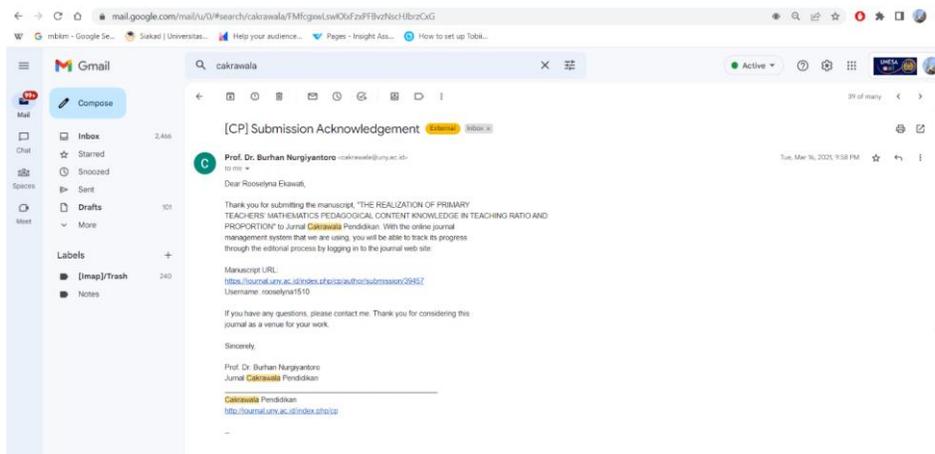


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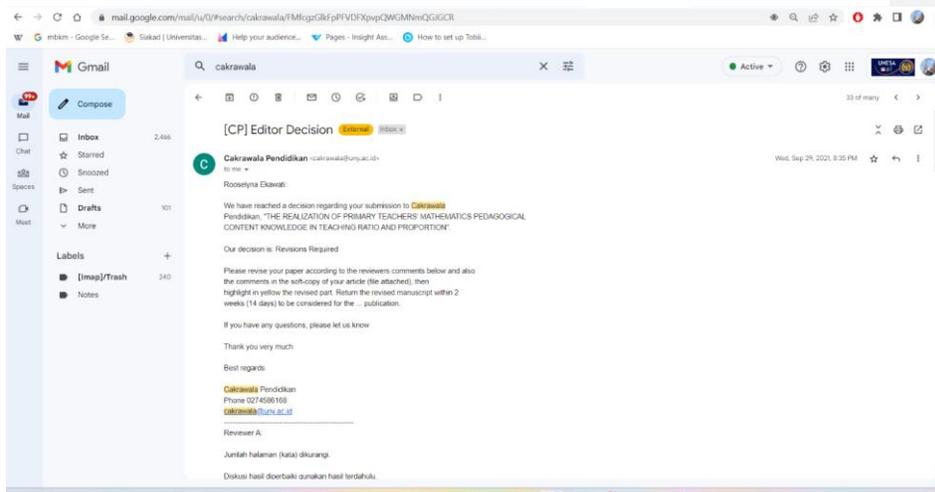
Judul : Investigating teachers' mathematics pedagogical content knowledge on ratio and proportion:
Does it exist in teaching?

1. Submit artikel ke jurnal Cakrawala Pendidikan (16 Maret 2021)
2. Editor decision (29 September 2021)
3. Editor decision 2nd round (23 Mei 2022)
4. Editor decision 3rd round (11 Juli 2022)
5. Editor decision (Accepted) (28 September 2022)
6. Available online (October 2022)

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Reviewer A

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Reviewer C

Dear Authors and Editor

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 "The Enactment of Mathematics Content Knowledge and Mathematics Pedagogical Content Knowledge in Teaching Practice of Ratio and Proportion: A Case of Two Primary"
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(3) Gap Analysis: What has been done?, and What needs to be done?

(4) Research objectives and excellence: introducing what is being done (researched), give the main purpose of this manuscript by including the novelty in this research.

METHOD

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METHOD

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 Has the data analysis technique been described as well?
 Has the technique of drawing conclusions in the study been clearly described in this section?

Add this research flow in the form of a chart

RESULT

The results of the research that are listed are like a Novel Book that tells about SPOCKMCKN and GO teachers. It is not appropriate to present research results in the form of scientific articles. Moreover, what is presented is not enough to answer the problem formulation.

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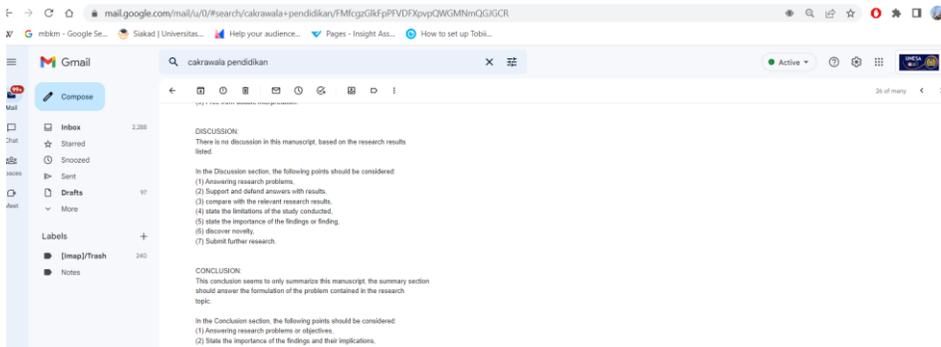
CONCLUSION

This conclusion seems to only summarize this manuscript, the summary section should answer the formulation of the problem contained in the research topic.

In the Conclusion section, the following points should be considered:
 (1) Answering research problems or objectives,
 (2) State the importance of the findings and their implications,
 (3) Don't recap the results but make a statement,
 (4) Use convincing statements (avoid "may be inferential...").

REFERENCES

The bibliography is marked in red, please replace it with the latest bibliography (within the last 10 years).
 244 Bibliography from the local and international journals (Conovic et al)

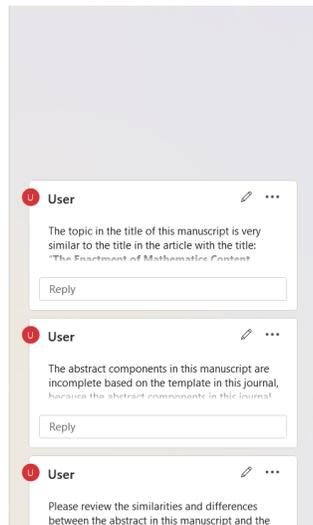


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THE REALIZATION OF PRIMARY TEACHERS' MATHEMATICS PEDAGOGICAL CONTENT KNOWLEDGE IN TEACHING RATIO AND PROPORTION

ABSTRACT

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strategy and knowing of students' conceptual understanding. The result from natural mathematics' teaching indicated that all components of teachers' MPCK can be observed appropriately in teacher's teaching practices, but some shared inappropriately due to teachers' different level of MPCK. In addition, teachers' teaching practices are influenced by not only the teachers' knowledge but also some other factors. The evidence leads to opportunity to learn for Pre and In-service primary learning trajectory which give opportunity to teacher to learn both Mathematics Content and Mathematics Pedagogy in a balance and integrated in courses.

Keywords: mathematics pedagogical content knowledge, mathematics teaching, primary teacher, ratio and proportion

INTRODUCTION

The attention of mathematics education research for more than fifty years has been paid to teachers' knowledge as key resources for mathematics teaching' behaviour. Effective mathematics teaching depends on the richness of teachers' knowledge (Mewborn, 2003, National Mathematics Advisory Panel, 2008, Fenstermacher, 1986; Shulman, 1986; Fawns & Nance, 1993). Several studies showed that strong mathematics' knowledge provided many examples of mathematics within teachers' teaching. Research on the assessment of Mathematics Teachers' Knowledge for Teaching (MKT) had been done such as by Hill et.al (2008). The MKT concept considers the teacher requirement a great deal of knowledge and expertise in carrying out the teaching.

