

Students' Perceptions of Mathematics Learning Based on Their Brain Domination Group

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Abstract

This research discusses students' perceptions of mathematics learning based on their brain dominance. Descriptive qualitative methods were used with questionnaires and interviews. The research subjects were 26 students who filled out a questionnaire in the form of a brain dominance questionnaire, with details of 6 students who were interviewed in depth. Data analysis was carried out through discourse analysis of the interview results by considering the respondent's environmental context. The results of the research show that there are differences in perception between students who are right and left brain dominant and students who use both equally. Some students have different ease and difficulties in learning mathematics, as well as different views about the benefits of this material in everyday life. Apart from brain dominance, there are several other factors that influence students' perceptions, including the way teachers teach and the learning environment. Knowing students' brain dominance is important, because it can help teachers determine how to teach material appropriately so that it gets a good perception for all students, whether they are right-brain dominant, left-brain dominant, or those who tend to be balanced. In conclusion, students' perceptions of mathematics learning can be different, depending on their brain dominance.

Keywords: students' perception, brain dominance, mathematics learning

Abstrak

Penelitian ini membahas tentang persepsi siswa terhadap pembelajaran matematika berdasarkan dominasi otaknya. Metode kualitatif deskriptif digunakan dengan kuesioner dan wawancara. Subjek penelitian berjumlah 26 siswa yang mengisi angket berupa angket dominasi otak, dengan rincian 6 siswa yang diwawancarai secara mendalam. Analisis data dilakukan dengan analisis wacana terhadap hasil wawancara dengan mempertimbangkan konteks lingkungan responden. Hasil penelitian menunjukkan terdapat perbedaan persepsi antara siswa yang dominan otak kanan dan kiri dengan siswa yang menggunakan keduanya secara seimbang. Beberapa siswa mempunyai kemudahan dan kesulitan yang berbeda-beda dalam mempelajari matematika, serta pandangan yang berbeda-beda tentang manfaat materi tersebut dalam kehidupan sehari-hari. Selain dominasi otak, ada beberapa faktor lain yang mempengaruhi persepsi siswa, antara lain cara guru mengajar dan lingkungan belajar. Mengetahui dominasi otak siswa merupakan hal yang penting, karena dapat membantu guru dalam menentukan cara mengajarkan materi dengan tepat sehingga memperoleh persepsi yang baik bagi seluruh siswa, baik yang dominan otak kanan, dominan otak kiri, maupun yang cenderung seimbang. Kesimpulannya, persepsi siswa terhadap pembelajaran matematika bisa berbeda-beda, tergantung dominasi otaknya.

Kata kunci: persepsi siswa, dominasi otak, pembelajaran matematika

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INTRODUCTION

Perception is a person's response (acceptance) to something, which a person obtains through observing his five senses (Badan Pengembangan dan Pembinaan Bahasa, 2016). Viewed from the process, perception leads to the process when sensory stimuli are translated into organized experiences (Epstein et al., 2023). Perception can also be defined as the process of interpreting a

stimulus into a response in various forms, depending on the attention of the individual concerned (Baumeister & Vohs, 2004; Walgito, 2004).

Every individual has the possibility of seeing the same thing from different angles, and that is what is called perception. A person's perception can be positive or negative and is influenced by various factors, including knowledge, experience, feelings, thinking abilities, and memories that have been stored in their schema (Hamilton & Ghatala, 1994). These factors are very closely related to the learning process, so perception is an important factor that must be considered in the learning process, one of which is learning mathematics.

In the context of mathematics learning, student perceptions are important because they can influence students' attitudes towards learning mathematics (Kasmin, Otman, & Ahmad, 2019). Students who feel afraid when learning mathematics tend to avoid mathematics-related tasks (Atan & Kasmin, 2018; Mensah & Okyere, 2019). In fact, these tasks can provide many benefits for the success of students in the future, both in terms of academic achievement at school and in social life in the future (Fadilah & Munandar, 2021; Siregar & Restati, 2017).

Several research results show that mathematics gives rise to many different perceptions among people who study it (Anggoro, 2016; Attard & Holmes, 2022; Siregar et al., 2020). There are those who think it is easy, there are those who think it is difficult, and there are also those who find it easy to learn certain material but find it difficult to learn other material. This perception could be related to a person's thinking style, which predominantly uses one part of the brain (Wahyuningsih & Sunni, 2020).

