Primary School Teachers' Perspectives on Teaching Fractions

(A Study between Dutch Primary School Teachers and Indonesian Primary School Teachers)

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Abstract: This research aimed to investigate the perspective of Dutch and Indonesian primary school teachers in teaching fractions. The research participants were six volunteer primary school teachers in the Netherlands and Indonesia. The method used in this research is a survey with open questions. The research finding indicated that teachers in the Netherlands and Indonesia addressed fractions' basics using contextual situations. There are two perspectives of teachers in teaching fractions: 1) Strengthening the basics of fractions using a model, and 2) Strengthening specific procedural strategies to solve fraction problems. The results of this study can be used as a reference for teacher educators to design professional development for teachers, especially in mathematical teaching and to give an overview how the strategies applied in teaching fractions.

Keywords: fractions, teacher, Indonesia, the Netherlands

INTRODUCTION

Learning mathematics is a fundamental principle of a problem-solving approach aimed at fostering students' learning by or for themselves. Learning mathematics as one process to build knowledge and a broader way of thinking on systematic problems to get a good experience is known as mathematical reasoning (1–8). Case-Based Reasoning (CBR) systems through experiences can tackle knowledge in long-term memory (9). It means that in classroom practices, teachers should be able to provoke students' mathematical reasoning.

However, there is a gap between educational research findings and classroom practices that is shown in the traditional paradigm that teachers' duty is only to teach (10). Teachers usually act as implementers rather than researchers or co-designers (11). Furthermore, in the preliminary study conducted, the researchers found out the formal procedures/ traditional way of mathematical teaching, especially in teaching fractions. Most teachers only focused on the result, not the children's way of thinking. As a result, when the students learned fractions, they still struggled in referring to the whole (Pramudiani, et al., submitted manuscript). However, according to (12) procedural knowledge in mathematical learning could become an alternative to exercises, since it accomodates more creative problem-solving activity, with comparable effectiveness in developing procedural fluency.

In the process of students' mathematical reasoning, building knowledge or curiosity, intrinsic motivation is needed (self-motivation). One of the triggers to provoke students' mathematical reasoning is using questions with HOTS characteristics (High Order Thinking Skills). HOTS contains elements in understanding complex information, theory of analysis and problem solving, use of tools, procedures, problem-solving, and investigation (adapted from 12,13). According to (15), HOTS problem can identify scientific creativity skill, critical thinking skill and creative thinking skill.

(16) described that teaching approach conducted by teachers should begin by giving students a mathematical problem applying the principles they have not learned yet. When compiling a problem, an educator can use a variety of issues, including closed, semi-open, or open-ended problems (various ways of thinking). In the Netherlands, there is a learning theory developed since the 1970s by Hans Freudenthal which is called Realistic Mathematics Education/ RME in which one of characteristic of RME is self-develop model constructed by children (17). Starting from 2000, RME was adapted in some provinces in Indonesia become *Pendidikan Matematika Realistik Indonesia*/ PMRI (18). However, not all teachers in Indonesia have experienced in implementing RME/PMRI.

In this study, teachers' perspective, both Dutch Primary School Teachers and Indonesian Primary School Teachers, was investigated using an open-ended mathematical problem in teaching fractions. In addition, teachers' ability to observe children is elaborated in this research. According to (19), the better we learn how to observe children, the more meaningful our teaching will be. Therefore, the research question is, "What are the perspectives of Dutch and Indonesian primary school teachers in teaching fractions?" This study aimed to dig into teachers' analytical skills in applying strategies they thought made sense in order to improve students' mathematical reasoning in learning fractions.

RESEARCH METHOD

To reach the research goal, the researchers conducted several stages, including sharing experiences with some Dutch educators and teacher trainers in Indonesia and in the Netherlands. Since RME was found in The Netherlands, the researchers chose the participants from some Dutch primary school teachers who become mathematics specialist coordinator and some Indonesian primary school teachers who do not experience in implementing RME/ PMRI. The teachers were asked about their experiences observing the students when they teach fractions and how they usually teach them in class. They were asked to provide an example or their sharing experience in teaching fractions.

