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Profile of Student's Mathematical Connection in Aritmethic Sequences and Series Based on Learning Styles

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Abstract: Mathematical connection is the linkage between mathematical concepts internally and externally. Internally, namely the linkage between the mathematical concepts themselves. Externally, namely the linkage between mathematical concepts with other disciplines and everyday life. This study aims to describe the profile of students' mathematical connections with visual, auditory and kinesthetic learning styles in the material of arithmetic sequences and series. The research subjects were students of class XI MIPA consisting of one student in each of the visual, auditory and kinesthetic learning styles. The criteria for research subjects in this study were that they were of the same gender and had high and equal scores on mathematical ability tests. The research instruments consisted of a Learning Style Questionnaire, Mathematical Ability Test, and Mathematical Connection Test. The research method used in this research is descriptive qualitative. Based on the analysis used, the results of this study are as follows: student with a visual learning style fulfill all indicators on all three aspects of mathematical connection. Student with a auditory learning style fulfill all indicators on all three aspects of mathematical connection. Student with a kinesthetic learning style fulfill indicators on the connection aspect between mathematical concepts and connection aspect between concepts mathematics with other disciplines, but didn't arrive to a final solution, and fulfill the indicator on the connection aspect between mathematical concepts with everyday life.

INTRODUCTION

The National Council of Teachers of Mathematics (NCTM, 2000) explains that mathematical connection is the linkage between mathematics topics, the linkage between mathematics with other disciplines and the linkage between mathematics with everyday life. Sitompul (2019) said that the importance of mathematical connections for students is so that mathematical concepts that have been learned are not just left as separate parts, but can be used as basic knowledge to understand new concepts. Another goal of the importance of mathematical connections is that students can use the mathematical concepts they have learned to solve contextual problems in everyday life. However, in reality the results of previous research show that not all students have good mathematical connection skills. The results of previous research by Laili and Puspari (2018), there are students who still have difficulty in linking math lessons with other lessons. This is also supported by the experience of researchers when implementing the Introduction to the School Environment. Researchers found that there were still many students who had difficulty in linking between mathematical concepts and mathematical concepts with everyday life.

One of the materials in learning mathematics is the arithmetic sequence. In the material of arithmetic sequence and series in SMA class XI also includes three aspects of mathematical connection. One example of the relationship between the concept of arithmetic sequence and the previous mathematical concept is the material of number patterns and SPLDV and the relationship between the concept of arithmetic sequence and the next mathematical concept is annuity and compound interest. In addition, in accordance with the mathematics learning module prepared by Darno, et al (2020) entitled "Application of Rows and Rows" explains that there are many applications of arithmetic sequence and series in other disciplines and everyday life. Examples of applications of arithmetic sequence and series in everyday life are finding the location of houses based on house number patterns, applications in other disciplines, one of which is economics, for example compound interest in banking.

Students' learning styles affect the students' mathematical connections. This is supported by Suprianto's research (2020) which shows that there are significant differences between students' mathematical connections based on auditory, visual and kinesthetic learning styles. Each student has their own learning style characteristics. According to De Poter, there are 3 types of learning styles, namely visual, auditory and kinesthetic. Visual learners learn through what they see, auditory learn by hearing and kinesthetic learn through movement and touch (Widayanti, 2013). Most students fail to understand lessons because they do not know how to learn (Fika Nurlova, 2018). Therefore, learning style plays an important role for students to understand a mathematical concept and connect between mathematical concepts. In addition, by understanding their learning style, students can learn actively so that they have their own abilities in understanding concepts and solving math problems, (Mashuri et al., 2020). This study aims to describe the profile of students' mathematical connections with visual, auditory and kinesthetic learning styles in the material of arithmetic sequences and series.