In terms of the mathematics used in the instrument for measuring teachers' mathematics knowledge for teaching usually did not specific on one content. For instance, prior research on examining teachers' knowledge and teaching practice have been done through cross mathematics topics. There was lack of linearity of the teachers' content knowledge measured and content for teaching in those studies. Therefore, the enactment of teachers' knowledge in teachers' teaching practice could not be assessed specifically. Although many studies have explored teachers' teaching practices through the view of learning approach such as problem-solving (e.g. Anderson, White, & Sullivan, 2005; Andrews & Xenofontos, 2015), inquiry-based learning (Engeln, Euler, & Maass, 2013; Xie & Sharif, 2014), and realistic or contextual approach (Abrahamson, Zolkower, & Stone, 2020; Özdemir, 2017; Zulkardi, Putri, & Wijaya, 2020), there is a lack of research that explore teachers' knowledge in practice which focus on one specific contents in mathematics. Some findings investigating the teaching practices covered by the framework of teachers' MPCK were indeed investigated such as the MPCK on data handling (Leavy, 2015), rational number (Depaepe et al, 2018), and geometry (Brodie & Sanni, 2014). However, such an area of research which specifically investigates the extent to which teachers indicate their MPCK on ratio and proportion is not found.

This study extends the study of Ball et al (2008) and Ekawati et al (2015) about the construct of teachers' knowledge especially mathematics pedagogical content knowledge (MPCK) and skill unique to teaching on the topic of ratio and proportion. MPCK is closely related to Pedagogical Content Knowledge (PCK) studies in which is needed to be studied nowadays. MPCK includes complex interactions between knowledge of generic pedagogy, a strong understanding of the discipline of mathematics and a sound grasp of the principles of mathematics specific pedagogy (Kwong et al, 2007). Ekawati et.al (2015) described the component MPCK on ratio and proportion in their study consist of the knowledge how teachers make the content (ratio and proportion) understandable for students, the suitable teaching

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method for students that emphasized the topic proportional reasoning, the cognitive demand of mathematics task for students and the understanding of students' error and misconception.

Regarding these phenomena, the existence of Mathematics Pedagogical Content Knowledge of in need to be investigated within in-service primary teachers' teaching practices. To support the investigation, video-based research was done to capture behavior and enables wide ranges of analysis (Jacobs, Hollingsworth & Givvin, 2007). By the video-based research, mathematics' teachers' teaching behavior and its analysis could be done. Thus, the aim of this research is to explore the realization of Mathematics Pedagogical Content Knowledge (MPCK) of three primary teachers with different level of MPCK within their teaching practices through observation using video vignettes.

METHOD

Participants

This study used descriptive qualitative research in which it investigated the different teaching behaviour of in-service primary teachers with different MPCK categories on the content of ratio and proportion. A case study was chosen to be a way of investigating an empirical topic by following a set of pre-specified procedures (Yin, 1994). We chose three in-service primary teachers from 271 teacher participants that had been categorized based on paper and pencil test of MPCK result from our previous study (Ekawati et al, 2015). MPCK data was analyzed with cluster analysis as well as Exploratory Factor Analysis (EFA) and resulted Good, Medium and Low MPCK categories. The participants of this study were three primary teachers selected from Ekawati's (2015) teacher participants categorized in the group of Good (G), Middle (M) and Low (L) for MCK and MPCK respectively (Ekawati et.al, 2015). We coded the three teachers as GG, MM and LL respectively for Good MCK and MPCK, Middle MCK and MPCK and Low MCK and MPCK. Three meetings for teaching ratio and proportion in grade 5 were recorded for each teacher.

Framework for analyzing MPCK on teaching video observation

The three MPCK factors resulted from Exploratory Factor Analysis on paper and pencil test (Ekawati et.al, 2014, 2015) were the main component for observation such as Knowing students' conceptual understanding, Ratio and Proportion Task Level Feature and Teaching Problem Solving Strategy. Thus, these three factors become aspects of analysis of teachers' teaching practices during teaching observation. However, the presentation could be appropriate and inappropriate with regards to several resources in relation to ratio and proportion teaching. Therefore, each of aspects can be described as three possible coding, i.e. presented and appropriate, presented and inappropriate, and not presented. Table 1 shows the framework for analyzing the existence of MPCK in mathematics teach with the criteria for presentation MPCK in teaching ratio and proportion. Taking and recording of the teaching practices on ratio and proportion of each teacher participants took place during two meetings using two video cameras that capture teacher's teaching and students learning. Since the analysis were in the form of video, we applied type of whole-to-part of Erickson's (2006) approaches of analyzing video-based data. Therefore, the steps of analyzing video started from 1) reviewing the entire recorded interactional event as a whole, 2) reviewing the entire event again, stopping it, and, if necessary, replaying it at major section boundaries to look for, locate, and label its major constituent parts, 3)

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Add this research flow in the form of a chart.

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There are three factors?

choosing within an episode of interest, in which the interest is around the aspects of analysis provided in table 1 by firstly transcribing the verbal and nonverbal listening reactions was carried out in step 3), and 4) continuing the analysis by focusing only on relevant analysis points and narrowing them down sufficient descriptive information to answer the research question was obtained.

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What are these four steps of analysis based on? Or In whose opinion? Where did it come from?

Table 1. Framework for analyzing video teaching with regard MPCK

Aspects	Presented and Appropriate	Presented and Inappropriate	Not Presented
Ratio and Proportion Task Level Feature (MPCK)	<ul style="list-style-type: none"> - Launch task that is mathematically appropriate and enables students to work productively - Teacher gave flexible task to students in terms of number structure and situation presented (i.e give different task to different group of students) - Teacher made change of the task difficulty level with regard the number structures and situation presented (i.e the task contains hierarchical number structures as suggested by Hart (1981); Situation were changed from ratio as comparing quantity situation to situation with geometrical properties 	<ul style="list-style-type: none"> - Teacher did not make change of the structures of the task (i.e number structures and situation). - The tasks presented contain inappropriate number structure and situation. - Students were disabled to work productively with the task given due to a lot of intervention from teachers. - The tasks discussed were not proportional problem. - The task contains easy number structure but there was no discussion and intention on the multiplicative relation within it. 	
Teaching Problem Solving strategy (MPCK)	<ul style="list-style-type: none"> - Teacher guided and shared unitary method to students for proportional problem. - Teacher guided students to understand several problem-solving strategies instead of directly share the strategy (i.e. discuss about cross multiplication strategy, equivalence fractions, etc.). - Teacher gave opportunity to students to explore the solution 	<ul style="list-style-type: none"> - Teacher shared formula to be memorized by students. - Teacher did not elicit students' description. - There was no feedback given to students when they shared errors. - If students shared error, teacher directly shared her/his evaluation by stating it was wrong. 	

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Because all the contents (aspects) of the presentation in Table 1 are already contained in the previous article.

	<p>of proportional problem with their own strategy.</p> <ul style="list-style-type: none"> - Teacher guides students to check their solution answer - Teacher shared guided questions when they had misconception in solving proportional problem. - Teacher guided students' misconception by reminding them to previous lesson related to the problem. - Teacher asked about the steps they used. - Teacher ask 'why' question that contribute to build good explanation. 		
Knowing students' conceptual understanding	<ul style="list-style-type: none"> - Teacher posed task/question that possible for students to have misconception (i.e. number structure arranged for possible addition strategy to proportional problem) - Teacher asked question that have more than one answer to students. - Teacher respond to, use or otherwise address student error - Discuss students' error to whole class. 	<ul style="list-style-type: none"> - There was no specific support to students to aware misconception. - Teacher did not response on students' questions. - Address students' errors with pointed its errors. - Teacher gave hints to students' errors by directly stated the formula without underline reason. - Teacher missed the point of students' errors. 	

One of those three codings was given to each of aspects of analysis based raters' observation using the aspects provided in table 1. To obtain the valid and reliable data, we employed data source triangulation techniques by adding, modifying, and merging such codings with the observation data which was not recorded by the video we obtained from some field notes (Patton, 2002). The minimum match rates of three observer coders on the coding log observation of MPCK in teaching ratio and proportion was 85% which showed a reliable observation.