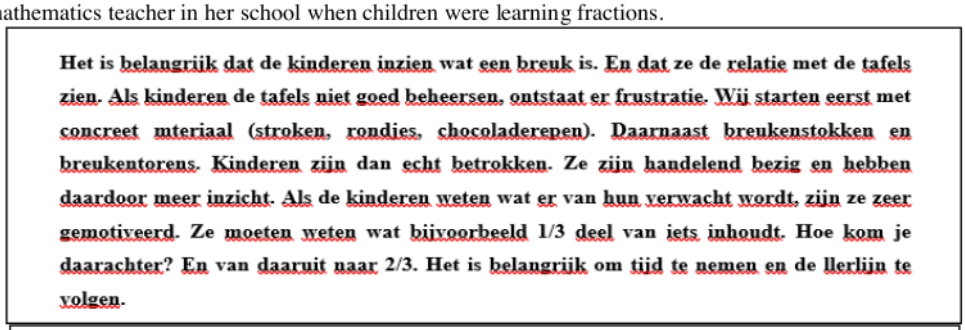
There was also a discussion about Teacher Professional Development in those two countries. After that, several open questions were formulated and given to some primary school teachers in the Netherlands and Indonesia. Three Indonesian and three Dutch primary school teachers were selected to become the research subject. In the next stage, the answers were analyzed and categorized based on their perspective. Therefore, to achieve the goal we obtained much information about how mathematical teaching was conducted by the teachers in the Netherlands and in Indonesia, especially in teaching fractions.

RESULTS AND DISCUSSION

The research showed that teachers from the Netherlands and Indonesia addressed fractions' basics using contextual situations. According to (17) and (12), the researchers made classification become two perspectives of teachers in teaching fractions: 1) Strengthening the basics of fractions using a model, and 2) Strengthening specific procedural strategies to solve fraction problems.

1. Strengthening the basics of fractions using model

Figure 1 below is the answer of Dutch Primary School Teacher A (DA) when she was asked about what she saw as a mathematics teacher in her school when children were learning fractions.



Het is belangrijk dat de kinderen inzien wat een breuk is. En dat ze de relatie met de tafels zien. Als kinderen de tafels niet goed beheersen, ontstaat er frustratie. Wij starten eerst met concreet mteriaal (stroken, rondjes, chocoladerepen). Daarnaast breukenstokken en breukentorens. Kinderen zijn dan echt betrokken. Ze zijn handelend bezig en hebben daardoor meer inzicht. Als de kinderen weten wat er van hun verwacht wordt, zijn ze zeer gemotiveerd. Ze moeten weten wat bijvoorbeeld 1/3 deel van iets inhoudt. Hoe kom je daarachter? En van daaruit naar 2/3. Het is belangrijk om tijd te nemen en de llerlijn te volgen.

Translate: *It is important that the children understand what a fraction is. And that they see the relationship with the tables. If children do not master the tables well, frustration ensues. We first start with concrete material (strips, circles, chocolate bars). In addition, fraction sticks and fraction towers. Kids are really involved. They are active and therefore have more insight. If the children know what is expected of them, they are highly motivated. They need to know what, say, 1/3 of something means. How do you find out? And from there to 2/3. It is important to take your time and follow the line.*

FIGURE 1. The answer of Dutch Primary School Teacher A

Based on Figure 1, DA answered the important thing in teaching fractions is to understand what a fraction is. She figured out the relationship between fractions and tables. She usually started with concrete materials such as strips,

circles, and chocolate bars. After that, she used fracture sticks and fracture towers. When starting from familiar context, children were then really involved, active, had more insight, and were highly motivated. They needed to understand what is 1/3 of something and how to find out, and after that, it continued to 2/3 and so on. It was essential to take time and follow the order as long as the children understand it.

