

SYMBOL SENSE ABILITY OF JUNIOR HIGH SCHOOL PROFESSIONAL MATHEMATICS TEACHERS'

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Abstract

Symbol sense is the intuitive feeling of calling out symbols in the process of solving problems. Professional teachers are teachers who have graduated from the Teacher Education Program (PPG). The objectives of this qualitative descriptive study are to describe the symbol sense ability of professional mathematics teachers in junior high school. From 25 mathematics teachers from three different schools, three were selected with more than 10 years of teaching experience in junior high schools and who had passed PPG as research subjects. Data were collected through six symbol sense tasks adapted from Jupri and Suspiyati and interviews. Assignments and interviews were analyzed using the triangulation method proposed by Miles, Huberman, and Saldana. The study results show that professional teachers tend to have good symbol sense abilities. In the second symbol sense characteristic, two out of three teachers display poor symbol sense performance by manipulating the equation directly rather than reading the assignment in depth-first to get a better understanding so that they can complete the task correctly and efficiently. The teacher should improve his symbol sense ability.

Keywords: PPG, professional mathematics teacher, symbol sense

Abstrak

Symbol sense adalah perasaan intuitif saat memanggil simbol dalam proses memecahkan masalah. Guru Profesional merupakan guru yang telah lulus dari Program Pendidikan Guru (PPG). Tujuan dari penelitian deskriptif kualitatif ini adalah untuk mendeskripsikan kemampuan simbol sense dari guru matematika profesional di jenjang SMP. Dari 25 guru matematika dari tiga sekolah berbeda, dipilih tiga guru dengan pengalaman mengajar lebih dari 10 tahun di SMP dan telah lulus PPG sebagai subjek penelitian. Data dikumpulkan melalui enam tugas simbol sense yang diadaptasi dari Jupri dan Sispiyati dan wawancara. Tugas dan wawancara dianalisis menggunakan metode triangulasi yang diajukan oleh Miles, Huberman, dan Saldana. Hasil penelitian menunjukkan bahwa guru profesional cenderung memiliki kemampuan simbol sense yang baik. Pada karakteristik simbol sense kedua, dua dari tiga guru menampilkan performa simbol sense yang kurang baik dengan melakukan manipulasi persamaan secara langsung daripada membaca tugas secara mendalam terlebih dahulu agar memperoleh pemahaman yang baik sehingga dapat menyelesaikan tugas dengan benar dan efisien. Guru sebaiknya meningkatkan kemampuan simbol sensenya.

Kata kunci: guru profesional matematika, simbol sense, PPG



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INTRODUCTION

Algebra is called a language that expresses mathematical relationships

and is considered a mathematical language and is used to describe the relationship between people, thoughts,

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elements, and structures (Ontario Ministry of Education, 2013; Samo, 2009). Algebra is an important topic of mathematics that must be studied by students from elementary school, junior high school, and senior high school to college (Andini & Yuniarta, 2018; Jupri & Drijvers, 2016; Kusumaningsih et al., 2018; Pramesti & Retnawati, 2019). However, some students in elementary school, junior high school, or senior high school have difficulty working on algebra problems related to facts, concepts, and principles (District et al., 2021; Radiusman et al., 2020; Sugiarti & Karyati, 2021; Sugiarti & Retnawati, 2019; Tiwari & Fatima, 2011; Zielinski, 2017). Many students around the world learning mathematics only emphasize memorizing procedures (Eichhorn et al., 2018). Algebra material should be taught by developing students' conceptual knowledge (Fernández-Millán & Molina, 2017).

Arcavi introduces a concept that is symbol sense. Symbol sense is the intuitive feeling of calling out symbols in the process of solving mathematics problems (Arcavi, 1994). This ability is needed to know the basic algebraic skills of a person. Therefore, symbol sense is indispensable in completing non-routine and routine algebraic tasks (Kop, 2020). Symbol sense has an important role in solving mathematical problems, especially algebra problems (Bokhove & Drijvers, 2010) and symbol sense proficiency is an important aspect of algebra learning (Jupri & Sispiyati, 2020b). According to Arcavi, to assess a person's symbol sense ability, can be seen from six characteristics, that is (1) friendliness with symbols, (2) an ability to manipulate and 'read through' symbolic expressions in solving mathematic problems, (3) the realization that one can successfully

engineer symbolic relationships, (4) the ability to choose the best possible symbolic representation for a problem, (5) awareness of the need to check the meaning of symbols during the implementation of the procedure, (6) awareness that symbols can play different roles in different contexts (Arcavi, 2005). Jupri and Sispiyati (2021) made several mathematical tasks based on six characteristics of symbol sense ability and the various possible responses given by students to these task. They suggest using the tasks they have compiled for further research.