RESULT AND DISCUSSION

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The Potential of realization of MPCK in GG teaching

GG teacher explained the application of ratio and proportion in daily life such as for preparing ingredient to make a birthday cakes and sharing the watermelon to family. She mentioned that ratio and proportion content were related to the previous lesson which was fraction. To illustrate the used of ratio, GG provided a context of sharing watermelon and draw a circle to be divided and shared into 6 people so that the first ratio number structure that students grab was 1 : 6. She shared ratio as comparing quantities in which she showed three board markers and three rulers and asked question of the ratio of the number of ruler to all ruler and board marker. She pointed the number of ruler was three and whole was six and formulated ratio 3 : 6. In this example stage also, GG focused on the variance of number structure with regards the quantity of ruler and board marker. Afterwards, in the students' work time stage, GG made students' group to work on the shared worksheet with ratio table in it.

There were some non-integer multiple number structure resulted from student's data of number of boys and girls such as the ratio of boys to all students in group AB and ratio of girls to all students in group AB were $\frac{2}{11}$ and $\frac{9}{11}$ respectively. There was an error made by a group of students in determining the ratio of boys and girls in group AB. GG used this error for discussion and asked all students to explore why that group show different result. There was a verbal negotiation in the discussion between teachers and students to perform the correct answer. In the negotiation, GG highlighted students' thoroughness in reading the problem and stating the ratio. Afterwards, with regard proportion, GG intended to let students learn how to solve proportional problem if given the ratio and one given value. She demonstrated the procedure to find the number of candy with given the ratio and the total quantity. Afterwards, GG shared another proportion problem in the context of students of boy and girls and doubling number structure: "Given the total number of students is 30 students and the ratio of boys to girls is 2 : 4. How many boys and girls?. GG guided students posited the ratio for boys was 2 in the numerator over the ratio of all students (here was 6) in the denominator multiplied with 30. Afterwards, one of students found the number of girls correctly. We explored scene that revealed MPCK factors such as Ratio and proportion task Level Feature, Teaching problem solving strategy and knowing students' conceptual understanding. Regarding MPCK factor of "Ratio and proportion task level feature", It was highlighted in the connection to the used number structures in that task.

In the second meeting, GG started by ask the previous students learned and discuss its relation to fraction. GG mentioned that students would learn about scale and proportion. She gave illustration of scale in map and explained if students know the distance of two cities in map, they might curious of the real distance of those two cities. Then, she continued with provided a measurement context with ruler. Then, she continued with provided a measurement context with ruler. GG demonstrated measuring a board marker with ruler and explained to students that if they wanted to draw it in the small paper, they needed a scale such as 1 : 200. In the example stage, GG continued to discuss the meaning of that scale by challenging students to express what does it means by 1:200 or how to read that scale number. Furthermore, she explained how to find the real distance if given the scale and distance in map by giving opportunity to student to learn the essence of scale used. For example, GG stated *'We already discuss the meaning of the scale and we see that since the real distance was longer than in the map so to find the real distance is by multiplying the scale and the size in the map. And you*

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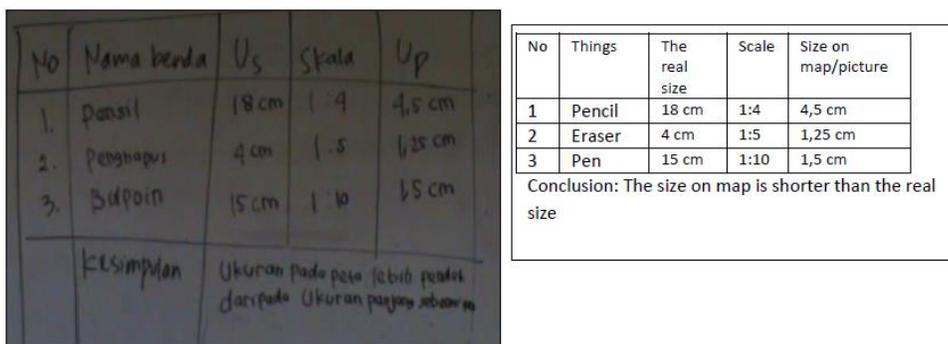
Show it by illustrating it in the form of a real object (photo) or illustration in the form of a picture

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Where is an example of this error? What is the percentage of student errors?

can find the size on map by the real distance divided by the scale". GG did not consider to work with big integer multiple numbers structures but tend to challenge students with easy integer multiple number structure.

A table was presented in the worksheet and students were asked to measure things nearby them such as book, pencil and pen. The data would be submitted to the table with given some scale such as 1 : 4, 1 : 5 and 1:10. Students were asked to find the size of those things in the drawing and stated the conclusion of what they got from the activity related to scale. One representative of each group shared their finding on the white board. GG draw table on the board as in the worksheet.



No	Nama benda	Us	Skala	Up
1.	Pensil	18 cm	1 : 4	4,5 cm
2.	Penghapus	4 cm	1 : 5	1,25 cm
3.	Pen	15 cm	1 : 10	1,5 cm
Kesimpulan		Ukuran pada peta lebih pendek daripada ukuran sebenarnya		

No	Things	The real size	Scale	Size on map/picture
1	Pencil	18 cm	1:4	4,5 cm
2	Eraser	4 cm	1:5	1,25 cm
3	Pen	15 cm	1:10	1,5 cm

Conclusion: The size on map is shorter than the real size

Figure 1. Students' worksheet

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Each group shared their conclusion of what they found. After students did measurement activity and filled the worksheet, GG asked students to read scale on map of Indonesia (1 : 4500000) and reminded them to the meaning of scale by discussion. GG also demonstrated measuring distance between two cities (Aceh-Padang) with the real map and they got 14 cm with its scale in the map was 1:4500000.

In the third meeting, GG focused on proportional problem. She gave a clear illustration, GG showed a cake she brought and mentioned that it would be shared to three people. She asked how many part each people get and students answered that was $\frac{1}{3}$. The next question: how many cake that was needed for six people?. GG addressed these kind of problem were elaborated in that day lesson. Students answered that it needed two cakes. GG continued by explaining the mathematics model to find that solution and wrote $\frac{1 \text{ kue}}{3 \text{ anak}} = \frac{?}{6 \text{ anak}}$ and pointed verbal mathematics on 'for every one cake is for 3 people, then for 6 people, how many cake needed?'. She challenged students to share their strategy. Two students shared different strategies such as one student considered equivalence fractions and another shared cross multiplication strategy. Instead of giving feedback directly to two different strategies, GG tend to share other proportional problem with non-integer multiple number structures within the context of time spending for reading textbook related to the number of pages. Instead of giving feedback directly to two different strategies, GG tend to share other proportional problem with non-integer multiple number structures within the context of time spending for reading textbook

related to the number of page. The problem was “:”Mrs. GG has a book with 30 pages that could be read within 2 days. If Mrs. GG read that book for 3 days, how many pages that Mrs. GG can read?”

GG continued to give another proportional problem within the context of enlargement rectangular figures. Those two problems regard integer multiplier and GG asked students to solve in front of the class. One student could answer correctly the first problem and another student shared error in solving the second problem as shown in the figure below

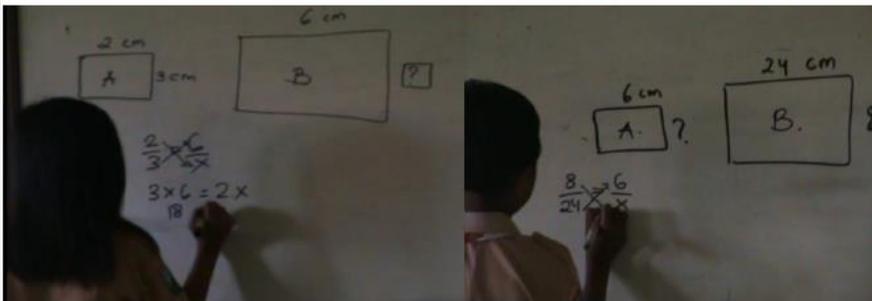


Figure 2. Students performing the problem solution on whiteboard

GG: Before I explain about this, let's think logically this problem. What is compared in this problem is small and large figure. The one that is explored is the side of small or large figure?