Figure 2 shows the answer of Dutch Primary School Teacher B (DB) when she was asked about her experience in teaching fractions.

In groep 5 starten we met breuken door eerlijk te delen. We nemen daarbij als uitgangspunt iets uit de leefwereld van de kinderen. Een taart, en pizza of een stokbrood. Ze mogen bij de helft van een taart: één van de twee stukken noteren. Soms zetten we daar de officiele breuk bij als kinderen daar zelf meekomen.

Translate: *In group 5 we start with fractions by dividing fairly. We take as a starting point something from the living environment of the children. A pie, and pizza or a baguette. For half of a cake, they may write down one of the two pieces. Sometimes we add the official fractions if children come with them by themselves.*

FIGURE 2. The answer of Dutch Primary School Teacher B

Based on Figure 2, DB answered that in group 5 they started teaching fractions by using a fair sharing context such as a pie, a pizza or a baguette. For introducing a half, they may figure out the one of the two pieces of cake. Sometimes they added the official fraction if the children have already known it by themselves.

In figure 3 it can be seen that Dutch Primary School Teacher C (DC) shared her experience in teaching fractions.

I see kids in the senior grades who find the fractions really hard and don't like them at all. There are children who like them. Those are usually the better calculators. In the lower grades, children like them very much. I experience that the children look at it in a different way and .....I think it is very important, we work with materials that the children like. I think using physical materials can do a lot of good. Working outside the methods and with moving learning is also an important part.

FIGURE 3. The answer of Dutch Primary School Teacher C

Based on Figure 3, DC answered that there was difference between students in higher grades and in lower grades. The higher-grade students think fractions as a difficult and need formal procedures to solve it. However, the lower-grade students really like fractions because they can find many contexts and experienced it in their daily life. DC also proposed to try learning materials out of the box. In her perspective, trying something new is important.

Furthermore, DC gave an example of her experience in teaching fractions (figure 4):

Last October I participated in a study trip to California, USA. There I learned a game called fractionball. Children play against each other in groups and try to get points by throwing a ball into a basket. One student throws from a certain distance and passes the score to the other, who can move forward a number of places. In this way, the fractions are added together. See attached picture.

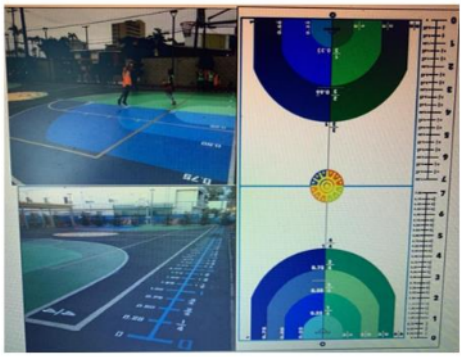


FIGURE 4. The example provided by Dutch Primary School Teacher C

Based on figure 4, DC used one High Order Thinking Skills problem in teaching fractions using a game called fraction ball. This was applied in addition of fractions. In this activity, when student throws a ball from a certain distance and passes the score to the other, the fractions are added together using number line.

2. *Strengthening specific procedural strategies to solve fraction problems.*

In figure 5, it can be seen the answer of Indonesian Primary School Teacher A (IA) when she was asked about what she saw as a mathematics teacher in her school when children were learning fractions.

Belajar bilangan pecahan itu lebih sulit dibandingkan dengan mengajarkan bilangan bulat.