Mathematics is a subject that requires and can develop logical, critical, analytical-synthetic, creative, and holistic but specific thinking abilities, although each material does not always contain all these abilities. Meanwhile, each part of the brain has different functions that other parts of the brain do not have (Allen & Zwan, 2019; Wahyuningsih & Sunni, 2020). Using the right brain causes a freer, random, holistic, literary, subjective, synthetic, and abstract thinking style. Meanwhile, the use of the left brain supports a logical, specific, objective, sequential, and analytical thinking style (Ghairabeh, 2012).

There are even several studies that say that someone who is good at mathematics or says they like mathematics is someone who uses the left brain more dominantly (Sadiqin, Istyadji, & Winarti, 2017; Wahyuningsih & Sunni, 2020). On the other hand, there is research that finds that the lack of ability to learn mathematics is caused by a lack of imagination and creativity in students, which are part of the right brain's abilities (Sukirwan, Darhim, & Herman, 2018; Wardhani & Rumiati, 2011)

Based on the findings and facts above, the perceptions of students with different brain dominance groups regarding mathematics learning are interesting and important to research. This research aims to describe the perceptions of students who are more right- and left-brain dominant towards learning mathematics and analyze the differences. It is hoped that the results of this research can provide information that can be useful for improving the quality of mathematics learning by

increasing students' perceptions of mathematics learning. Every individual has the possibility of seeing the same thing from different angles, and that is what is called perception. A person's perception can be positive or negative and is influenced by various factors, including knowledge, experience, feelings, thinking abilities, and memories that have been stored in their schema (Hamilton & Ghatala, 1994). These factors are very closely related to the learning process, so perception is an important factor that must be considered in the learning process, one of which is learning mathematics.

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METHOD

This research was conducted using a qualitative descriptive method. This method is used because this research aims to describe, explain, and answer the problems studied in detail (Sugiyono, 2019). The results of this research are in the form of descriptions or statements, but they do not have a definite form and cannot be predicted (Nasution, 1988). The instruments used have been validated by experts who are lecturers at Universitas Pendidikan Indonesia.

The first instrument used were a brain dominance questionnaire, which contained 32 statements with two answer choices (yes or no). These 32 statements describe the respondent's brain dominance tendency. The instrument was distributed to 26 grade 9 students in one of the junior high schools in Bandung City, and interviews were conducted with six selected students among the 26 students who filled out the brain dominance questionnaire.

The questionnaire used was a questionnaire from Education World (Education World, 2000). The brain dominance questionnaire is used to group students who are more left-brain dominant, more right-brain dominant, and tend to have balanced brain use. The results of the brain dominance questionnaire are then presented as an illustration of how big the dominance is.

Of the 26 questionnaire respondents, several students were selected who were left-brain dominant and right-brain dominant, whose use of the right and left brains tended to be balanced. The six students were then interviewed to find out their perceptions of mathematics learning.

The interviews conducted were unstructured interviews with an interview guide as the instrument. The interview guide was prepared based on some indicators: explored students' perceptions regarding students' interest in studying mathematics, what material students thought was the easiest and most difficult to learn in studying mathematics, what made students find it easy and difficult to learn mathematics, and students' opinions regarding the usefulness of mathematics in everyday life.

After the data is collected, its validity is checked, which includes credibility, transferability, dependability, and confirmability (Sugiyono, 2019). The data then analyzed using discourse analyzed using discourse analysis, which analyzes students' perceptions based on what they convey and adapts them to their social environment.

RESULT AND DISCUSSIONS

Student Brain Dominance

Based on the results of the brain dominance questionnaire filled out by 26 students as respondents, the results showed that there were 13 students who were left-brain dominant, 7 students who were right-brain dominant, and 6 students whose brain use was balanced. The percentage of each respondent is presented in Table 1 below.

Table 1. Percentage of Right and Left Brain Dominance

Respondent	Right-Brain Dominance	Left-Brain Dominance
1	55,6	44,4
2	42,3	57,7
3	52,4	47,6
4	47,4	52,6
5	56,3	43,8
6	40,0	60,0
7	45,5	54,5
8	42,9	57,1
9	41,2	58,8
10	41,2	58,8
11	40,0	60,0
12	55,0	45,0
13	38,9	61,1
14	47,4	52,6
15	33,3	66,7
16	53,6	46,4
17	57,1	42,9
18	42,9	57,1
19	47,8	52,2
20	64,7	35,3
21	47,8	52,2
22	37,5	62,5
23	45,0	55,0
24	47,6	52,4
25	54,2	45,8
26	41,2	58,8

Of the 26 students, 6 were taken as participants for interviews, namely: Respondent 3, Respondent 4, Respondent 11, Respondent 17, Respondent 20, and Respondent 22.