Students: small

GG: so for instance the side which is unknown is x. The length of big figure here is 24 cm, the size of small rectangle should be bigger or smaller?

Students: smaller

The enlargement context was felt more difficult by students since they need to integrate the multiplicative thinking in similarities figures. These could be interpreted that teachers identify and used hierarchical task level difficulties in her teaching, though the teaching material (i.e. textbook) did not support the integration of geometrical figure in proportional problem. The phenomena described above were included in the appropriate presented factor for Ratio and proportion task level feature. For the MPCK factor of Teaching problem solving strategy, GG teacher presented this factor component in some lesson stages appropriately.

In the closing stage, GG asked students what they learn on that day lesson and students answered that they learned to find one missing value with given three value. Furthermore, GG also summarized and pointed on the proportional statement and asked students to pay attention on the equal position of the same unit.

The way GG teacher gave responses to two different students strategies showed her appropriate feedback and evaluation to help students aware of its differences. Besides, another event in the example stage of Meeting 3, GG teacher was intended to share precise used of language of unit to solve proportional problem. The use of language “for every” stated by teacher could be interpreted that teacher guide students to unitary strategy. Regarding these phenomena, in interview, GG teacher shared that the scene was what she expected in which students shared different solution strategies and

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Interview results: Has the interview guide used in this research been validated?
The interview guide used in this study should be validated first to a minimum of three validators, namely Professor, Doctor, and Megister.

It is necessary to pay serious attention to the above:
Due to the interview guidelines used in this study, no validation process was carried out, so this manuscript cannot be published in this journal. Because the interview results obtained are not scientific.
However, if the interview guide has been validated before, then please include it with a clear description in the Research methodology section and present the validation results in the research results section.

all students recognize equivalence fraction strategy first as basic for cross multiplication and it helps students to avoid addition strategy in solving proportional problem.

For the factor of *knowing students conceptual understanding*, GG teacher created proportional problem that fit to primary level and were not taken from textbook such as investigating ratio as scale within measurement activity from easy number structure to the harder ones. The problem types were missing value problem and ratio comparison problem. In GG teacher's classroom, there was no task that can reveal students' misconception. However, there was a moment in student's work time stage of third meeting in which students shared errors in finding one missing size of enlargement figures problems. It was shown by two students with similar strategy and another student different solution below:

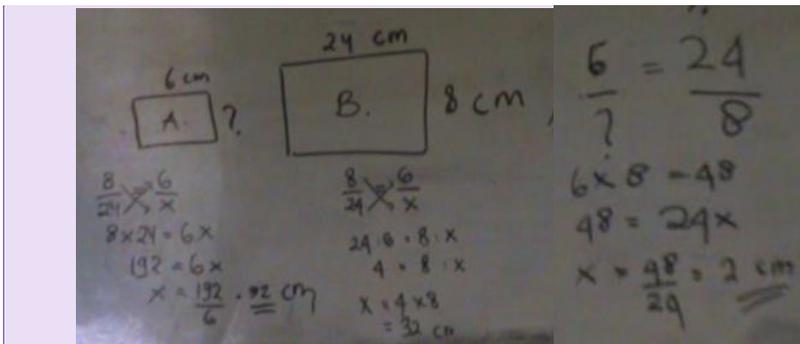


Figure 3. error that was showed by students

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After her two students showed errors, GG teacher tried to address that student's errors or misconception and responded to those first two students' thinking. She discussed student's error to other students within the whole class instead of simply telling the students that it was wrong. She guided all students to aware of the misconception by giving chance to students to present different solution strategy. Besides the exploration of MPCK in teaching with regard the conceptual framework for teaching observation, the observation from the teaching was also done to explore the possible MPCK that was not in line with the factors. For instance, in every opening stage of his teaching, GG teacher always asked students about the previous related lesson. This could be interpreted that GG teacher presented the MPCK factors of activating students' previous knowledge. In addition, GG teacher also provided students opportunity to do hands on activity such as counting and measuring so that students can actively 'do mathematics'.

From the exploration of MPCK in GG teacher's teaching, it could be summarized that all MCK and MPCK factors were presented and activated in her teaching. Most MCK and MPCK in GG teaching were presented. In the next part, i portrayed some finding on the relation among MCK and MPCK factors within teaching practice. It regards the MCK and MPCK factors component that presented appropriately.

The Potential of realization of MPCK in MM teaching

In the first meeting, MM opened the lesson by reminding students about the previous lesson learned. She mentioned that last time students already learned about fraction which were changing fraction form into percentage and decimal, addition, subtraction, multiplication and division of fraction.

She tried to check students' understanding of addition of fraction operation by giving a problem on black board $\frac{1}{2} + \frac{2}{4}$. In showing the solution, there was semi monologue between her and her students. Students need to make the common denominator by finding the least common multiple of the denominator. Afterwards, MM explained the aim of lesson on that day : (1). Students could read the ratio and proportion correctly, For example fraction of 12 could be read as 'one over two' or 'one to two'. (2) Students could write the ratio and proportion correctly. She mentioned that there were many applications of ratio and proportion in daily life. MM asked students in group 1 and 2 (note that students were already arranged in groups seats) to stand up in front of the class. Teacher lead a discussion with whole class. Furthermore, MM shared different context of ratio as comparison quantity such as the ratio of book and pen. Students could answer properly that the ratio of book to pen that MM showed was 5 to 4. She highlighted that students need to pay attention to what mentioned first should be in the upper part or written first and it should not be inverted.

MM shared another worksheet to be worked out individually. When students worked on the problem individually, MM walked around and guided some students that found difficulties in answering the problem given. There were four problems given to students. The three problems were about representing ratio of boys and girls, ratio of number of triangle to rectangle given and ratio of students followed school activity (i.e. volley ball and pramuka) with non-integer multiplier number structure such as 9: 6, 9:15 and 6:15. Another problem was proportional problem with money context: "The ratio money of Ana : Yuli = 2:3. The amount of Yuli's money is Rp. 75.000,-. How much is Ana's money?". Some students raised question on the solution's strategy of proportional problem and MM came to them to guide them individually. There was a scene when MM guided a student to answer that problem.

MM : What is being asked?

Student 1: Ana's money

MM : yes, so the ratio for Ana is posited in the upper part (numerator) and over the ratio of Yuli. Looked at this, the given was Yuli's money. What is the ratio for yuli?

Student 1: three

MM : yes...so two over three multiplied with Yuli's money. Okay..you can continue the calculation

From the video teaching scene, it could be observed that teacher took most intervention in teaching so that it lack of students productively work on the problem. The students' intention to work on the problem was applying formula to solve the problem. In terms of the structural of number structure, the tasks were also not presented in hierarchical order. Therefore, it could be interpreted that the factor of ratio and proportion task level feature was not presented in MM's teaching

In the second meeting, MM pointed out that ratio is in the simplest form of fraction. She described about the symbolization of ratio within fractional form or the written with division sign. She always reminded students about the importance of changes the fraction into the simplest form and did simple monologue of stating the simplest form of fraction.

MM : Where do you always see scale?

Students : in map

MM : What else

Students : Sketch or floor plan

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In the example stage, MM illustrated the used of scale in daily life. She described the used of scale by architect to draw Sidowungu village in a paper. She continued by asking the meaning of 1 : 1000000 in scale.

Student 1 : one over one million

MM : yes. What does it mean?. So if you have 1 cm in a paper. It is very small right, it represents 1000000 cm in the real size. Or 1 million is 10 kilometers. So you can imagine that 10 kilometer is about from here to Kedurus and drawn in 1 cm.

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She also gave another scale (1 : 6000000) and did semi monologue to explain its meaning. Afterwards, MM gave a scale problem, "The distance of Sidowungu to Kedurus is 10 km. It was drawn on paper 2 cm. What scale that is used?". To answer that problem, MM shared the formula for finding the scale. See figure 4. She also intended to tell the manipulative of the scale. It was done by small number division such as assuming the scale was 3 and distance on the map was 6, therefore the real distance should be 2. From the assumed number, MM guided students to find the 6 was from 2 times 3. This implied on the second formula, finding the distance of map = scale x the real distance.