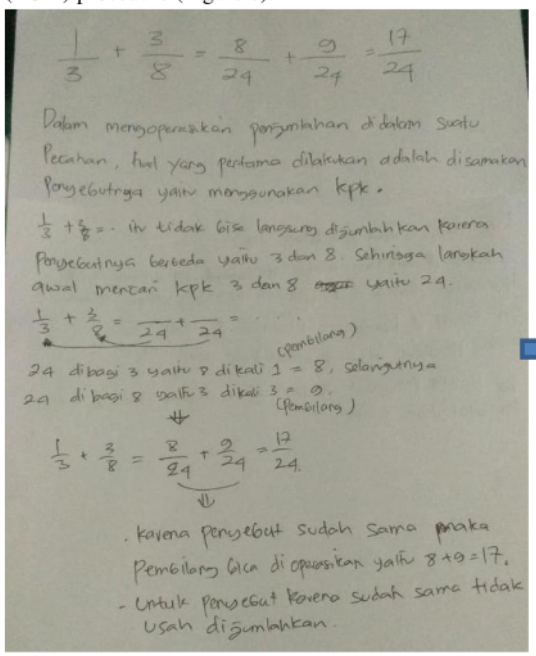
Ketika mempelajari pecahan anak-anak diajarkan melalui sesuatu hal yang konkret dan sediakan media pembelajaran misalnya dengan potongan kue.

Tahapan pada buku teks biasanya langsung dijelaskan apa arti pecahan, kemudian ke bentuk umum pecahan a/b, dimana b ≠0, a sebagai pembilang dan b sebagai penyebut.

Translate: *Learning fractions is more difficult than teaching whole numbers. When studying fractions, children are taught through something concrete and provide learning media, for example with pieces of cake.The stages in textbooks are usually explained directly what a fraction means, then to the general form of a/b fraction, where b ≠ 0, a as the numerator and b as the denominator.*

FIGURE 5. The answer of Indonesian Primary School Teacher A

Based on Figure 5, IA answered that teaching fractions were more complicated than whole numbers. When learning fractions, she usually uses a concrete media such as a piece of cake. She also uses the steps in the textbook provided whereas fraction is taught as a general form of a/b, where b ≠ 0, a is the numerator and b is the denominator. Furthermore, she added an example of her experience in teaching addition of fractions using Least Common Multiple (LCM) procedure (Figure 6).



Translate:

When I teach fractions, for example in addition of fractions I usually do such in the following:

$$\frac{1}{3}+\frac{3}{8}=\frac{8}{24}+\frac{9}{24}=\frac{17}{24}$$

In operating addition in fractions, the first thing to do is to equate the denominators, that is, to use the least common multiple (LCM).

$\frac{1}{3}+\frac{3}{8}=\cdots$ *could not be added directly because the denominators are different, namely 3 and 8. So the first step is to find the LCM of 3 and 8, which is 24.*

$$\frac{1}{3}+\frac{3}{8}=\frac{\cdots}{24}+\frac{\cdots}{24}=\cdots$$

24 is divided by 3 become 8 then it is multiplied by 1 (first numerator), and the result is 8.

Then,

24 is divided by 8 become 3 then it is multiplied by 3 (the second numerator), and the result is 9.

$$\frac{1}{3}+\frac{3}{8}=\frac{8}{24}+\frac{9}{24}=\frac{17}{24}$$

Because the denominators are the same, the numerators can be operated (added) i.e. 8+9 = 17.

For the denominators because those are the same then there is no need to add.

FIGURE 6. The example provided by Indonesian Primary School Teacher A

Figure 7 shows the answer of Indonesian Primary School Teacher B (IB) when she was asked about her perspective in teaching fractions.

Anak-anak harus memahami konsep pecahan terlebih dahulu dengan membawa alat-alat peraga dari benda-benda yg biasa mereka lihat

Untuk mengenal pecahan siswa harus dikenalkan dengan konsep pecahan dengan mengenalkan pecahan melalui gambar atau benda-benda yang biasa mereka lihat atau temui. Jika untuk operasi hitung anak-anak diajarkan konsep dasar operasi hitung pecahan (jika penjumlahan dan pengurangan harus disamakan nilai penyebutnya), (jika perkalian atas kali atas, bawah kali bawah) (pembagian pecahan harus diubah menjadi bentuk perkalian). Siswa juga diajarkan beberapa cara mengerjakan soal penjumahan, pengurangan, perkalian dan pembagian.

