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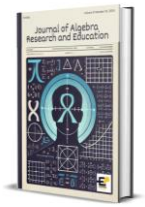

Analysis of Difficulty Learning Mathematics on Algebra Material Based on Gender

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Abstract

This research uses a qualitative descriptive method to describe learning difficulties in class VIII algebra material based on gender. The research subjects comprised 1 class of class VIII junior high school students, male and female. The data collection method used a written test on algebra material, and interviews with students were conducted regarding the written test that had been carried out. The results of this research are that male students have more difficulties than female students. Male students experience difficulties expressing principles and solving problems with solutions that require determining the form of variables but do not have difficulty when expressing the concept of grouping similar terms in algebraic form. Meanwhile, female students do not experience difficulty using the principles of operating algebraic forms and finding the value of a variable but experience difficulties when presenting the concept of grouping similar terms in algebraic form and when solving problems with solutions that require determining the variable form because female students feel confused when working on it—the next step is you do not do the problem until it is finished.

Keywords: Learning Difficulties, Algebra Mathematics, Gender

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1. Introduction

Education is an important aspect of a country, where the quality of a country's education is one of the benchmarks for whether a country can be said to be a developed or developing country. (Adelina et al., 2023). However, the quality of education in Indonesia is still relatively low; this is proven by the results of the 2018 PISA (Program for International Student Assessment) international test that Indonesia is at level 1, ranked 72 out of 77 countries (OECD, 2019). One of the subjects that has an important role in the world of education is mathematics. According to PISA, which was held in 2018, the mathematics learning achievement of Indonesian students is still relatively low; this can be seen in Indonesia's score in mathematics of 378, which is still far below the standard PISA score of 500 (OECD, 2019).

One of the subjects at the junior high school (SMP) level of education is mathematics. Mathematics is used for problem-solving in daily activities. For example, it was used to calculate, interpret, measure weight, process data, etc. This shows that humans cannot be separated from mathematics. Mathematics is a subject that exists at every level of education, from elementary school to college, which is always related to mathematics. (Sugiarti, 2018). One of the materials in mathematics that students must master is algebraic forms. Regarding the form of algebra, one of the basic competencies is based on educational units in junior high school (Nurhamsiah, 2015).

Mathematics learning is a process of interaction between teachers and students that involves thinking patterns and processing logic in a learning environment deliberately created by the teacher using various methods so that the mathematics learning program grows and develops optimally. Students can carry out learning activities effectively and efficiently to achieve ideas. -ideas, structures, and their relationships organised around abstract concepts (Limardani, 2015). According to Safitri et al., (2019) Mathematics learning has the function of developing critical, logical, creative and collaborative thinking skills that students need in this increasingly advanced life, so mathematics learning must cover the three domains of learning outcomes, namely cognitive, affective and psychomotor.

According to Hardianti and Kurniasari (2020), algebra is a branch of mathematics that must be studied because it can be useful in life. Moreover, Haniah & Senjayawati (2023) stated that Algebra is one of the materials in mathematics subjects considered difficult by students because, in the algebra material, there are operations that combine numbers with letters or variables, making students confused when solving algebra problems, especially algebra questions in the form of story problems. Maulana et al. (2023), algebra trains and encourages students to engage in critical, creative, lateral, and abstract thinking, turning them into competent problem solvers. Because of the importance of having knowledge of Algebra for studying mathematics or other subjects, NCTM (2000) urges all students to be allowed to study Algebra.

According to Hardianti & Kurniasari, (2020) believes that there are still many students who experience difficulties in completing algebraic forms. If students experience difficulty working on mathematics problems, it will prevent them from being able to do mathematics in their lives. Students' obstacles in studying mathematics influence their mastery of the material studied subsequently. Mistakes made by students in answering algebraic questions are evidence of difficulties experienced by students in the material. This confirms that difficulties are the cause of errors (Sugiarti, 2018).

According to research, errors originating from students can be in the form of preconceptions or initial conceptual errors, associative thinking, humanistic thinking, incomplete or wrong reasoning, wrong institutions, learning abilities and interests (Nugraha et al., 2019). Purwanti & Pujiastuti, (2020) stated that the learning difficulties experienced by students in working on algebra problems include difficulties in defining and understanding algebraic concepts, writing explanations, simplifying the algebraic forms of addition and subtraction, and simplifying the algebraic forms of multiplication and division.