Teachers play the most important role in developing students' academic potential (Burroughs et al., 2019; Ezezi Isaac Obilor, 2020). Teacher-centered learning activities are more effective in improving student achievement (Akiba & Liang, 2016). The results indicated that teacher performance on student learning attainment was positively correlated with experience, quality (professional, pedagogic, and communication skills), and teacher performance (Ambussaidi & Yang, 2019; Amie-Ogan & Onyebuchi, 2020; Burroughs et al., 2019; Kimani et al., 2013; Mahulae et al., 2020). Teacher knowledge influences students' academic success (Khan et al., 2016). The results showed that teachers who had PPG experience had good knowledge in knowing and overcoming misconceptions experienced by students (Juhaevah et al., 2020).

In developed nations, the practice of teacher professional development is common (Yangambi, 2021). The development of the teaching profession is very important for teachers in Indonesia to maintain the quality of their profession. In addition, teachers can develop their pedagogical knowledge, content knowledge,

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pedagogic content knowledge, and skill by taking part in PPG, which will help them to increase student learning achievement and the standard of national education. (Kasi et al., 2020; Kusumawardhani et al., 2017). As a strategy to support the increasingly complex skills that students need to learn to be prepared for further education and employment in the 21st century, teacher professional learning is becoming more and more in demand. (Darling-hammond et al., 2017). The finding of the study state that teacher professional development can improve teacher knowledge and skills which lead to improvements in teacher quality to meet student needs, from this it can improve student learning achievement (Bachtiar, 2021; Nurtanto et al., 2020; Osei-owusu, 2022; Yangambi, 2021).

Symbol sense is one of the concepts that can be used to assess the ability of algebraic material. The results showed that some students had difficulty understanding algebraic material. One of the main factors for student success in learning is the teacher. Teachers who master the material well will have a positive influence on the success of students. The professional teacher program (PPG) enhances the professional abilities of teachers. Finding out the mastery of the material or teacher professionalism in algebraic material can be measured by giving the task of symbol sense. Several previous studies raised the theme of symbol sense. Jupri & Sispiyati (2020a) made three symbol sense tasks on quadratic equation material, Jupri & Sispiyati (2021) made six math tasks according to the characteristics of symbol sense ability, Jupri & Sispiyati (2020b) examined students' algebra

skills in terms of symbol sense, results in the study showed that more than half of the students were less proficient in symbol sense, and Mutammam et al. (2023) examined junior high school students' symbol sense thinking. When solving equation problems, students frequently choose procedural solutions over those that rely on symbol sense. Furthermore (Arcavi, 2005) makes characteristics along with examples of symbol sense. However, professional teachers' ability to complete symbol sense tasks has yet to be described.

To assess the expertise of professional teachers in algebraic material, several task according to the characteristics of symbol sense were given. This study aims to assess the proficiency of junior high school mathematics teachers in the symbol sense.

METHOD

This study is descriptive research using qualitative methodologies. This study aims to describe the ability of junior high school teachers in symbol sense. The procedure of this research are (1) making instruments, (2) selecting subjects, (3) collecting data, (4) analyzing data, and (5) writing reports. There are two research instruments. The first is the symbol sense task in algebraic material, which we adapted from Jupri & Sispiyati (2021) and can be seen in Table 1. The second interview guide refers to the indicators in Table 2. Before the instrument is used, the instrument is validated by three experts. The validation carried out includes content validity and construct validity.

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Table 1. Symbol sense task

Number of Question	Question
1	Find two positive numbers such that the addition of the two numbers is 6 and the multiplication of the two numbers is also 6.
2	Solve the equation $(2x - 3)/(4x - 6) = 5$.
3	A rectangle has a length 3 cm more than its width. If the perimeter of the rectangle is 26 cm, find the area of the rectangle.
4	Find three consecutive numbers whose sum is 708.
5	Solve the equation $40 - (2x+4)^2 = 4$.
6	Solve the following system of equations: $\begin{cases} x - y = p \\ x + y = q \end{cases}$