METHODS

This type of research is descriptive with a qualitative approach because the purpose of this research is to describe the profile of students' mathematical connections with visual, auditory and kinesthetic learning styles in the material of arithmetic sequences and series. The subjects in this study were 1 student with visual learning style, 1 student with auditory learning style and 1 student with kinesthetic learning style. The instruments in this study consisted of Learning Style Questionnaire, Mathematics Ability Test and Mathematical Connection Test. The instruments of Mathematics Ability Test and Mathematical Connection Test were consulted to the supervisor, while the Learning Style Questionnaire was not consulted because it was adopted from the GLS Manual Series.

The Learning Styles Questionnaire consists of 30 questions, the questions are presented in the form of multiple choice where there will be three answer options namely A, B or C. Choice A refers to visual learning style, choice B refers to auditory learning style and choice C refers to kinesthetic learning style. The Mathematics Ability Test instrument is used with

the aim of knowing how students' mathematical abilities. The Mathematical Ability Test contains math questions based on prerequisite material from arithmetic sequences and series. The questions presented are short fill-in questions totaling 10 questions. Learning Styles Questionnaire and Mathematics Ability Test are given to 33 students in class XI MIPA 2, then three students will be selected consisting of one visual learning style student, one auditory learning style student and one kinesthetic learning style student. the three subjects selected are of the same gender and have high and equal Mathematics Ability Test scores with a difference in scores of no more than 10.

This Mathematical Connection Test Sheet contains questions related to the material of arithmetic sequence and series in the form of description questions. The Mathematical Connection Test is structured in such a way that it can show the profile of students' mathematical connection. The results obtained from the Mathematical Connection Test are used to describe the profile of students' mathematical connection on the material about arithmetic ranks and series in terms of learning styles, namely visual, auditory and kinesthetic. The results of the Mathematical Connection Test were analyzed qualitatively by referring to alternative solutions and indicators of mathematical connections in this study. The mathematical connection indicators used in this study are as follows:

Table 1. Indicators of Mathematical Connection

Aspects of Mathematical Connection	Indicators used in research
Connections between math concepts	Identify the mathematical concepts of the given question.
	Identify connections regarding mathematical concepts from the given question.
	Using the linkage between mathematical concepts in solving the given question.
Connection of math concepts with everyday life	Use the linkage between mathematical concepts and non-mathematical concepts in solving question related to everyday life..
Connection of math concepts with other disciplines	Use the linkage between mathematical concepts and non-mathematical concepts in solving question related to economics..

not all of them can write down the answers that are in their minds and not all research subjects can write their answers clearly and in detail. In this case, the interview guideline can be used to reveal things that are not written down and things that are less clear, the results of which will be to find out the profile of students' mathematical connection in the material of arithmetic rows and series in terms of visual, auditory and kinesthetic learning styles.

RESULT AND DISCUSSION

Result

Data collection in this study was conducted at SMAN 2 Sumenep. Data collection was carried out with two meetings. The first meeting was filling out the Learning Style Questionnaire and the Mathematics Ability Test . Then, the second meeting continued with giving Mathematical Connection Test questions to 3 selected research subjects. As for the interview, it was conducted online with the time adjusting the subject that had been determined. In this study, researchers chose one visual student, one auditory student and one kinesthetic student. The subjects chosen were students with high and equal mathematics abilities with a difference in scores of no more than 10, and the same gender. Based on the data that has been obtained, the research subjects taken are 3 female students as follows:

Table 2. Data of Research Subjects

No	Name	Learning Style	Score of Learning Styles Questionnaire	Score of Mathematics Ability Test	Code for Subject
1	AFV	Visual	13	100	SV
2	SMA	Auditory	13	90	SA
3	DTP	Kinesthetic	14	90	SK

In this study, three research subjects who had been determined were given a Mathematical Connection Test. The Mathematical Connection Test consists of two description questions. The following presents the data results of mathematical connection profiles of students in terms of learning styles. The following are excerpts from the interview (R = Researcher)