To overcome the above problems in learning algebraic material, it is necessary to choose learning methods that are effective and efficient so that students can understand them. (Kurniawan, 2019). Students' algebraic thinking abilities must be developed by training students to think algebraically. Also, the ability to think algebraically is very important and fundamental in solving algebra-related problems.

Based on research conducted Permatasari, D, A et al., (2015) The difficulties experienced by class VIII students of SMP Negeri 2 Bangil in solving algebra material questions are based on the ability to understand concepts and the causes of students' difficulties in studying algebra material; it can be seen that students are still unable to understand the concepts in algebra material well and Correct. So, students feel confused about solving algebra material questions. This is because students are accustomed to solving questions without understanding the concepts in the questions properly. Moreover, using teaching methods, teaching aids, and media in learning by teachers is quite influential in students' difficulties in learning algebra. From the research they carried out. Rukhmana, (2020) stated student difficulties consist of difficulties regarding concepts and principles related to the algebra problems given. Students' difficulties regarding these two things result in students using incorrect question-solving procedures.

Understanding mathematical concepts is influenced by several factors, including gender differences. According to the laterization theory (theory about brain organs), gender differences cause boys and girls to have different learning experiences. This is because women tend to use the intelligence of the left brain more; the left hemisphere of the brain provides better abilities in terms of memorising, remembering, and understanding, while men tend to use right-brain intelligence; the right hemisphere provides superior intelligence response to thinking abstractly (Puspita & Masriyah, 2021).

Based on these various opinions, gender differences in students will affect students' learning achievement in algebra material, so researchers researched to explain the difficulty of learning in class VIII algebra material from gender differences. It is hoped that this research can become a reference for further research and also a reference for teachers to determine more effective learning methods to minimise learning difficulties so that the learning objectives of algebra material can be achieved.

2. Methods

The type of research carried out in describing the mathematics learning difficulties of class VIII SMP students regarding algebra material was a descriptive research method that used a qualitative descriptive approach. Qualitative research aims to describe and analyse phenomena, events, social activities, attitudes, beliefs, perceptions and thoughts of a person individually or in groups (Nugrah et al.,2013). Descriptive research is research that presents

an overview of something by describing it. This qualitative descriptive research aims to describe the various learning difficulties experienced by students based on gender when learning mathematics on algebra material (Setyawati & Ratu, 2021).

This research was carried out at SMPN 6 Siak Hulu in April 2024, in the even semester of the 2023/2024 academic year. The research subjects were 1 class VIII students. The instruments used in the research used researchers as the main instrument because the researchers functioned as selecting research subjects, collecting data, analysing data, and concluding the research results. Then, the assistance instrument uses an algebra material test containing three questions to find out the learning difficulties experienced by students working on algebra material from the perspectives of female and male students. The interview guide is a question to students regarding the reasons for answering questions with these answers, which strengthens the results of student work data on test instruments. Interview guidelines also aim to focus the discussion so that it does not expand beyond what is being studied according to the indicators of learning difficulties the researcher has determined.

Indicators and sub-indicators of learning difficulties used by researchers are as follows:

Table 1 - Indicators and sub-indicators of learning difficulties according

No	Indicator	Sub Indicator
1.	Difficulty in expressing concepts	a. Students forget abbreviations or object names and one or more conditions b. Students cannot explain the abbreviation or technical name of an object and cannot explain one or more conditions
2.	Difficulty in using principles	a. Students do not have concepts that can be used to develop principles as new items of knowledge b. Students cannot use the principles because there is a lack of clarity about the principles and so on
3.	Difficulty in solving problems with solutions that require determining the form of variables	a. Unable to know the meaning of what is read due to students' lack of knowledge about concepts or some unknown terms b. Unable to assign variables to establish variables to construct equations or able to assign variables but unable to construct equations

(Puspita & Masriyah, 2021)

This research procedure includes three stages: preparation, implementation, data analysis, and data conclusion. The preparation stage includes determining the research subject and preparing research instruments by preparing test questions and interview guidelines. The implementation stage involves testing research subjects and conducting

interviews. The test the student has taken is to find out the mistakes made by the student in solving the questions. After the essay test, an interview is conducted to obtain information regarding difficulties working on the questions. The stage of data analysis and concluding is analysing the data obtained from students' answers in working on test questions and interviews. The data is combined, compared, and analysed with comparisons with previous research related to learning difficulties in algebra material, and then the conclusion is made.