Students' Perception of Mathematic Learning

Students' perceptions of mathematics learning in this research are described for each respondent interviewed as follows:

1. Respondent 3

Respondent 3 has a right-dominant brain, but his dominance is not very significant, so his use tends to be balanced. This respondent stated that his attitude towards learning mathematics was normal because the learning results were always good, even though the process was difficult. He said that what makes mathematics difficult are the calculations and learning, which require analysis first to determine the correct use of the formula.

According to Respondent 3, easy mathematics material includes: numbers, sets, linear equations and inequalities, comparisons, social arithmetic, lines and angles, quadrilaterals and triangles, data presentation, number patterns, Cartesian fields, relations and functions, Pythagorean

theorem, circles, building flat-sided spaces, statistics, probability, numbers with powers and root forms, quadratic equations, geometric transformations, as well as similarity and congruence. Meanwhile, difficult mathematics material includes algebra and quadratic functions.

According to Respondent 3, things that make mathematical material easy to learn are the use of formulas that can be used straight away and the help of pictures when studying it. Student responses to mathematics learning can be seen from the following interviews:

Q: Menurut kamu, pelajaran matematika tuh harus bermanfaat buat menyelesaikan kehidupan sehari-hari nggak, sih?

A: Harus sih, Kak.

Q: Ooh, harus, ya? Berarti kamu tahu manfaat dari semua materi matematika yang kamu pelajari untuk kehidupan sehari-hari?

A: Nggak tahu semuanya, tapi saya yakin pasti ada manfaatnya meskipun kita belum tahu apa.

Respondent 3 believes that every mathematical material studied at school has benefits in everyday life, although currently there are still many benefits that he does not know about. Therefore, according to him, the mathematical material studied must have benefits in everyday life.

2. Respondent 4

Respondent 4 has a more left-dominant brain but not too significantly, so the use of both hemispheres tends to be balanced. His attitude towards learning mathematics is presented in the following interview results:

Q: Kamu suka pelajaran matematika nggak?

A: Nggak suka sebenarnya.

Q: Kenapa nggak suka?

A: Soalnya menguji kesabaran, apalagi kalau yang nggak bisa langsung dipake rumusnya.

Respondent 4 stated that he did not like learning mathematics because it tested his patience. These participants tend to find it difficult to learn material that uses a lot of pictures, but they also find it easy when studying material on similarity and congruence as well as geometric transformations. The perception of whether this material is easy or not is influenced by the way the teacher teaches.

Mathematical material that, according to this participant, is easy includes: numbers, algebra, linear equations and inequalities in one variable, lines and angles, quadrilaterals and triangles, data presentation, the Pythagorean theorem, flat-sided shapes, numbers with powers and root forms, quadratic equations, function squares, geometric transformations, as well as similarity and congruence. Meanwhile, mathematics material that was difficult according to this participant included: algebra, comparison, social arithmetic, number patterns, Cartesian fields, straight line equations, linear equations in two variables, circles, statistics, and probability.

Respondent 4 admitted that he often had difficulty studying material that contained images but could easily learn material about congruence and geometric transformation because the use of

formulas and images was balanced, not more of one of them. This is different with material on functions, linear equations, and the like, where the use of formulas and calculations is more dominant than the pictures.

Respondent 4 stated that mathematics material does not have to be useful in everyday life because there is a lot of material that is very rarely or even never used by ordinary people in everyday life. All existing material must be studied, even though the benefits are not yet known.

3. Respondent 11

Respondent 11 has a dominant left brain. This respondent stated that his attitude towards learning mathematics depends on the material, who teaches it, and how it is taught. When the material is felt to be easy or those who teach it can present the material in a more interesting way, then these participants like learning mathematics. If the opposite occurs, he states that he does not like learning mathematics.

Materials that, according to respondents, are easy include: numbers, sets, algebra, comparison, social arithmetic, quadrilaterals and triangles, data presentation, number patterns, Pythagorean theorem, flat-sided shapes, statistics, numbers with powers and root forms, quadratic equations, function squares, geometric transformations, as well as similarity and congruence. Meanwhile, material that participants found difficult included linear equations and inequalities, lines and angles, Cartesian planes, relations and functions, equations of straight lines, circles, and probability. The reasons why respondent consider the material easy or difficult can be seen in the following interview:

Q: Apa yang bisa bikin kamu merasa lebih mudah memahami matematika?