1. Results and Data Analysis on Subjects with Visual Learning Style.
   a. Mathematical Connection Test No. 1.

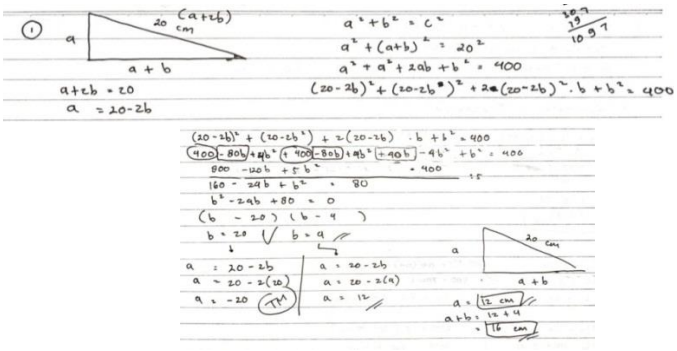

Figure 1. SV's Answer Sheet for Question Number 1

R : "try to state what is known from question number 1?"
SV : "the length of the hypotenuse is 20cm, and the lengths of the sides of the triangle are in the form of an arithmetic sequence"
R : "then what is asked in the question?"
SV : "length of the other unknown side"
R : "okay, why did you draw a right triangle?"
SV : "to make it easier for me to understand the problem and solve the problem"
R : "Then what mathematical concepts do you think are present in the solution you wrote??"

SV : "pythagoras, arithmetic, and factoring"

Based on the answer sheet and interview transcript with SV, in identifying mathematical concepts contained in the arithmetic sequence and sequence problem, SV read the problem twice to understand the meaning of problem number 1, SV wrote down what was known in the problem, SV explained verbally what was known and asked in the problem, SV presented the information in the problem in a right triangle picture, SV also explained verbally what concepts were contained in solving problem number 1, namely the concept of pythagoras, arithmetic sequence and factoring.

R : "why you changed b to $a + b$?"

SV : "because the sides form an arithmetic sequence, so if the shortest side is a then the next side is $a + b$"

R : "then what is the difference between b in the first row and b in the second row?"

SV : "b in the first row is the general pythagoras form, while the b in the second row means that it is different from the arithmetic sequence"

R : "In your opinion, is there a connection between the concept of pythagoras and the concept of arithmetic sequence?"

SV : "I think there is, first I used the pythagoras formula because the triangle is a right triangle, then because the sides of the triangle are in the form of an arithmetic sequence, then I changed side b to $a + b$ and side c to 20.

From the interview transcript, it shows that SV knows the concept of pythagoras and the concept of arithmetic sequence are interrelated, but the letters used are the same so it is confusing. SV wrote the pythagoras formula first, then changed b to $a + b$ because the problem explained that the length of the sides of a right triangle is in the form of an arithmetic sequence. This shows that SV identified the linkage of mathematical concepts from the given problem.

In the answer sheet, SV changed a to $20 - 2b$. Then SV produces a quadratic equation $b^2 - 24b + 80$. SV did the factoring so that it found two possible values b. After that SV substituted the value of b into the equation $a = 20 - 2b$ to determine the value of a. After finding the value of a and b, SV determines the lengths of the unknown sides of the triangle which are 12 and 16. This shows that SV uses the linkage of mathematical concepts in solving the given problem.

b. Mathematical Connections Test No. 2.

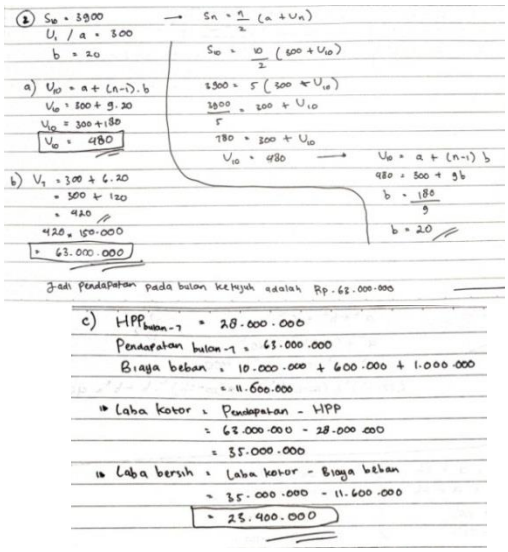

Figure 2. SV's Answer Sheet for Question Number 2

R : "what mathematical concepts do you think are present in the solution you wrote??"