3. Results and Discussion

3.1 Results

The test questions used are as follows:

1) Group-like terms of this algebraic form $5\,y^2 + 7y + 10x^2 - 2y^2 + 6x^2 - 4x$
2) a. Is known: $20a + ab = 60$; $a = 8$. What is the value of b?
   b. Make it simple $\frac{x^2-16}{x} : \frac{x+4}{3x} =$
3) Pak Deni distributed money $Rp.300.000{,}00$ To his five children. The first child earns more.$Rp.15.000{,}00$ a Second child. The second child receives more. $Rp.15.000{,}00$En the third child, and so on. The amount of money the first child received was...

Based on the data analysis that has been carried out, the following results and discussion were obtained:

3.1.1 Analysis of Learning Difficulties in Class VIII Algebra Material for Boys

3.1.1.1 Difficulty in Expressing Concepts

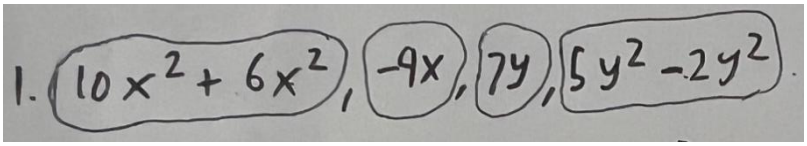

Figure 1 Male students have difficulty expressing the concept of question no. 1

Based on the male student's answer to question number one, it can be seen that the student has a basic understanding of algebra concepts. This male student was able to identify similar terms from the questions given. Despite this, he encountered errors in understanding the essence of the question. The first question asked to group similar terms, but the student provided an addition or subtraction operation between these terms. This error shows that male students lack understanding of what the question asks. In the interview, the male subject expressed learning difficulties in presenting algebraic concepts, where one of the main problems was a lack of understanding of the questions asked in the problems.

R: What is the letter after the number in the question?
C: Variable sis
R: So, what does the number in front of the variable mean?
C: Coefficient sis
R: Explain what a similar tribe means!
C: Like terms are terms that have the same variables
R: Do you understand the meaning of question number one?
C: Understand, sis, grouping similar terms which have the same variables
R: Are you asked to operate (addition) too?

C: No sis
R: So, question number one, what is the command? Is your answer appropriate?
C: Only groups with similar terms do not use operations either. Not yet, sis.

From the interview results above, it can be seen that male students can know variables and coefficients, like terms; the student did not understand the question well because the answer did not match the instructions, which asked to group similar terms.

3.1.1.2 Difficulty in Using Principles

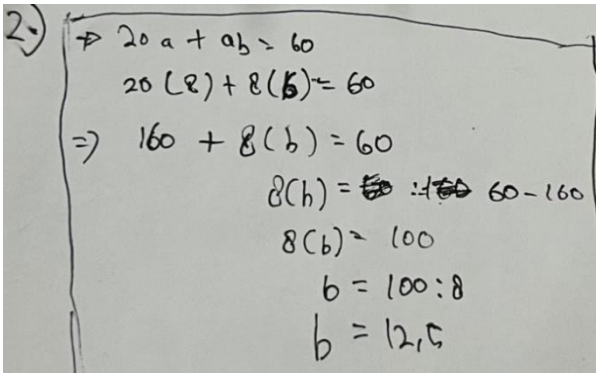

Figure 2 Male students have difficulty using the principle of question no. 2a

Based on observations of the male student's answer to question 2a, it was stated that the student could answer the question correctly. However, the student could not correctly use the multiplication principle between positive and negative numbers. Where the student subtracts between 60 and 160, the resulting 100 should be -100. This indicates that male students do not understand the principles of algebra. The following is an excerpt from an interview with male students regarding the difficulty of learning algebra material at the stage of difficulty using principles.