A: Yaa, yang gak terlalu banyak ngitungnya atau ngitung tapi rumusnya udah jelas.

Q: Kalau rumusnya belum jelas, berarti susah?

A: Susah, tapi jadi mudah kalau kaitannya sama logika atau analisis yang masuk akal gitu.

Q: Ooh, gitu. Kalau penggunaan gambar bikin materi jadi lebih mudah nggak menurut kamu?

A: Nggak terlalu sih, soalnya banyak juga materi yang pake gambar tapi tetep susah.

Respondent 11 has the perception that easy mathematics material is material that does not require a lot of calculations but rather uses definite formulas and can be grasped by logic or material that requires analysis. The use of images is not very influential because there are several materials that use images that are still difficult to learn.

According to respondent, mathematics material does not have to be useful in everyday life. This means that, even though they have not been able to find the benefits of some mathematical materials, these participants still consider some of these materials important to learn.

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4. Respondent 17

Respondent 17 is a respondent whose brain use is dominated by the right brain. Respondent 17 stated that his attitude towards learning mathematics was normal. This attitude is because in every mathematics teaching and learning process in class, he does not really understand when the teacher explains it. These participants were only able to understand the lesson when it was explained to them by their friends or when they studied alone outside of class.

Mathematical material that was easy according to this participant included: numbers, sets, social arithmetic, lines and angles, quadrilaterals and triangles, the Pythagorean theorem, circles, flat-sided shapes, geometric transformations, as well as similarity and congruence. Meanwhile, mathematical material that is difficult, according to this participant, includes: algebra, linear equations and inequalities, comparison, data presentation, number patterns, Cartesian planes, relations and functions, straight line equations, statistics, probability, numbers with powers and root forms, quadratic equations, and quadratic functions.

Respondent 17 tends to find it easier to learn mathematical material that contains images, such as plane shapes, lines, and angles, as well as similarity and congruence. According to him, difficult material is material that is full of calculations or uses algebra. However, this respondent believes that all mathematical material must be studied, even though its benefits cannot be found in everyday life.

5. Respondent 20

Respondent 20 has a brain that is more dominant on the right side. Respondent 20 stated that he did not like learning mathematics because he did not really understand it when the teacher explained it.

Mathematical material that, according to this participant, is easy includes: numbers, sets, comparisons, social arithmetic, lines and angles, quadrilaterals and triangles, data presentation, Cartesian planes, relations and functions, straight line equations, Pythagorean theorem, circles, flat-sided shapes, statistics, probability, quadratic equations, quadratic functions, geometric transformations, and similarity and congruence. Mathematical material that was difficult, according to this participant, included linear equations and inequalities, number patterns, and numbers with powers and root forms.

Respondent 20 preferred studying mathematics material with lots of pictures or graphs

compared to calculations without presenting pictures because pictures made it easier for this respondent to learn mathematics. According to this respondent, all the mathematics material studied should have benefits in everyday life. This means that if there is no benefit in everyday life, then there is no need to study it.

6. Respondent 22

Respondent 22 has a brain with left-brain dominance. This respondent initially stated that he did not like mathematics. However, after that, he added that whether he likes learning mathematics or not depends on the material too. If the material is easy to learn, he likes mathematics. If the material is difficult to learn, he does not like math.

Materials that, according to respondents, are easy include: numbers, sets, algebra, comparison, social arithmetic, quadrilaterals and triangles, data presentation, number patterns, Pythagorean theorem, flat-sided shapes, statistics, numbers with powers and root forms, quadratic equations, function squares, geometric transformations, as well as similarity and congruence. Meanwhile, material that participants found difficult included linear equations and inequalities, lines and angles, Cartesian planes, relations and functions, equations of straight lines, circles, and probability.

Respondent 22 stated that he easily learned mathematics, which involved a lot of calculations or the use of algebra, even without presenting pictures. In fact, material with images such as lines and angles was difficult for this respondent to learn. According to this respondent, the mathematical material studied does not necessarily have benefits in everyday life.

Discussions

The results of filling out the brain dominance questionnaire show that most students have a brain that is more dominant in one part of their brain, it could even be said that there are no students who use both hemispheres of their brain equally. The most dominant brain of the 26 respondents is the left brain. This can happen because learning in Indonesia currently supports the development and use of the left brain more than the right brain (Handayani & Mulyani, 2021; Rahayu & Diyas P, 2022).