Table 1 Symbol sense indicator

Type	Characteristics of Symbol Sense	Symbol Sense Indicators
1	Friendliness with symbols	<ul style="list-style-type: none"> - Explain the meaning of the symbols used in completing the task. - Have sufficient knowledge related to symbolic expressions so that they can complete tasks appropriately
2	An ability to manipulate and 'read through' symbolic expressions in solving problems	<ul style="list-style-type: none"> - Thorough understanding of the meaning of tasks in the form of symbolic expressions - Recognizing the specifics of a task that contains a symbolic expression before completing it to complete it appropriately in an efficient manner
3	The awareness of the capability of creating symbolic relationships that express verbal or graphical information	<ul style="list-style-type: none"> - Converting tasks in the form of verbal or graphical information into a form of symbolic expression that leads to task completion
4	The ability to select one possible symbolic representation for a problem	<ul style="list-style-type: none"> - Converting verbal information into some possible form of symbolic representation - Choose the most efficient symbolic representation to complete the task
5	The realization of the need to check for symbol meanings during the process of solving problems	<ul style="list-style-type: none"> - Checking the symbolic meaning during the problem solving process - Finding special things in symbolic problems in the process of solving them so that they can solve them in an efficient way
6	The realization that symbols can play roles as variables or parameters	<ul style="list-style-type: none"> - Realize which symbols act as variables and which act as parameters in a symbolic problem

From 25 mathematics teachers from three different schools under the auspices of the Amanatul Ummah

Foundation, three people who had experience teaching in junior high schools for more than 10 years and had

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passed PPG were selected as research subjects. In 2022, the three teachers were given six tasks based on the characteristics of symbol sense. After that, to deepen the data results, interviews were conducted. The results of the teacher's work and the results of the interviews were analyzed. The results of the teacher's work were analyzed by analyzing the data by describing the work of each symbol sense task. Likewise, the results of the interviews were described by the interview guidelines. From the two resulting data, a triangulation method was carried out (Miles et al., 2014). To make it easier to understand, the subject is coded as in Table 3.

Table 3. Subject code

No	Initial	Code
1	A	S1
2	ALS	S2
3	SA	S3

RESULTS AND DISCUSSIONS

After getting the data, namely the results of the teacher's work and interviews, the next step is to describe each data based on indicators. Furthermore, from these results, triangulation of methods is carried out to obtain research results. The result of the study in the form of an illustration of the symbol sense ability of a professional junior high school mathematics teacher in completing tasks one to six are presented in Table 4.

Table 4. Overview of junior high school professional mathematics teachers' ability in completing symbol sense tasks

Subject			Conclusion
S1	S2	S3	
Characteristic 1			
S1 has a friendliness with symbols that can be used to solve problems. S1 uses the symbols a and b to represent the two values being searched for. S1 changes the verbal information on the questions into a symbolic form $a+b=6$ and $ab=6$. In completing the task, S1 converts the symbolic information into the form of a quadratic equation $x^2-6x+6=0$, then converts it to a complete square form $(x-3)^2-3=0$, and solves it with the formula for the difference of squares $(x-3+\sqrt{3})(x-3-\sqrt{3})=0$.	S2 has a friendliness with symbols that can be used to solve problems. S2 uses the symbols x and y to represent the two values being searched for. S2 changes the verbal information on the questions into a symbolic form $x+y=6$ and $xy=6$. In completing the task, S2 changes $xy=6$ to $x=6/y$, then substitutes it into $x+y=6$, so that we get $6/y+y=6 \Leftrightarrow 6+y^2=6y \Leftrightarrow y^2-6y+6=0$. Next, S2 solves the quadratic equation with the quadratic formula $y_{1,2} = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$. The	S3 has a friendliness with symbols that can be used to solve problems. S3 uses the symbols p and q to represent the two values being searched for. S3 changes the verbal information on the questions into a symbolic form of $p+q=6$ and $pq=6$. In solving the task, S3 changes $p+q=6$ to $p=6-q$, then substitutes it into the equation $pq=6$, so that we get $(6-q)q=6 \Leftrightarrow 6q-q^2=6 \Leftrightarrow q^2-6q+6=0$. Next, S3 solves the quadratic equation with the quadratic formula $x_{1,2} = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$. The solutions obtained	The three subjects have friendliness with symbols that can be used to solve problems. S2 and S3 use a quadratic formula to solve the problem, while S1 changes to a complete square form which is followed by the formula for the difference of squares. S1 describes in more detail the value of the two possible numbers.