R: Sis, permission to interview me for a moment. Do you think the answer to number 2a is correct?
RAW: Yes, sis.
R: Can you explain how to get a b in question number 2a?
RAW: By substituting the value of an into the equation that has been given, sis, then 20 is multiplied by 8 to produce 160 and also eight multiplied by b gets 8b, then we move the segments of 160 and subtract 60 to produce 100 is after that 100 is divided by eight sis so the b value is 12.5.
R: okay, I want to ask again; try to see whether 60 minus 100 is correct.
RAW: Oh yes, sis, I thought I was still confused about the results of subtracting positive numbers and saying negative means the result should be negative, sis.

Based on the results of interviews, male students stated that students experienced confusion in subtracting and adding positive and negative numbers. Therefore, male students cannot understand the principles of algebra and cannot use them.

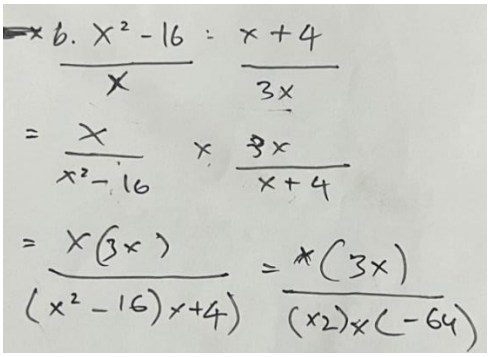

Figure 3 Male students have difficulty using the principle of question no. 2b

Based on observations of the male student's answer to question 2b, the student could not answer correctly. Errors occur when students do not understand the concept of division and multiplication in algebra. So, the student changes the position of the two sides, which should be if he wants to change the sign to times only on the left side. This proves that male students do not understand the concept of division and multiplication in simplifying algebraic operations. This results in simplifying division and multiplication operations being incomplete and incorrect.

The following is an excerpt from an interview with a male subject regarding difficulties in learning algebra material at the stage of difficulty using principles.

R: Okay, do you think the answer to number 2b is correct?
MIR: Yes, sis.
R: Try explaining your answer to question number 2b.
MIR: I first changed the division sign to multiply by changing the position of the two equations. After that, keep it simple, bro.
R: Try to pay attention again to how you changed the sign, correct or appropriate?
MIR: Yes, sis
R: Let us look at the method again; if we are dividing and want to change it to times, we only change the position of bottom to top, top to bottom of the equation on the left side, so if only the left side changes the position after that we simplify it, which means the final result isn't it? This is the answer, yes.
MIR: Oh, okay, sis.

Based on the results of interviews, male students stated that students did not understand division and multiplication in algebra. Therefore, male students cannot understand the principles of algebra and cannot use them.

3.1.1.3 *Difficulty* in Solving Problems with Solutions that Require Determining the Form of the Variable

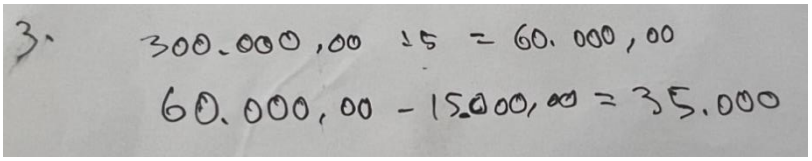

Figure 4 Male students have difficulty solving problems with solutions that require determining the variable form of problem no. 3

Based on observations of male students, not a single male student could solve question number 3 due to a lack of understanding in solving word problems by determining the form of variables. The student does not understand the basic algebra concepts proposed. The following is an excerpt from an interview with a male subject regarding the difficulty of learning algebra material at the stage where it is difficult to solve problems in variable format.

R: Does the answer to number 3 match the question asked?
R.A: Yes, sis.
R: Explain the meaning of the story.
R.A: From the question, you are asked to find out how much money Mr. Deni's first child received, Sis.
R: Explain what is known and what is asked based on the question.
R.A: It is known that Mr. Dana has Rp. 300,000.00 and gave it to each of his children. After that, Mr. Deni's money was IDR. We divide the 300,000.00 into five brothers because Mr. Deni has five children. Then, we can determine how much money Mr. Deni's first child received.