Translate:
Children must first understand the concept of fractions by bringing the learning media from objects they usually see.
To get to know fractions students must be introduced to the concept of fractions by introducing fractions through pictures or objects they usually see or encounter. If for arithmetic operations children are taught the basic concepts of fractional arithmetic operations (if addition and subtraction must be the same as the denominator), (if multiplication is up times up, bottom times bottom) (dividing fractions must be changed to multiplication). Students are also taught several ways to work on addition, subtraction, multiplication and division problems.

FIGURE 7. The answer of Indonesian Primary School Teacher B

Based on figure 7, IB usually uses the context or learning media which is familiar for children to learn fractions. And for teaching the operation of fractions such as addition, subtraction, multiplication, and division of fractions she used the certain procedures to solve it. According to IB, for addition and subtraction of fractions, the denominators should be the same, and for multiplication of fractions she taught the children to multiply each numerator and also each denominator. For division of fractions she uses the procedure of changing division become multiplication.

The same as IA, IB gave the example about addition of fractions using LCM method, and she named by herself this method as "butterfly method". Figure 8 describes the example provided by IB.

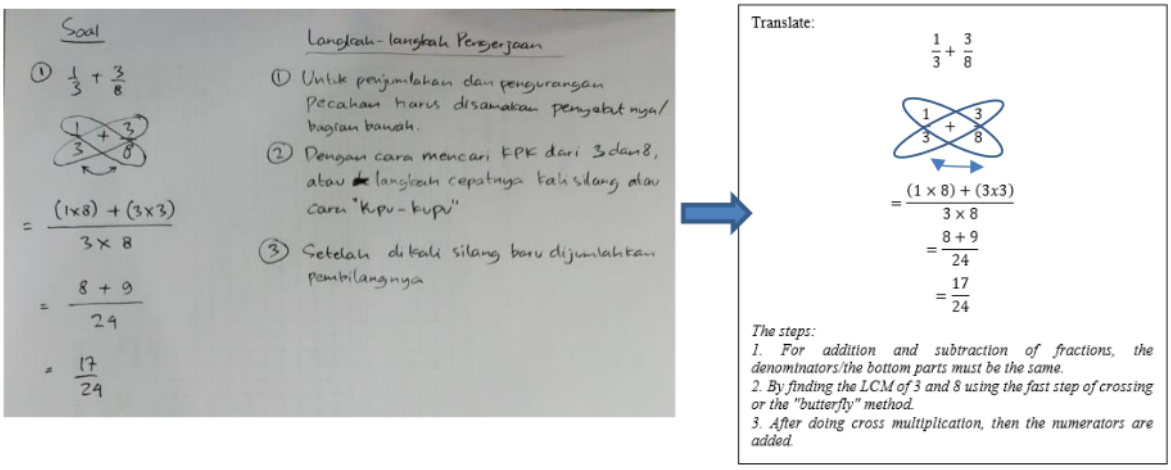


FIGURE 8. The example provided by Indonesian Primary School Teacher B

Figure 9 shows the answer of Indonesian Primary School Teacher C (IC) when she was asked about what she saw as a mathematics teacher in her school when children were learning fractions. The answer is the following:

Dalam pembelajaran pecahan di kelas IV ini saya melihat peserta didik masih harus diberikan pemahaman secara jelas tentang pengertian pecahan dan konsep pecahan. Selain itu kelas IV ini materi pecahan terdapat di Bab 1 dimana terbagi beberapa bagian sub bab yaitu pecahan senilai, urutan pecahan, bentuk-bentuk pecahan, pembulatan dan penaksiran. Karena tingkatan materi yang sudah secara mendalam membahas pecahan, peserta didik membutuhkan konsentrasi yang baik agar paham materi pecahan tersebut. Namun, kemampuan peserta didik itu berbeda-beda, apalagi di pecahan ini sangat berkaitan erat dengan operasi hitung perkalian dan pembagian. Disitulah hal yang mendasar, jika perkalian dan pembagian saja belum bisa memahami dengan baik akan berpengaruh dalam pembelajaran pecahan.