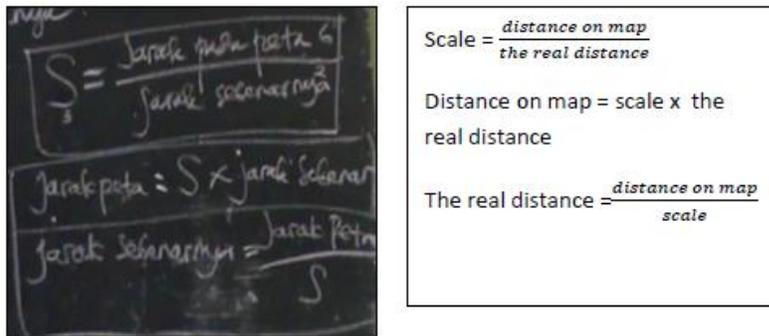


Figure 4. A formula for finding the scale shared by MM

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In the students' work time stage, MM started with posing two scale problems on the board and asked students to share their findings. One problem was about finding the scale and another one about finding the real size of picture with given the scale and the size on map.

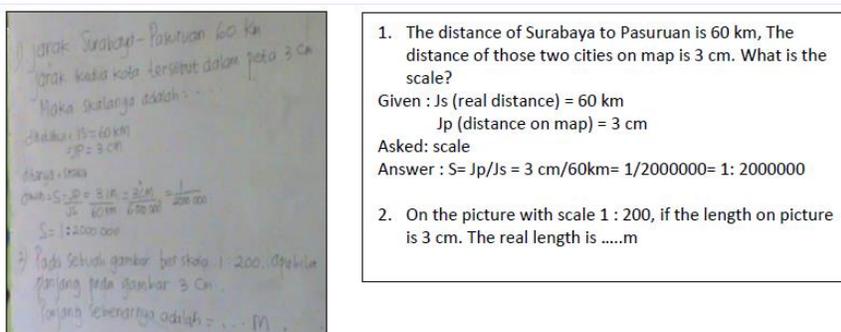


Figure 5. Student solution of a scale problem

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From the scene, MM tried to interrupt student when he wrote his result. For instance, for the second number, a student wrote the solution by distance on the map divided by the scale as 3: 1:200. Directly MM asked to change the scale into the fractional form and always reminded student to change the measurement unit from centimeter to meter. Figure 5 demonstrate these findings.

In the third meeting, MM shared a proportion problem “the ratio of red marbles to yellow marbles is 2 : 3. If the number of red marble is 20 pieces, how many does the yellow marbles?. Students were asked to read the problem loudly. To answer that exemplary problem, MM guided students to list what is given in the problem. Students could reply on the given information from the problem.

Afterwards, MM led the discussion by giving strategy to solve the problem

MM : If the question was finding the yellow marbles, then the ratio for yellow was put in the upper part over the the ratio given and multiplied with the given. Then, how many yellow marbles was? (MM wrote on board: $\text{Yellow} = \frac{3}{2} \times 20 = 60/2=30$)

MM : Remember and pay attention here. What was asked, the yellow ones, its ratio put in upper part, which is 3 and what was given, the red ones, its ratio in below part times 20. Can you solve it?

Another exemplary problem was shared within age context: “The difference of the age of Siti and Ana is 4 years. The ratio of their age is 3:5. What is Siti and Ana age?”

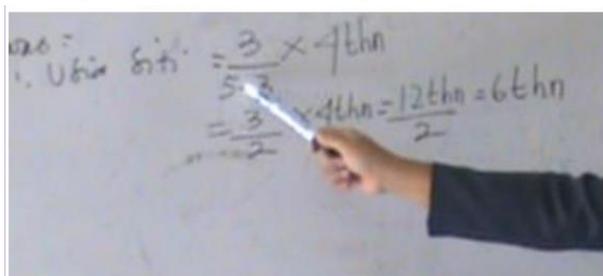


Figure 6. MM trying to explain students' work

MM : Looked at your friend's work. Siti's age is three over five minus three. Why do you think five is subtracted to three.

Student 2: Because of the differences

MM: If given the difference, then the ratio should be subtracted. Great that is smart.

Who are able to work on the second number, Ana's age?

Additional task were given by MM to be worked on individually. She shared five problems to students. In closing section, MM shared the summary of that day lesson in relation to solving proportional problem.

MM : If you solve proportional problem, the number of ratio of what being asked should be posited in the upper part (numerator), remember that. As problem number 1, it asked the red one, so the ratio of the red should be in upper part then the green one. Many of you put inversely and make errors in your writing document. As to number two, the upper part is for number of ratio that is asked over the number of ratio of the given. If the given is the sum of boys and girls for example, so you need to add

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For the teaching problem solving strategy, some captured scenes show inappropriateness of this factor. MM presented this factor in her third meeting when giving feedback to students. She tended to remind students to apply the algorithmic rules for proportional problem with less developing of multiplicative thinking. Furthermore, in the stage of students work time of meeting one, there was a scene that a student asked for the certain answer of the possible of stating ratio not in the simplest form. MM did not answer this question and just repeated that ratio should be presented in the simplest form. It also considered as inappropriate presented. The way MM gave assessment to the written ratio form would be elaborated in the interview part. Therefore, the factor of Teaching problem solving strategy was not presented appropriately in her teaching.

For the factor of Knowing students conceptual understanding, some components of this factor were appropriate presented and some inappropriately presented. In the example and students work time stage, MM tried to elicit students' description and explanation of problem solving strategy. This was in terms of teacher asked 'why question' that contribute to build explanation. Specifically, in the example stage of meeting 3, there was a scene when MM and students discussed the solution of a proportional problem within age context: "The difference of the age of Siti and Ana is 4 years. The ratio of their age is 3:5. What is Siti and Ana age?"

Furthermore, there was a scene where MM elicit students' explanation and encouraged students to aware misconception. A problem was given to students: "The total number of students of grade 5B is 28 students. Ratio boys and girls is 3: 4. How many boys in grade 5B and how many girls in grade 5B?" All students worked on that problem and one student shared his solution.

Student 3: The boy is three over four times twenty eight is twenty one. For girl is four over three times 28 is 44.

MM : Is that correct? The total number of students is only 28. If the girls are 21 and the boys is 44, how many it will be for 21 plus 44?

The dialogue above showed that MM addressed students' errors in her explanation without directly mentioned the solution was wrong. Furthermore, another student shared different solution as student 3. He could explain and solve the problem correctly. MM used this situation to elicit student's explanation and led him to aware their misconception.

MM : So Satrio (student 3), you need to be more careful and remember the rule. Why the ratio should be added? You see in hafiz answer three is added to four. Why the numbers in the ratio were added? It is because what is mentioned there is the sum of all students. And to check you can add the number of boys and girls is 28.

From the transcript above, to make student aware of his misconception, MM posed guiding question that lead to students' errors. Within the whole class, MM discussed that student error in solving the problem. She also asked students to think back to initial question. From this phenomenon, it could be interpreted that the factor of knowing students conceptual understanding was presented appropriately. However, although MM did not directly show students misconception, her responses led to the calculation result. She reminded students about rules without pointed out to the need of developing students' multiplicative thinking. For this part, it was considered as inappropriate responses for developing students' conceptual understanding. Based on this phenomenon, the factor of knowing students' conceptual understanding was presented appropriately in some parts and inappropriate in another part.

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The Potential of realization of MPCK in LL teaching

As to other teachers in this study, three MPCK factors were also explored in LL's classroom. In the first meeting, LL started the lesson by motivating students to learn mathematics that applied in daily life. She mentioned about the topics for students' learning in that day was ratio and proportion and she encouraged students to share their opinion bravely. LL shared a question: "What is ratio?". A student stated that ratio is the simple form of fraction. LL stated that it was correct and repeated what student said to whole class. To illustrate, she wrote a fraction $\frac{4}{7}$ and explained that fraction could be regarded as ratio of 4 : 7. Another fraction she shared was $\frac{5}{750}$ that could interpreted in the ratio form of 5 : 750. Furthermore, LL shared first the ratio of 1: 750.000.000 and asked students about another written and she wrote it as 1750.000.000. She did simple monologue, in which most of her questions were answered by herself. LL argued that students need to know ratio for the basic of proportion. The used of proportion was introduced by LL by sharing the proportional situation of the number of students. For example, the number of students in a class is 36 with 20 boys and 16 girls, what is the ratio of boys to girls would be? Some students directly answered by 5 to 4.