The interview results revealed that the male students did not understand algebraic concepts and terms and could not determine the variables to formulate the equation proposed in question number 3.

3.1.1.4 *Analysis* of Learning Difficulties in Class VIII Algebra Material for Girls

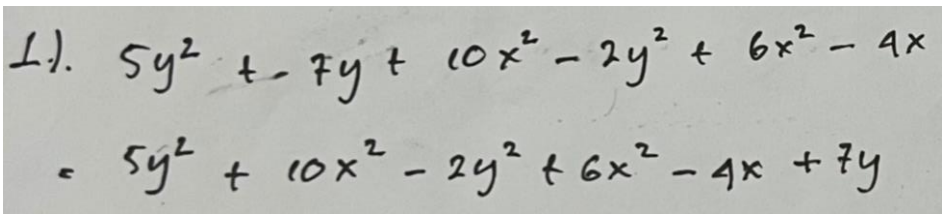

Figure 5 Female students have difficulty expressing the concept of question no. 1

Based on the female students' answers to question number one, it states that he did not understand the basic concepts of algebra. The student experienced difficulty identifying similar terms from the questions and understanding the question's essence. The answer does not fulfil the question's request to group similar terms, and it seems that the student does not understand the meaning of question number 1. In the interview, the female subject expressed her learning difficulties in presenting algebra concepts, where one of the obstacles was a lack of understanding of the material presented.

R: What do the letters behind the numbers in the question mean?
SAR: Variable, sis.
R: Then, what do the numbers mean? In front of the variable?
SAR : Coefficient sis.
R: Explain what a similar tribe is!
SAR: Like terms are terms that have similar variables the same.
R: Do you understand the meaning of question number one?
SAR: Sis, I was told to group tribes with the same variables.

The interview results show that female students understand basic algebra concepts well. Students can remember the terms variables and coefficients contained in the questions, but these students are mistaken and do not understand the meaning of the questions given. In this way, the student could not answer the questions correctly according to the instructions for grouping like terms.

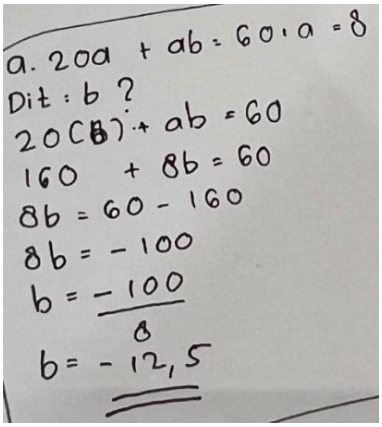

Figure 6 Female students have difficulty using the principle of question no. 2a

Based on observations of the female student's answer to question 2a, it was stated that the student was able to answer the question correctly and also that the student understood how to use the principle of multiplication between positive and negative numbers correctly. This indicates that female students understand the principles of algebra. The following is an excerpt from an interview with female students regarding difficulties in learning algebra material at the stage of difficulty using principles.

R: In your opinion, is answer number 2b correct?
RFN: That is it; I think it is correct.
R: Please explain how you arrived at the value b in question 2a.
RFN: By substituting the value a into the equation that has been given, bro, then 20 is multiplied by 8 to produce 160 and also eight multiplied by b gets 8b, then we move the segments of 160 and subtract 60 to produce -100 sis, after that, we divide -100 8 is so the b value is -12.5.

Based on the interview results, the female student stated that she could state the steps to obtain a B grade according to the results of her work. This will help the student understand the principles of algebra and be able to apply these principles.

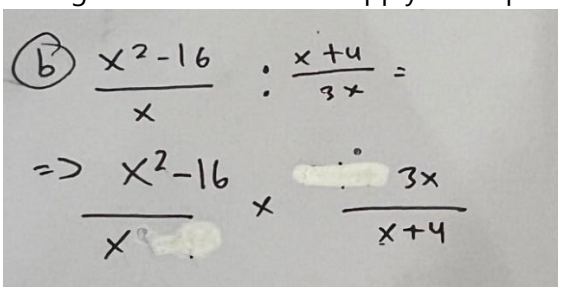

Figure 7 Female students have difficulty using the principle of question no. 2b

Based on observations of the female students' answers to question 2b, these students could work on the questions for the initial stage. Errors occur when students do not

understand the concept of multiplication in algebra. So, the student cannot simplify the form of the multiplication equation. This proves that female students do not understand the concept of multiplication when simplifying algebraic operations. This results in simplifying division and multiplication operations being incomplete and incorrect.