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Subject			Conclusion
S1	S2	S3	
<p>The solutions obtained are $x_1=3-\sqrt{3}$ and $x_2=3+\sqrt{3}$. So it can be concluded that for $a=3-\sqrt{3}$ then $b=3+\sqrt{3}$, and for $a=3+\sqrt{3}$ then $b=3-\sqrt{3}$. S1 states that the two numbers fulfill the assignment request because $\sqrt{3}\approx 1,73$, so the two numbers obtained are positive numbers.</p>	<p>solutions obtained are $y_1=3-\sqrt{3}$ and $y_2=3+\sqrt{3}$. S2 states that the two numbers fulfill the assignment request because $\sqrt{3}\approx 1,73$, so the two numbers obtained are positive numbers. Even though both numbers are the completion of the task, mathematically the completion of S2 is not complete because S2 has just found the value of y. S2 should also find the value of x.</p>	<p>are $x_1=3-\sqrt{3}$ and $x_2=3+\sqrt{3}$. S3 states that the two numbers fulfill the assignment request because $\sqrt{3}\approx 1,73$, so the two numbers obtained are positive numbers. Even though both numbers are the completion of the task, mathematically the completion of S3 is not complete because S3 has just found the value of q. S3 should also find the value of p.</p>	
Characteristic 2:			
<p>At first S1 tries to complete the task by moving the 5 on the right hand side to the left side, then equating the denominators. However, S1 realizes that the aliarbar form of the assignment between the numerator and denominator can be simplified because they have the same factor, namely $(2x-3)/(4x-6)=5\Leftrightarrow(2x-3)/2(2x-3)=5\Leftrightarrow 1/2=5$. Since $1/2$ it will never equal 5, the task has no solution.</p>	<p>S2 solves the problem by converting 5 into a fractional number $5/1$, then cross multiplies and simplifies it to get the result $x=3/2$. S2 does not read in depth the information on the assignment, as a result, assumes that it $3/2$ is a solution, even though if it is $3/2$ substituted in the initial equation, it $3/2$ does not meet the equation.</p>	<p>S3 solves the problem of moving $4x - 6$ on the left side to the right side, so that $2x-3=5(4x-6)$. S2 is obtained then performs distributive multiplication and simplifies the algebraic form to get the result $x=3/2$. S3 does not read in depth the information on the assignment, as a result, assumes that it $3/2$ is a solution, even though if it is $3/2$ substituted in the initial equation, it $3/2$ does not fulfill the equation.</p>	<p>S1 has a thorough understanding of the meaning of tasks in the form of symbolic expressions. S1 is aware of the specifics of a task that contains a symbolic expression before completing it so that it can complete it precisely in an efficient manner. While S2 and S3 are not. They immediately perform algebraic manipulations and do not realize if the results they get do not meet the equation.</p>
Characteristic 3:			
<p>S1 is able to change the tasks presented in the form of verbal information to the</p>	<p>S2 is able to change the tasks that are presented in the form of verbal information</p>	<p>S3 is able to change the tasks presented in the form of verbal information to the</p>	<p>The three subjects were able to change the task in the form of verbal</p>

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Subject			Conclusion
S1	S2	S3	
<p>form of symbols that lead to problem solving. The length is denoted by p and the width is denoted by l. "The length is 3 cm more than the width" is symbolized by $p=3+l$. With the perimeter formula S1 gets the length and width of the rectangle. Then S1 can get the exact area of the rectangle.</p>	<p>to the form of symbols that lead to problem solving. The length is denoted by p and the width is denoted by l. "The length is 3 cm more than the width" is symbolized by $p=l+3$. Using the formula for the perimeter of S2, we get the length and width of the rectangle. Then S2 can get the exact area of the rectangle.</p>	<p>form of symbols that lead to problem solving. The length is denoted by p and the width is denoted by l. "The length is 3 cm more than the width" is symbolized by $p=3+l$. With the perimeter formula S3 gets the length and width of the rectangle. Then S3 can get the exact area of the rectangle.</p>	<p>information into a form of symbolic expression that led to the completion of the task. The three subjects completed the task correctly.</p>

Characteristic 4:

<p>In solving the task, S1 immediately divides 708 by 3 to get the second number of 3 consecutive numbers. Then he gets the other two numbers. In completing this task, S1 answered correctly without using any example. Based on the results of the interview, S1 stated that the method used was the fast method. In addition to the method written, S1 states that the task can be by assuming three consecutive numbers as $a, a+1$, and $a+2$ or $a-1, a$, and $a+1$. S1 mentions that the easier examples to use are $a-1, a$, and $a+1$ because they are easier to compute.</p>	<p>S2 assumes three consecutive numbers as $a-1, a$ and $a+1$. Next, S2 performs algebraic manipulation so that it gets a value of $a=236$. Then S2 found the three consecutive numbers in question are 235, 236, and 237. Based on the results of the interview, S2 stated that to complete the task you can use other examples such as $a, a+1$, and $a+2$, but for example $a-1, a$ and $a+1$ is better to use because -1 and $+1$ will run out in the calculation, so it's faster to calculate even though using other examples you still get the same result.</p>	<p>S3 assumes three consecutive numbers as $a, a+1$, and $a+2$. Next, S3 performs algebraic manipulation so that it gets a value of $a=235$. Then S3 found the three consecutive numbers in question are 235, 236, and 237. Based on the results of the interview, S3 stated that to complete the task, you can use other examples such as $a, a-1$, and $a-2$, but for example $a, a+1$, and $a+2$ is preferable because there is a concern when using the subtraction symbol worrying about getting a negative result. S2 does not realize that there are other examples that are more efficient in calculations, namely $a-1, a$, and $a+1$.</p>	<p>All three subjects were able to convert verbal information into several possible forms of symbolic representation. The three subjects were also able to choose the most efficient symbolic representation of the ones they mentioned to complete the task. It's just that S3 doesn't mention the most efficient symbolic representation in problem solving.</p>
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Subject			Conclusion
S1	S2	S3	
Characteristic 5			
<p>In completing the task, S1 realized that the equation can be converted into the form of a difference of squares. S1 converts $40-(2x+4)^2=4$ to the form $36-(2x+4)^2=0 \Leftrightarrow (6-(2x+4))(6+(2x+4))=0$ so that the solution is obtained $x=1$ or $x=-5$.</p>	<p>In completing the task, S2 changes $40-(2x+4)^2=4$ to $36=(2x+4)^2$. By pulling the roots of both sides we get $6=2x+4 \Leftrightarrow x=1$. Based on the results of the interview, S2 realized that there were incomplete calculations because the result of the root of an algebraic expression must be positive and negative. S2 continues the calculation $-6=2x+4 \Leftrightarrow x=-5$.</p>	<p>In completing the task, S3 describes $(2x+4)^2$ to the equation $40-(2x+4)^2=4$ so that he gets $40-(4x^2+16x+16)=0$. By doing algebraic manipulation, it is obtained $x^2+4x-5=0 \Leftrightarrow (x+5)(x-1)=0 \Leftrightarrow x=-5 \vee x=1$. Based on the results of the interview, S3 checks the calculations to ensure the + and - signs in the translation of the equation $40-(4x^2+16x+16)=0$. S2 is not aware of the task in depth that algebraic expressions are $40-(2x+4)^2=4$ similar to arithmetic expressions $40-\dots=4$ so that it will be easier to conclude that $(2x+4)^2=36$ and easier to solve.</p>	<p>In completing the task, S3 describes $(2x+4)^2$ first so that the solution is less efficient. In doing his master's assignment, he was less thorough, but he realized his mistake and was able to correct it during the interview. Meanwhile, S1 uses the difference of squares in solving problems.</p>
Characteristic 6:			
<p>In completing the S1 task using elimination twice. S1 eliminates y to get the value of x and eliminates x to get the value of y, so that the solution $x=(p+q)/2$ and $y=(q-p)/2$. S1 understands which symbols act as variables and which act as parameters in a symbolic problem.</p>	<p>S2 eliminates y to get the value of $x=(p+q)/2$. Next, S2 substitutes x into the equation $x+y=q$ so that we get $y=(q-p)/2$. S2 understands which symbols act as variables and which act as parameters in a symbolic problem.</p>	<p>S3 eliminates x to get the value of $y=(p-q)/(-2)$. Next, S3 substitutes y into the equation $xy=q$ to $x-(p-q)/(-2)=p$ so that both sides are multiplied by -2, so that $-2x-p-q=-2p \Leftrightarrow x=(-p+q)/2$. When multiplying both sides by -2, S3 makes an error. The result that should be obtained is $-2x-p+q=-2p$, as a result the value of x obtained is also wrong. Based on the results of the interview S3 looks very careful in calculations that</p>	<p>The three subjects understand which symbols act as variables and which act as parameters in a symbolic problem. In performing algebraic manipulation S3 is careful in performing operations involving negative numbers. However S3 still make mistakes.</p>

Subject			Conclusion
S1	S2	S3	
		involve a negative sign. In addition, S3 already understands which symbols act as variables and which act as parameters in a symbolic problem.	