SV : "arithmetic series and sequence"

R : "are there any non-mathematical concepts in the problem? If so, please mention them."

SV : "There is a lot of production, revenue and net profit and gross profit"

R : "In your opinion, which ones relate to daily life and which ones relate to other disciplines?"

SV : "In my opinion, a lot of production and income is related to everyday life, if net profit and gross profit go into economics."

R : "Is there a connection between the arithmetic sequence and the concepts you mentioned earlier?"

SV : "There is, the amount of production is the same difference each month, so it forms an arithmetic sequence. What is known in the question S_{10} and u_1 so finding the difference in production each month means finding the difference in the arithmetic sequence."

The first step SV took was to write down the known things in the problem. SV wrote $S_{10} = 3900, u_1/a = 300$. SV explained that in solving problem number 2 there are concepts of arithmetic sequence, production, revenue and profit. SV also explained verbally about the relationship between the concepts mentioned. The next step SV did was to substitute the known things into the formula S_n thus finding the value of $u_{10} = 480$. Then SV looks for the value of b by substituting the value of a which is already known, namely 300 and $u_{10} = 480$ into the formula u_n.

The next step, question number 2 at point a is to determine the production of jackets in the last month, namely month 10. SV determines the production of jackets in the last month using the formula u_n, because what is asked is the production of jackets in the last month, SV looks for the value of u_{10} which is the 10th term of the arithmetic sequence. SV found that the production of jackets in the last month was 480. This shows that SV uses the connection of mathematical concepts in solving arithmetic sequence problems related to daily life.

Then, on question point b, namely determining the net profit of the "Suka Maju" factory in the seventh month. SV determines the revenue of the "Suka Maju" factory in the seventh month first, SV determines the amount of jacket production in the seventh month by looking for the value of u_7. Then SV multiplied the production of jackets in the seventh month by the price of 1 jacket, which resulted in an answer of 63,000,000. Next, SV wrote down what was known first, namely the Cost of Goods Sold and revenue of the "Suka Maju" Factory in the seventh month. SV also calculated the cost of factory expenses in the seventh month by summing up salary expenses, electricity and water costs, and monthly taxes. Furthermore, SV calculated the gross profit in the seventh month first, then continued to calculate the net profit. SV determined the net profit obtained by the "Suka Maju" factory in the seventh month correctly, so SV used the linkage of the concept of arithmetic rows and series to solve problems related to other disciplines, namely economics.

2. Results and Data Analysis on Subjects with Auditory Learning Style.
   a. Mathematical Connection Test No. 1.

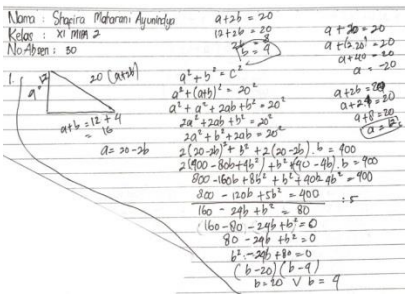

Figure 3. SA's Answer Sheet for Question Number 1

R : "state what is known in the question!"
SA : "the sides are in the form of an arithmetic sequence, and the length of the hypotenuse of the triangle is 20"
R : "then what is asked from the question?"
SA : "the length of the other sides, only the hypotenuse is known."
R : "what is the purpose of drawing a triangle?"
SA : "the problem explained that there was a triangle, so I drew it to make it easier to imagine and solve the problem"
R : "what mathematical concepts are in the solution that you wrote?"
SA : "pythagoras, factoring, arithmetic sequence, and substitution"

Based on interview transcripts and answer sheets, SA read the problem 3 times, drew a right triangle and wrote down what was known about the triangle, SA explained verbally what was known and asked in problem number 1. SA also explained what mathematical concepts were involved in solving problem number 1, namely the concepts of pythagoras, factoring, substitution and arithmetic sequence. This shows that SA identifies the mathematical concepts of the problem regarding arithmetic sequence and series.