In the example stage of LL's teaching, she considered to give some examples of proportional problem. She delivered a problem of buying in groceries store such as Toni was asked by his mother to buy rice, The price for 5 kg rice is Rp. 30.000,- and mother asked to buy 8 kg rice. How much money he need to bring to the store?. She explained the solution and asked students about the calculation. LL : you need to divide Rp.30.000,- by 5 so that you got six thousand. Since it is 8 kilos, then you multiply with 8 and if it 10, then multiply with 10.

For MPCK factor on Teaching problem solving strategy, this factor is presented appropriately such as LL shared the unitary method strategy for solving proportional problem. Besides, LL also shared equivalence fraction strategy which is appropriate in the following scene.

LL also explained equivalence fraction strategy to solve proportional problem. She wrote $\frac{5}{8} = \frac{b}{40}$. To get b, LL shared the need to find multiplicative factor for the numerator and denominator. For instance, in the denominator which from 8 to 40 by multiply with 5, the numerator is also multiplied with 5 become 25

In the students' work time stage, LL gave three proportional problem. She divided students into four groups to discuss the solution. The first problem she shared for students to work was "Ira's age is 40 years old. The ratio of Ira and father is 2 :3. What is father's age?".

Student 1: sixty

LL : We could take a half of Ira's age and added to Ira's age. Because ayah is older than Ira.

Furthermore, LL continued the lesson by explaining three things that were learned by students in relation to ratio and proportion such as ratio as fraction, direct proportion and addition in proportion. She reminded back to some problem in example stage such as the problem with context of marble was in ratio as fraction. The problem of buying rice in the example stage was explained and constituted as direct proportion. Another problem of direct proportion was shared such as "You are asked to buy pencil. Four pencils cost IDR25000,-, how much you pay if you buy 1 dozen?". Students were asked to solve this problem in group. LL gave hint to students to find one unit . She wrote the price of one pencil is $IDR25000 : 4 = IDR6250,-$. One student came to the front to continue the writing solution and resulted $12 \times IDR6250 = IDR75000,-$.

LL : To make it easy, we need to find one unit and then calculate it. Or you can directly calculate by twelve divided by four times IDR25000,-. The result would be the same. Try it.. Which one do you think is easier, we can use it. In the student work time, LL also explained about content she named as *addition in proportion*. She gave problem to student: "Ega's money = 37 Yoga's money. Yoga's money is IDR14000,-. How much is Ega's money?". One student raised her hand and willing to share her solution. She made an error by adding the ratio and put as numerator as shown in the figure below:

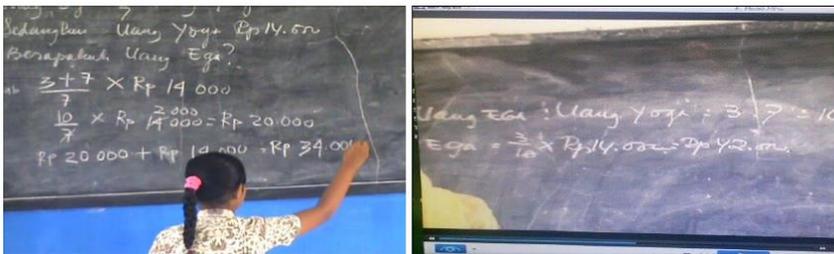


Figure 7. A student of LL showing solution of direct proportion problems

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LL also showed wrong solution to all students. It might be influenced by the term she mentioned about 'proportion in addition' so the ratio number were added. She did not realize that the problem should not be solved by adding the ratio as she mentioned before. This condition reveals the MPCK factor of Teaching problem solving strategy which presented inappropriately due to there was no guidance for students' errors so that they could not reflect on their error. This is also related to the MPCK factor of Knowing students' conceptual understanding which presented inappropriately which LL missed the point of students error.

Furthermore, LL made error in solving proportional problem as well as share formula for solving proportional problem.

In the example stage, LL shared more examples about the scale such as in the map, the size would be in centimeter, for example 1 cm and the real size could be 100 meter or maybe in kilometers. LL drew a line and divided that line into six and showed that it was 6 cm and the real size was 6 kilometers. However, she did not clarify the scale based on that. Afterwards, she wrote a scale 1 : 10000 and explained its meaning that 1 cm is equal to 10000 cm of the real size. In explaining the scale, she always mention that students needed to memorize the formula and it would easy for them to solve scale problem. She wrote on the black board as the picture below:

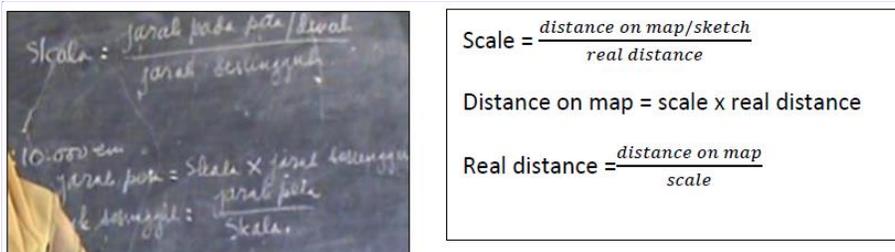


Figure 8. LL showing a formula for scale problem

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In the students' work time, LL shared scale problem to students to work out. " the length of the railway from Surabaya to Kediri on map is 18 cm. Scale on map is 1 : 450000. What is the real length of the railway?. When students worked on that problem, LL remind students to the formula she shared. She pointed that it would be easier for students if they remember all the formula to apply. Furthermore, she discussed about the km as measurement unit for the real size and reminded students the formula of finding the real distance.

The activation of MPCK in teaching Ratio and Proportion

This part discusses the different teachers' performance with different MPCK activated the MPCK factors in their teaching. Figure 10 showed how teachers revealed the potential MPCK factors in their teaching. The circle showed *the inappropriately presented of the MPCK factors* in teachers' teaching practice.

Ratio and proportion task level feature	GG	MM	LL
Teaching problem solving strategy	GG	MM	LL
Knowing students' conceptual understanding	GG	MM	LL

Figure 10. Potential MPCK factors of teachers' teaching

From the illustration of the figure 10, the better MPCK lead to the more presented potential MPCK factor appropriately. To be more specific, teacher with Low MPCK presented more inappropriate potential MPCK in practice compared to Middle and Good MPCK teachers. Beside the teachers' knowledge that could be observed in the teaching practice as foregrounded in this study, it is also possible to explore knowledge that inhibited or could not be observed in teaching practice such as those that regarded as knowledge for practice and knowledge of practice of Cohran & Lytle (1999).

Conclusion

With regard the potential of MPCK factors, there are two different direct transformation of MPCK into their natural teaching practice (GG and LL teachers). All MPCK factors were activated by GG teacher in her teaching appropriately differ with LL teacher. The study displays the natural mathematics teaching of teachers with different level of knowledge. It showed that Mathematics Pedagogical Content Knowledge is very essential for mathematics teaching and students' learning process. Besides, this study also highlighted the lack of mathematics connectedness in ratio and proportion teaching for teacher with Low MCK and MPCK. This implied for future Mathematics Teacher Education which give opportunity to teacher to learn both Mathematics Content and Mathematics Pedagogy in a balance and integrated in courses.

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Where is the discussion based on the data from Figure 10?

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This conclusion seems to only summarize this manuscript, the summary section should answer the formulation of the problem contained in the research topic.

In the Conclusion section, the following points should be considered:

- (1) Answering research problems or objectives,
- (2) State the importance of the findings and their implications,
- (3) Don't recap the results but make a statement,
- (4) Use convincing statements (avoid "may be inferential...").