Based on the results of the interview, there are visible differences in perception between students who predominantly use the left brain, dominantly use the right brain, and those whose use of both tends to be balanced. However, there are also several similarities between the perceptions of the three brain dominance groups.

Some visible similarities are as follows. First, students' attitudes towards learning mathematics. There are those who say they do not like learning mathematics, there are those who say they are okay with it, there are also those who say whether they like it or not depends on the material, the way of teaching, or who is teaching. Some of the attitudes shown do not depend on the dominance of the student's brain. The results of several studies state that several factors influence students' attitudes towards learning mathematics, including: teacher and learning characteristics, teaching methods,

classroom environment, learning motivation, mathematical abilities, parental support, self-efficacy, and learning styles (Hannula, 2020; Mutie & Wambua, 2022).

Second, students' perceptions of the usefulness of the material studied. There are those who think that all the material designed in the current curriculum must be studied even though they cannot find any benefits in everyday life, there are also those who think that all the material must be studied because it has benefits in everyday life, but there are also those who think not. everything must be learned. If it is not needed in everyday life, then there is no need to learn it. This shows that most students are aware of how important mathematics is, but not all of them understand why it is important.

This fact is in line with research conducted by Rahmah, that as many as 80% of students said mathematics was an important subject, because it was used in everyday life and to continue their education to a higher level (Rahmah, 2018). However, not many people understand that mathematics is also useful in forming thought patterns to be more mature in solving mathematical and non-mathematical problems. This perception is not determined by the student's brain dominance group, but rather the mindset that has been ingrained in the student's mind through their environment and learning experiences.

Third, the assumption that some mathematical material is easy. Mathematical material that was considered easy by all respondents was: numbers, sets, quadrilaterals and triangles, Pythagorean theorem, geometric transformations, as well as similarity and congruence. Meanwhile, the material that is considered difficult varies for each respondent. Based on interviews, respondents stated that the material was easy because the content of the material was simple, it did not use too much analysis, and the teacher's way of teaching suited them so that they could understand. This similarity in perception is natural because the respondents came from the same class and were taught by the same teacher.

Differences in the perceptions of students from different brain dominance groups can be seen in the perceived ease and difficulty of some material, as well as things that make it easier for them to learn mathematics and things that make certain material difficult in their opinion.

Respondents who are more left-brain dominant are Respondent 11 and Respondent 22. The material that is considered easy by the two respondents who are more left brain dominant apart from the material that is considered easy by all respondents is quadratic equations and quadratic functions. Meanwhile, the material that was considered difficult by the two respondents whose left brain was more dominant was linear equations and inequalities, lines and angles, Cartesian planes, relations and functions, equations of straight lines, circles, and probability. These two respondents stated that the use of pictures did not have much influence in making it easier for them to learn mathematics, and sometimes even made the material more difficult. This is in accordance with research that it is easier for the left brain to learn things by reading, writing and listening to lectures, not by drawing (Oflaz, 2011; Springer & Deutsch, 2019).

Respondents who are more right-brain dominant are Respondent 17 and Respondent 20. The material that is considered easy by the two respondents who are more right-brain dominant, apart from the material that is considered easy by all respondents, is lines and angles, circles, and flat-sided geometric shapes. Meanwhile, the material that is considered difficult is numbers with powers and root forms. The thing that makes it easier for respondents with right brain dominance to learn mathematics is the presentation of pictures. According to research results, people whose right brain is more dominant usually find it easier to learn something by making mind maps or diagrams, watching videos or presentations, and other related things. with visuals (Springer & Deutsch, 2019).

Respondents whose brains tend to be balanced are Respondent 3 and Respondent 4. The material that is considered easy by the two respondents, who tend to be balanced, is data presentation material. What makes the material easier for respondents with brains that tend to be balanced is the use of balanced images and formulas, such as geometric transformation material.

CONCLUSION

Based on the results and discussion, it can be concluded that there are differences in perception between students who are more right-brain dominant, left-brain dominant, and those whose brain use tends to be balanced. These differences include the perceived ease or difficulty of mathematical material. However, there are other factors that influence students' perceptions, such as the way teachers teach and the learning environment, so there is some material that is considered easy by all students because the teacher can teach it well and the learning environment is also supportive. Students with left brain dominance find it easier to learn material that does not use a lot of picture presentation, while students with right brain dominance find it easier to learn material that uses a lot of pictures. Students who tend to use a balanced brain can easily learn material with different characteristics if they are able to balance the use of images and formulas.

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