Translate:
In learning fractions in grade IV, I see that students still need to be given a clear understanding of the meaning of fractions and the concept of fractions. Apart from that, in grade IV contains material for fractions in Chapter 1 which is divided into several sub-chapters, namely equivalent fractions, order of fractions, forms of fractions, rounding and estimation. Because the level of material has already discussed fractions in depth, students need good concentration in order to understand the fractional material. However, the abilities of the students differ, especially in this fraction which is very closely related to the arithmetic operations of multiplication and division. That's where the basic thing is, if you can't understand multiplication and division well, it will have an effect on learning fractions.

FIGURE 9. The answer of Indonesian Primary School Teacher C

Based on figure 9, IC proposed that in teaching fractions, the students should understand the meaning and the concept of fractions itself. According to IC, since fractions in primary schools contain of several topics, there is intertwinement between one topic and another topic in mathematics, such as to solve arithmetic operations of fractions the students should understand about multiplication and division as well.

From all teachers' answer and the description, it can be seen that "there is a difference" in teachers' perspectives when they teach fractions, namely 1) strengthening the basics of fractions using a model, and 2) strengthening specific procedural strategies to solve fraction problems. According to the Dutch primary school teachers in this research, mathematical teaching should start from the foundation to build students' motivation to learn more about mathematics. It is in line with (20) that using a model for progressive mathematization can bridge the informal to formal level of mathematics. Meanwhile, Indonesian primary school teachers in this research encouraged students to use specific strategies to be more efficient in answering the questions. In this case further study should be developed since (12) stated that procedural knowledge in mathematical learning could become an alternative to exercises, since it contain more creative problem-solving activity in effective ways.

Regarding the role of using HOTS problem in teaching fractions, there was only one Dutch primary school teacher who provided the example outside from the textbook that usually used for teaching fractions. Whereas most participants from Dutch and Indonesian teachers chose an easier way from familiar context for children that they thought would create an understanding of fractions. It is contrary to (16) described that the teaching approach conducted by teachers should begin by giving students a mathematical problem that applies the principles that they have not learned.

According to their perspectives, both the Dutch and Indonesian Primary School Teachers have their own strategies in teaching fractions. In this research, the researchers do not judge which one is better because each strategy has its own reasoning. However, since all participants could describe the way of looking at the children and reflect their own lesson, it showed that every teacher has done their best with their own version. It indicated that the role of teacher in classroom is very important for students (21–30). From the teachers' descriptions, the researchers analyzed that there are two teachers' abilities that should be strengthened in mathematical teaching: 1) Teacher's noticing skill generally refers to the sense of the teacher in observing: "looking at the children"; 2) Teachers' reflective skill to develop

teachers' reasoning about why they use specific instructional strategies and how they can improve their teaching to give a good impact on students.

CONCLUSION

This research indicated that teachers in the Netherlands and Indonesia addressed the basics of fractions using contextual situations. There are two perspectives of teachers in teaching fractions: 1) strengthening the basics of fractions using a model, and 2) strengthening specific procedural strategies to solve fraction problems. Most Dutch and Indonesian teachers chose an easier problem in teaching fractions. However, because of the limited number of participants in this research, further research is needed to find more about teachers' perspectives on their teaching method or the materials used and also the impact for the students' mathematical reasoning. Regardless of the limitation of the research, this finding can become a recommendation for designing teachers' professional development especially in developing teachers' noticing skills and teachers' reflective skills especially for Indonesian Primary School Teachers who have never experienced in implementing RME/PMRI in their classroom.