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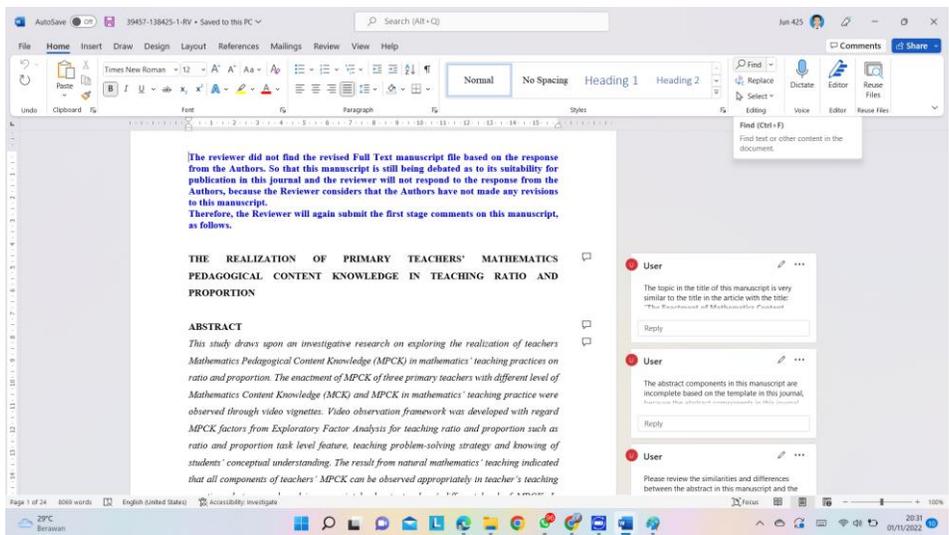
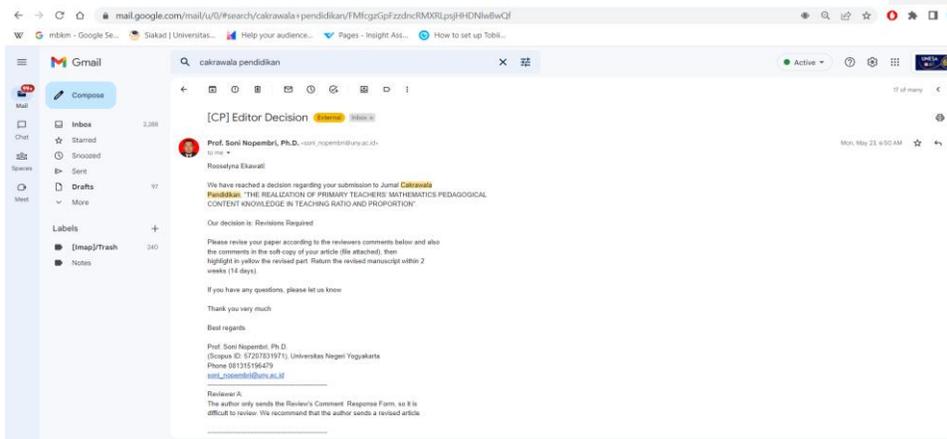
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3. Editor decision 2nd round (23 Mei 2022)



Review's Comment & Response Form

Commented [A41]: Please sends a revised articles

Reviewer	Reviewer's Comment	Respond to Reviewer
A	Jumlah halaman (kata) dikurangi.	Number of words has been reduced,
	Diskusi hasil diperbaiki gunakan hasil terdahulu.	We have revised the discussion part and add

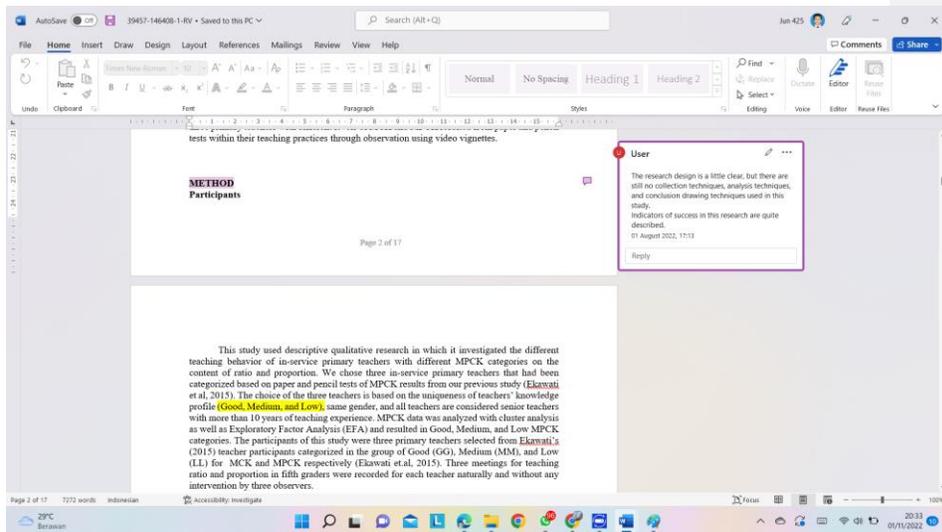
		relevant research result that in line with our findings
B	The manuscript does not match the template of Cakrawala Pendidikan.	We did matching the template into Cakrawala journal template
	Research abstracts are not well structured, preferably abstracts consisting of background, objectives, research methods and conclusions. The author did not write down the objectives on the abstract	Thank you for the suggestion. We do revise the abstract by writing background, objectives, research methods and conclusions
C	<p>Is the owner of the article above the same person as the owner of this manuscript?</p> <p>(1) If the authors are the same, then the title should be revised with a different editor and the content of the manuscripts should also be made different (not only the number of teachers is different), because both contents are almost the same. So there is no novelty)</p> <p>(2) if the authors are different people, then the suitability of this manuscript is highly debated to be published in this journal because the topic and content of this manuscript are almost the same as the article, even it seems that it is just a copy-paste, only some sentence structures- the sentence is rearranged (as if the sentence structure was made to look different).</p>	Thank you for your suggestion, the title has been revised. There are several novelties in this paper compare to other paper in terms of the indicator for data analysis on video vignettes
	<p>The abstract components in this manuscript are incomplete based on the template in this journal, because the abstract components in this journal use IMRAD, while the abstract in this manuscript use Non-IMRAD.</p> <p>Please adjust and complete</p>	Thank you for the suggestion. We do revise the abstract by writing background, objectives, research methods and conclusions
	Please review the similarities and differences between the abstract in this	We add several literatures in the Introduction part

	<p>manuscript and the abstract in the article above: see the article link in [U1].</p> <p>The background is not rich in the literature review or there are still very few supporting theories from previous studies that focus on research topics so that the State of the art that is built is not good.</p> <p>The inverted triangle principle is not well structured and unsystematic, and the existing analysis gaps are not sufficient to strengthen the research objectives in this paper.</p> <p>There is no novelty in this study, and there is no description related to the advantages of this study compared to previous research.</p>	<p>paragraph 1 (line 6-9) and paragraph 3 and paragraph 5.</p> <p>The three structure factors used in this paper are based EFA method on paper and pencil test on MPCK and already disseminated in reputable journal papers. Therefore, the three principle are used as basis component to measure the existence of MPCK in teaching practice.</p> <p>In paragraf 4 introduction part, we mention that this study extend the study of several previous study on the assesment of MCK and MPCK on ratio and proportion. In addition, the coding observation as well as the acceptable reliability was measured</p>
	<p>Several studies? Mention, at least from the previous three articles.</p>	<p>Several studies have already described in introduction parts</p>
	<p>Which of the authors' claims is that this study is superior to previous studies?</p>	<p>There is a sentence "However, such an area of research which specifically investigates the extent to which teachers indicate their MPCK on ratio and proportion has not been found with detail indicators"</p>
	<p>It should be noted in the introduction to a high-quality text, including: (1) Background: Introducing the topic, using the triangle principle; and emphasize why this topic is important</p>	<p>We did revise the introduction part by consider (1) –(4) as suggested</p>