The following is an excerpt from an interview with a male subject regarding difficulties in learning algebra material at the stage of difficulty using principles.

R: Okay, do you think the answer to number 2b is correct?
MAS: Yes, it is only for the initial stage, but I have not finished it yet.
R: Try explaining your answer to question number 2b.
MAS: I first changed the division sign to times is by changing the position of the left equation, with the bottom one moving up and the top one moving down. After that, simplify it, bro, but I am confused about the next step to simplify it, bro.
R: OK, try looking again; the answer to change the divide sign to times is correct; now, the next step is to simplify the form of the equation by factoring $x^2 - 16$, *After that, we multiply and divide equally so that the result becomes the same as if we simplify it.* $(x + 4)(x - 4)x + 4x\ (x - 4)33x - 12$ *Ay, you understand.*
MAS: Got it, sis.

Based on the results of interviews, female students stated that students did not understand division and multiplication in algebra. Therefore, female students cannot understand the principles of algebra and cannot use them.

Difficulty in Solving Problems with Solutions that Require Determining the Form of the Variable:

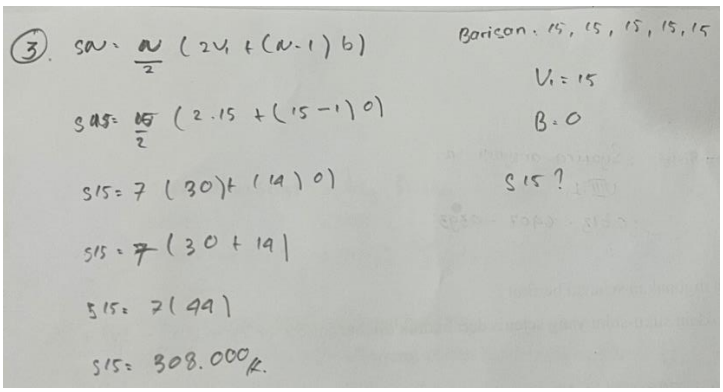

Figure 8 Female students have difficulty solving problems with solutions that require determining the variable form of problem no. 3

Based on observations of female students, it turned out that no one could solve question number 3 because of a lack of understanding regarding how to solve problems in word problems by determining the form of variables. Students do not understand the meaning of the questions because they do not understand the basic algebra concepts. However, these students know the formula for solving the problem in question number 3. The following is an excerpt from an interview with a female subject regarding difficulties in learning algebra material at the stage of difficulty solving problems in variable form.

R: Does your answer to number 3 match the question asked?

SAR: Hmm, I am doubtful, sis.
R: Explain the meaning of the story!
SAR: Based on the question, I was asked how much money Mr. Deni's first child received, Sis.
R: Try to explain what is known and what is asked based on the question
SAR: Mr Deni knows I have IDR 3000,000.00, so I give the money to each of my children, Sis. After that, I was confused, bro. I understood the formula used to find it but did not understand how to determine the U, sis. so I am not sure about the answer I made, sis.

Based on the interview result, it was found that the female students did not understand algebraic concepts and terms and could not determine the variables to formulate the equation proposed in question number 3.

3.2 Discussion

Based on the data analysis explained above, the discussion regarding the analysis of learning difficulties for class VII algebra material for male and female students is as follows.

3.2.1 Analysis of Learning Difficulties in Class VIII Algebra Material for Male Students

Based on the first indicator of expressing the concept, the male student already understands the algebra concept. However, this student does not understand the meaning of the question, so the student makes signs for addition and subtraction operations, so the answer to question no. 1 is incorrect. The question only asked to group similar terms, while male students answered by adding an operational sign, namely the "+" sign (operating with grouped terms). This is in line with research conducted by Dewi et al. (2012) stated one of the difficulties students face in learning mathematics is their inability to translate questions. However, male students could find variables, coefficients, and similar terms based on interviews.