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REFERENCES

1. Clements DH, Sarama J. Children's mathematical reasoning with the turtle programming metaphor. In: English LD, editor. Mathematical Reasoning: Analogies, Metaphors, and Images. Washington D. C: Routledge; 2013. p. 313–37.
2. Davis RB, Maher CA. How students think: The role of representations. In: English LD, editor. Mathematical Reasoning: Analogies, Metaphors, and Images. Washington D. C: Routledge; 2013. p. 93–115.
3. Gholson B, Smither D, Buhrman A, Duncan MK, Pierce KA. Children's development of analogical problem-solving skill. In: English LD, editor. Mathematical Reasoning: Analogies, Metaphors, and Images. Washington D. C: Routledge; 2013. p. 149–80.
4. Lakoff G, Núñez RE. The metaphorical structure of mathematics: Sketching out cognitive foundations for a mind-based mathematics. In: English LD, editor. Mathematical Reasoning: Analogies, Metaphors, and Images. Washington D. C: Routledge; 2013. p. 21–92.
5. Presmeg NC. Reasoning with metaphors and metonymies in mathematics learning. In: English LD, editor. Mathematical Reasoning: Analogies, Metaphors, and Images. Washington D. C: Routledge; 2013. p. 267–80.
6. Rattermann MJ. Commentary: Mathematical reasoning and analogy. In: English LD, editor. Mathematical Reasoning: Analogies, Metaphors, and Images. Washington D. C: Routledge; 2013. p. 247–64.
7. Sfard A. Commentary: On metaphorical roots of conceptual growth. In: English LD, editor. Mathematical Reasoning: Analogies, Metaphors, and Images. Washington D. C: Routledge; 2013. p. 339–71.
8. Wheatley GH. Reasoning With Images In Mathematical Activity. In: English LD, editor. Mathematical Reasoning: Analogies, Metaphors, and Images. Washington D. C: Routledge; 2013. p. 281–97.
9. Verma D, Bach K, Mork PJ. Modelling Similarity for Comparing Physical Activity Profiles - A Data-Driven Approach. In: Cox MT, Funk P, Begum S, editors. Case-Based Reasoning Research and Development [Internet]. Cham, Switzerland: Springer; 2018. p. 415–30. Available from: http://link.springer.com/10.1007/978-3-030-01081-2_28
10. Wahyu Purnomo Y, Pramudiani P, Abdul Aziz T, Kaur A, Noor Ismail S, Nuriadin I. Indonesian Teachers Beliefs On The Gap Between Educational Research And Practice. Aust J Teach Educ [Internet]. 2019 Dec;45(12):24–42. Available from: https://ro.ecu.edu.au/ajte/vol45/iss12/2/
11. Bakker A. Design Research in Education [Internet]. New York: Routledge; 2018. Available from: https://www.taylorfrancis.com/books/9781351329422

