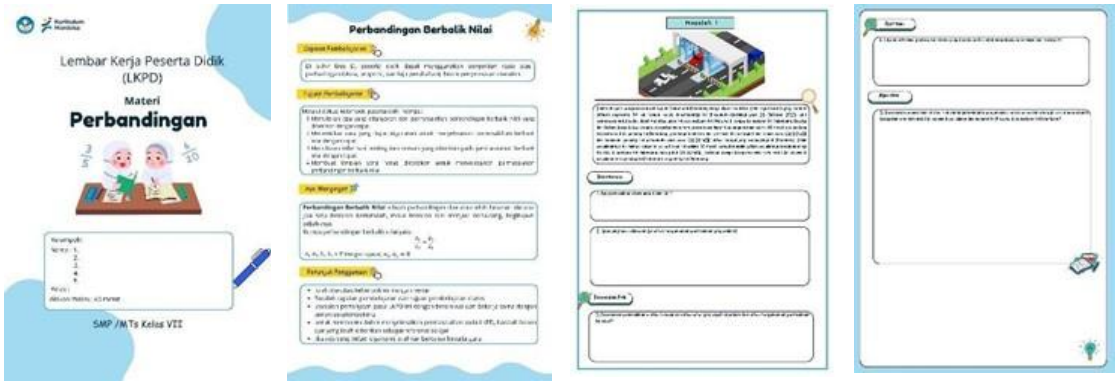
5. *Evaluation Stage*

Revisions were made to the student Worksheet which were produced based on comments from the previous stage. The results of the revision called prototype 3 are shown in Figure 5 and Figure 6.



(a) (b) (c) (d)

Figure 5. Students Worksheet 1 Prototype 3



(a) (b) (c) (d)

Figure 6. Students Worksheet 2 Prototype 3

Discussion

Based on the results of the expert validator, the student worksheet was declared valid so that it was worth testing, but before that in the validation activity there was a revision made by the researcher in accordance with the comments and suggestions from the validator. Furthermore, based on the one to one and small group stage that has been done, the students' worksheets were declared practical. This is in line with the purpose of the research, which is to produce student worksheets on ratio topic that valid and practical to support computational thinking skills.

This research is in line with research conducted by (Khumairoh & Hiltrimartin, 2024) those who developed student worksheet to support computational thinking skills that were declared valid. In addition, the research also develops student worksheet to support computational thinking skills that are declared valid and practical (Ostian et al., 2023; Septiana et al., 2024).

A good learner worksheet should be constructively appropriate to the learner's level of development, using a simple, clear, and uncomplicated sentence structure (Mubharokh et al., 2023). In addition, the attractive display makes it easier for students to better understand learning (Lathifah et al., 2021). In addition, the worksheets developed are also based on computational thinking skills. Computational thinking comprises four primary elements: problem decomposition, pattern recognition, abstraction, and algorithm (Junpho et al., 2022). These are embedded into the student worksheet design to align with modern digital education demands (R. M. Sari & Hapizah, 2020) in this case, there is a digital age so that computational thinking skills are in line with these developments. Students need to be familiar with the stages of solving comparative problems with the stages of computational thinking. CT plays a vital role in enabling students to identify problems, analyze them, and evaluate the effectiveness of possible solutions (Wu et al., 2024).

Integrating CT into instruction guides students in understanding how to approach and solve mathematical problems, such as ratio (Salwadila & Hapizah, 2024). As Lewis Presser et al. (2023) argue, CT-based learning aligns well with mathematical goals. Moreover, Lee et al (2023) emphasize that CT and mathematics mutually reinforce one another as core academic constructs. So that the implementation of

computational thinking-based learning has formed a framework for students to think computationally, building a foundation for future improvement (Hapizah et al., 2024).

Implication of Research

The implication of this study is that student worksheet make learning student-centered so that they become active in learning. Students become more flexible in solving daily problems related to the material being studied. Student worksheet can also be used as the latest teaching materials for teachers who can respond quickly in learning, and this student worksheet product can also be developed for material in other subjects by adjusting the content and learning design used.

Limitation

This study discusses ratio materials with sub-materials of direct ratio and invers ratio. The media produced in this study is a printed learning media in the form of student worksheet which are arranged based on indicators of computational thinking skills. Besides that, this study focuses on the validity and practicality aspects of student worksheet ratio material to support students' computational thinking skills, so it has not discussed or tested the effectiveness of the use of student worksheet on students' computational thinking abilities in the classroom.

CONCLUSION

Based on the results of the research, it was found that the student worksheet on the ratio topic that had been developed were included in the valid and practical criteria. The results of validity with an average percentage of 84.86% with criteria are quite valid. Then the results of the practicality test with an average percentage of 79.13% show practical criteria. So that valid and practical student worksheets are obtained. Therefore, student worksheet are declared worthy of being tested and used in the learning process. Further research is suggested that a trial can be carried out in schools to see the effectiveness of the use of student worksheets that have been developed.

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