Furthermore, male students answered the question incorrectly in the second indicator of difficulty using the principle of question 2a. This is because he has difficulty multiplicating positive and negative numbers, which makes the final result wrong. Therefore, students cannot use the principles of using positive and negative signs correctly. Then, in the next question, the male students could not answer correctly regarding difficulties in using the principle of question 2b. Errors occur when students do not understand the concept of division and multiplication in algebra. So, the student changes the position of the two sides, which should be if he wants to change the sign to times only on the left side. This indicates that male students do not understand number material. In line with research conducted by (Utami, 2016) This explains that students still do not understand the concept of arithmetic operations involving mixed integers and fractions, so they experience difficulties solving arithmetic operation questions of addition, subtraction, exponentiation, division and multiplication between positive and negative numbers.

In the third indicator of algebra difficulty, solving problems with solutions that require determining the form of variables, male students should write down what they know and arrange the equation first. In contrast, the male student divides Mr Deni's money by the number of his children, so the male student's answer is wrong. This is in line with research conducted by (A et al., 2019) Students do not know the correct stages for solving problems.

This is also in line with research explaining that students have difficulty understanding questions, such as determining what is known and what is asked by the question and concluding (Aminah & Kurniawati, 2018). Male students did not complete the answers correctly when solving the equations that had been created.

3.2.2 Analysis of Learning Difficulties in Class VIII Algebra Material for Female Students

Female students did not answer the questions correctly regarding difficulties in expressing concepts. Also, these students did not understand questions about variables, coefficients, and similar terms, so they did not understand algebraic concepts correctly. This is in line with research conducted by Dewi et al. (2012), one of the difficulties students face in learning mathematics is their lack of ability to translate questions.

Then, regarding the difficulty in using the principle, female students were correct in working on the problem. The female student's answer was correct, and the steps in completing the questions were also correct. So that female students can understand the principles of algebra and use them clearly and correctly. Then, the next question was about the difficulty of using principles, and female students did not answer correctly. However, the female student had taken the right steps at the start. Errors occur when students do not understand the concept of multiplication in algebra. So, the student cannot simplify the form of the multiplication equation. This is in line with research conducted by (A et al., 2019) Students do not know the correct stages for solving problems.

Due to difficulties in solving problems with solutions that require determining the form of variables, the steps taken are incorrect, namely writing answers only female students think are correct. When working on question number 3, the female student knew the formula used for this question. However, the female student did not write down the known and variable assignments in question number 3, so this student answered incorrectly. This is in line with research conducted by Dewi et al. (2012), explained that one of the students' learning difficulties is their lack of ability to complete work, so students do not continue their work until it is completed.

Overall, from the analysis of the discussion of difficulties in learning class VIII algebra material for male and female students, male students have more difficulty solving questions, so their answers experience errors when working on questions than female students. However, female students cannot understand the concepts when working on questions, so their answers experience errors compared to male students. This is in contrast to research conducted by Bassey et al. (2015), this explains that men are better at mathematics than women because men are based on academic abilities such as knowledge, intellectual skills, and work habits. Meanwhile, women prefer the work of homemakers, who have habits of being calm, respectful and full of affection. Research conducted by Hyde & Mertz (2009), they explained that contemporary data shows that girls in the US are almost equal to boys in mathematics achievement and in other countries.

4. Conclusions

From the data obtained and analysed, it can be concluded that male and female students from SMPN 6 Siak Hulu are the subjects of this research. Male students do not struggle to express concepts when working on class VIII algebra problems. However, male students have difficulty expressing principles and solving problems with solutions that require determining

the form of variables because they are less able to solve the problems they are working on, so they do not work on them until they are finished.

Female students do not experience difficulties expressing principles when working on class VIII algebra questions. However, female students struggle to use concepts and solve problems with solutions that require determining variable forms because they do not master the prerequisite material. Female students do not experience difficulties expressing principles with solutions that require determining variable forms but do not know the correct stages in working on problems.

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