In the first task, the three subjects had fulfilled all the indicators of the characteristic of "familiarity with symbols". In completing the task, the two subjects used the quadratic formula while S1 used a different method, completing the square and difference of two squares with more detailed results. It shows that most subjects completed the equation task procedurally, and only a few completed it using the symbol sense strategy. According to Jupri's (Jupri, 2022) research results, students tend to be fluent in using procedural rather than conceptual understanding.

In the second task, S2 and S3 immediately performed algebraic manipulations and did not realize that the results they obtained did not meet the equation. This is in line with what Arcavi (2005) said that when we observe students doing tasks involving symbols, we are mostly witnessing automatic manipulation. This is also in accordance with the predictions of Jupri & Sispiyati (2021) that if students manipulate the equation directly without reading the assignment in depth to gain understanding, then he will get results that do not meet the equation (Jupri & Sispiyati, 2021). Meanwhile S1 has shown a better symbol sense strategy by reading well and gaining understanding so that he realized that the numerator and denominator can be simplified so that he can complete the task precisely in an efficient manner. This is in accordance with what Arcavi (2005)

said that instead of directly completing the task, one should read symbols and pay attention to certain information.

In the third task, the three subjects have met the indicators on the characteristics of "the awareness to the capability of creating symbolic relationships that express verbal or graphical information". The three subjects were able to change the task in the form of verbal information into a form of symbolic expression that led to the completion of the task and completing it.

In the fourth task, the three subjects were able to convert verbal information into several possible forms of symbolic representation to solve the problem. The three subjects were also able to choose the most efficient symbolic representation of the ones they mentioned to complete the task. However, compared to S3, the other two subjects were able to make better symbolic representations in completing the task. This is in accordance with Jupri & Sispiyati's (2021) statement that a student who has a better feeling for symbols, which characterizes symbol sense ability, will choose more efficient representations ($n-1$, n , and $n+1$ than n , $n+1$, and $n+2$) in completing tasks.

In the fifth task, the three subjects have different methods in completing the task. S2 has a good mind in completing assignments. Instead of elaborating $(2x+4)^2$ as S3, S2 uses a more efficient way. Based on Jupri &

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Sispiyati (2020a), S2 has a conceptual understanding and S3 has a procedural understanding. Contrary to prediction Jupri and Sispiyati (2021), S1 has another efficient way of solving problems. Based on previous work, S1 seems to prefer solving quadratic equations using the formula for the difference of squares.

In the sixth task, the three subjects fulfilled the indicators of "awareness that symbols can act as variables or parameters". In completing the task, S1 uses the most efficient method. In contrast, S3 has problems with manipulation involving negative signs. Based on Mutammam's (2023) findings, sometimes, in completing assignments of symbol sense, students need to be more careful in doing algebraic manipulation, so they are wrong in completing a task.

CONCLUSION

From the results of the analysis carried out in the previous section, professional teachers can complete symbol sense tasks, especially S1. S1 always finds an efficient way to complete a task. We then refer to it as a good symbol sense ability. In contrast, the other two subjects tend to complete tasks using procedural methods. In addition, on the characteristics of sensory symbols, "the ability to manipulate and 'read' symbolic expressions in solving problems", two out of three professional teachers show poor symbol sense performance. Teachers tend to manipulate equations directly in completing symbolic tasks rather than reading the tasks in depth-first to understand better the information contained in the assignments and pay attention to specific information that can be used to complete tasks correctly and efficiently.

In addition, based on S2 and S3 work, professional teachers sometimes still make mistakes in solving problems due to inaccuracy.

The results of this study are good enough to describe the ability of professional teachers' symbol sense. It can be helpful for organizers and implementers of teacher professionalism programs in Indonesia to better develop teacher capabilities in the domain of content knowledge. Nevertheless, this study only used the symbol sense assignment in algebra to determine the ability of professional teachers' symbol sense. Therefore we suggest looking at the teacher's symbol sense ability in other math materials. The teachers who were the subject of this study were junior high school teachers. For other researchers interested in symbol sense, we suggest examining the ability of symbol sense for teachers at other levels of education.

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