12. Foster C. Developing mathematical fluency: comparing exercises and rich tasks. Educ Stud Math. 2018;97(2):121–41.
13. Gustiningsi T, Utari RS. Developing of Higher Order Thinking Skill (HOTS) Mathematical Problems With Cartesian Coordinate Material. In 2021.
14. Isnaini N, Harti H, Wulandari SS, Patrikha FD. Pengembangan Bahan Ajar Berbasis E-Modul pada Pembelajaran Komunikasi Perkantoran Program Studi Pendidikan Administrasi Perkantoran. J Pendidik Adm Perkantoran [Internet]. 2021 Dec 31;9(3):370–80. Available from: https://journal.unesa.ac.id/index.php/jpap/article/view/16928
15. Astutik S. HOTS student worksheet to identification of scientific creativity skill, critical thinking skill and creative thinking skill in physics learning [Internet]. Vol. 1465, Journal of Physics: Conference Series. 2020. Available from: https://api.elsevier.com/content/abstract/scopus_id/85082998125
16. Stigler JW, Hiebert J. The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom. J Curric Stud [Internet]. Reissue ed. 2000 Nov;32(6):867–74. Available from: http://www.tandfonline.com/doi/abs/10.1080/00220270050167215
17. Gravemeijer KPE. Developing Realistic Mathematics Education. Culemborg: Technipress; 1994.
18. Sembiring R, Hoogland K, Dolk M. A Decade of PMRI in Indonesia. Bandung, Utrecht: Ten Brink, Meppel; 2000. 1–223 p.
19. Terlouw B. What Children Tell Us During Arithmetic Lessons . The child as a mirror for the teacher. 2022; Available from: The Netherlands Local Newspaper
20. Gravemeijer KPE. Developing Realistic Mathematics Education: Ontwikkelen Van Realistisch Reken/wiskundeonderwijs. , 1994. CD-[beta] Press. 1994;13(3).
21. Vale I, Barbosa A. Mathematics creativity in elementary teacher training. J Eur Teach Educ Netw [Internet]. 2015;10:101–9. Available from: https://drive.google.com/file/d/147QKSH6XllduTyY8hPVFvYSIJKf84BXT/view
22. Ghanizadeh A, Jahedizadeh S. EFL teachers' teaching style, creativity, and burnout: A path analysis approach. Boylan M, editor. Cogent Educ [Internet]. 2016 Dec 31;3(1):1151997. Available from: https://www.tandfonline.com/doi/abs/10.1080/2331186X.2016.1151997
23. Soh K. Creativity fostering teacher behaviour around the world: Annotations of studies using the CFTIndex. Boylan M, editor. Cogent Educ [Internet]. 2015 Dec 31;2(1):1034494. Available from: https://www.tandfonline.com/doi/abs/10.1080/2331186X.2015.1034494
24. Machali I, Wibowo A, Murfi A, Narmaditya BS. From teachers to students creativity? the mediating role of entrepreneurial education. Tinoca L, editor. Cogent Educ [Internet]. 2021 Jan 1;8(1). Available from: https://www.tandfonline.com/doi/full/10.1080/2331186X.2021.1943151
25. Sumirattana S, Makanong A, Thipkong S. Using realistic mathematics education and the DAPIC problem-solving process to enhance secondary school students' mathematical literacy. Kasetsart J Soc Sci [Internet]. 2017 Sep;38(3):307–15. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2452315117303685
26. Likar B, Cankar F, Zupan B. Educational Model for Promoting Creativity and Innovation in Primary Schools. Syst Res Behav Sci [Internet]. 2015 Mar;32(2):205–13. Available from: https://onlinelibrary.wiley.com/doi/10.1002/sres.2261
27. Vandeyar S. The Teacher as an Agent of Meaningful Educational Change. Educ Sci Theory Pract [Internet]. 2017;17(2):373–93. Available from: https://jestp.com/index.php/estp/article/view/470
28. Huang X, Chi-Kin Lee J, Yang X. What really counts? Investigating the effects of creative role identity and self-efficacy on teachers' attitudes towards the implementation of teaching for creativity. Teach Teach Educ [Internet]. 2019 Aug;84:57–65. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0742051X18307972
29. Pareja Roblin NN, Ormel BJB, McKenney SE, Voogt JM, Pieters JM. Linking research and practice through teacher communities: a place where formal and practical knowledge meet? Eur J Teach Educ [Internet]. 2014 Apr 3;37(2):183–203. Available from: http://www.tandfonline.com/doi/abs/10.1080/02619768.2014.882312
30. Santoro DA. "I Was Becoming Increasingly Uneasy About the Profession and What Was Being Asked of Me": Preserving Integrity in Teaching. Curric Inq [Internet]. 2013 Dec 7;43(5):563–87. Available from: http://www.tandfonline.com/doi/full/10.1111/curi.12027

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