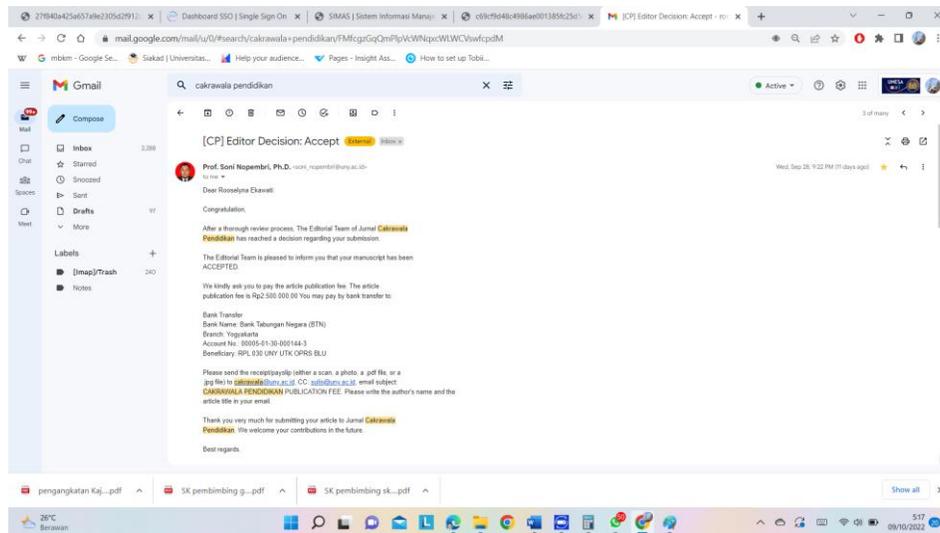
	<p>(2) State of the art: link with current knowledge; and use state of the art references.</p> <p>(3) Gap Analysis: What has been done ?; and What needs to be done?</p> <p>(4) Research objectives and excellence: Introducing what is being done (researched); give the main purpose of this manuscript by including the novelty in this research.</p>	
	<p>Have the data collection techniques been described?</p> <p>Has the data analysis technique been described as well?</p> <p>Has the technique of drawing conclusions in the study been clearly described in this section?</p> <p>Add this research flow in the form of a chart.</p>	<p>The information about the data collection and analysis has been described in the Framework for analyzing MPCK on teaching video observation</p>
	<p>What is the main reason the researchers only took three teachers from the existing 271?</p>	<p>The reason of choosing three teachers has been described in method part (line 5)</p>
	<p>There are three factors?</p>	<p>Yes, there are three factors component resulted from Exploratory</p>
	<p>What are these four steps of analysis based on? Or In whose opinion? Where did it come from?</p>	<p>We consider Erickson (2006) for analyzing video-based data</p>
	<p>The original source is required.</p> <p>Because all the contents (aspects) of the presentation in Table 1 are already contained in the previous article.</p>	<p>The original and detail framework just presented in this paper by considering MPCK factors and . Previous research has not described the indicators in detail.</p>
	<p>The results of the research that are listed are like a Novel Book that tells about MPCK MCK, and GG teachers. It is not appropriate to present research results in the form of scientific articles. Moreover, what is presented is not enough to answer the problem formulation.</p> <p>The Research Results section should pay attention to the following points:</p>	<p>Thank you for giving several important points to be considered. We already rewrite the Result and Discussion part based on reviewer suggestion such as made three models of realization of MPCK in teachings</p>

	<p>(1) present a summary of the results in the form of graphs and figures or tables,</p> <p>(2) Compare with different treatments,</p> <p>(3) Provide convincing quantitative (statistical tests) or and qualitative evidence,</p> <p>(4) Focus on what to emphasize,</p> <p>(5) Clear, convincing, and general,</p> <p>(6) Free from double interpretation.</p>	
	<p>There is no discussion in this manuscript, based on the research results listed.</p> <p>In the Discussion section, the following points should be considered:</p> <p>(1) Answering research problems,</p> <p>(2) Support and defend answers with results,</p> <p>(3) compare with the relevant research results,</p> <p>(4) state the limitations of the study conducted,</p> <p>(5) state the importance of the findings or finding,</p> <p>(6) discover novelty,</p> <p>(7) Submit further research.</p>	<p>We add relevant literature to support our findings.</p>
	<p>Is the description in this paragraph based on the results of interviews or observations?</p> <p>Please clarify.</p>	<p>The description in the paragraph based on observation</p>
	<p>Show it by illustrating it in the form of a real object (photo) or illustration in the form of a picture</p>	
	<p>Where is an example of this error? What is the percentage of student errors?</p>	<p>The error can be seen from the students work in whiteboard in classical discussion as well as in LL teacher when solving proportion problem</p>
	<p>The original image quality is poor.</p>	
	<p>Interview results: Has the interview guide used in this research been validated?</p>	<p>The result of this research is based on observation of natural teaching of each teacher in three meetings. The inter rater agreement of video</p>

	<p>The interview guide used in this study should be validated first to a minimum of three validators, namely Professor, Doctor, and Megister.</p> <p>It is necessary to pay serious attention to the above:</p> <p>Due to the interview guidelines used in this study, no validation process was carried out, so this manuscript cannot be published in this journal. Because the interview results obtained are not scientific.</p> <p>However, if the interview guide has been validated before, then please include it with a clear description in the Research methodology section and present the validation results in the research results section.</p>	<p>observation has been done to explore the reliability of the data.</p>
	<p>Where is the discussion based on the data from Figure 10?</p>	<p>We deleted this figure</p>
	<p>This conclusion seems to only summarize this manuscript, the summary section should answer the formulation of the problem contained in the research topic.</p> <p>In the Conclusion section, the following points should be considered:</p> <ol style="list-style-type: none"> (1) Answering research problems or objectives, (2) State the importance of the findings and their implications, (3) Don't recap the results but make a statement, (4) Use convincing statements (avoid "may be inferential..."). 	<p>We revised the conclusion part by adding the activation of GG, MM and LL's MPCK in teaching practice on ratio proportion</p>
	<p>The bibliography is marked in red, please replace it with the latest bibliography (within the last 10 years).</p> <p>Add Bibliography from this Journal and International journals (Scopus or and WoS).</p>	<p>We add several bibliography within the last 10 years.</p>



5. Editor decision (Accepted) (28 September 2022)



6. Available online (October 2022)

The screenshot shows the journal's website interface. At the top, the journal title "Cakrawala Pendidikan" and "Jurnal Ilmiah Pendidikan" are displayed in a dark red banner. Below the banner is a navigation menu with links for HOME, ABOUT, USER HOME, SEARCH, CURRENT, ARCHIVES, ANNOUNCEMENTS, and CALL FOR PAPERS. The main content area is titled "Archive" and contains a table of articles. The table has columns for ID, ISI ID, SUBJECT, SEC, AUTHORS, TITLE, VIEWS, and STATUS. One article is listed with ID 39457, ISI ID 03-36, SUBJECT ART, and authors Ekawati, Lin, Kohar. The title is "INVESTIGATING TEACHERS' MATHEMATICS PEDAGOGICAL CONTENT". The status is "New" and it is from Vol 41, No 3 (2022). Below the table, there is a "Refbacks" section with a table showing a backlink from a Google Scholar page. On the right side, there is a sidebar with various links and a "Cakrawala Pendidikan" logo with a Q3 Education badge and a SJR 2021 score of 0.24.

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Cakrawala Pendidikan

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ID	ISI ID	SUBJECT	SEC	AUTHORS	TITLE	VIEWS	STATUS
39457	03-36	ART		Ekawati, Lin, Kohar	INVESTIGATING TEACHERS' MATHEMATICS PEDAGOGICAL CONTENT	0	Vol 41, No 3 (2022): Cakrawala Pendidikan (October 2022)

1 - 1 of 1 Items

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CLICK HERE to go to step one of the five-step submission process.

Refbacks

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2022-10-04	40	https://scholar.google.com/	Investigating teachers' mathematics pedagogical content knowledge		New	EDIT DELETE

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Publication Ethics
Focus & Scope
Author Guidelines
Peer-Review Process
Publishing System
Indexing
Author(s) Fees
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