R : "what is the difference b in the first row and b in the second row?"
SA : "You mean that $b = a + b$?"
R : "Yes, what's the difference between the first b and the second b??"

SA : "the other side I let's say a, so the base is just added b which is different, it forms an arithmetic sequence"
R : "whether for b in the first row is the generalized pythagorean formula?"
SA : "yes"
R : "Is there a connection between the concept of pythagoras and arithmetic sequence? If so, explain the connection"
SA : "there is, that is, it is a right triangle, so use the general pythagoras formula, then change the side because the question explained that the sides are in the form of an arithmetic sequence, so a is still a, then b is changed to $a + b$, and c is changed to $a + 2b$. but because the hypotenuse is known, it is changed to 20."

Based on the results of the interview with SA, it shows that SA knows the relationship between the concept of pythagoras and the concept of arithmetic sequence, so SA identifies the relationship regarding the mathematical concepts of the given problem. After SA changed a to $a + b$, SA obtained the equation $2a^2 + 2ab + b^2$. Then SA changed a to $20 - 2b$ so as to obtain a quadratic equation with variable b. Then SA substituted the value of b obtained into the equation $a + 2b = 20$ to find the value of a. But SA is still looking for the value of b again by substituting the value of $a = 12$ into the equation $a + 2b = 20$. After obtaining the values of a and b, SA can determine the length of the other sides of the triangle, namely 12 and 16. This shows that SA uses the linkage of mathematical concepts in solving the given problem.

b. Mathematical Connection Test No. 2

Figure 4. SA's Answer Sheet for Question Number 2

R : "what mathematical concepts are present in the solution you wrote?"
SA : "arithmetic sequence"
R : "is there any concept other than math in the problem?"
SA : "exist, the concept of finance"
R : "what is the concept of finance?"
SA : "hmmm, income"
R : "In your opinion, is there a connection between the mathematical concept and the non-mathematical concept in the problem? explain the connection"
SA : "The question explains that the difference in the production of jackets is fixed, so the production amount forms an arithmetic sequence, meaning

that there is a connection between the arithmetic sequence and the production amount."

R : "there is no connection to everyday life or other disciplines other than mathematics?"

SA : "a lot of production belongs to daily life and income goes into another field of science, namely economics"

Based on the results of the interview transcript, SV explained what concepts were contained in the solution of problem number 2. SA verbally explained the relationship between interlinked concepts. This shows that SA identifies the relationship regarding the mathematical concepts of arithmetic sequence and series problems related to everyday life and other disciplines. The next step is that SA substitutes the known thing, namely $S_n = 3900$ and $u_1 = 300$ into the formula S_n, so SA find the value $u_{10} = 480$. Then SA substituted the value of $u_1 = 300$ and $u_{10} = 480$ inti the formula u_n, so SA can obtain the value of b or the difference from the jacket production each month which is 20. The next step, question number 2 at point a is to determine the amount of jacket production in the last month, namely month 10. SA is looking for by determining the value of u_{10} is 480. SA looks for a lot of jacket production at the "Suka Maju" factory in the last month using the formula u_n which is the n-th term of the arithmetic sequence. This shows that SA uses the linkage of mathematical concepts in solving problems of arithmetic sequence and series related to everyday life.

Then, question number 2 at point b is to determine the net profit of "Suka Maju" factory in the seventh month. SA looks for the value of u_7 first is a lot of jacket production in the seventh month. Then SA determines the amount of "Suka Maju" factory revenue in the seventh month by multiplying the seventh month's jacket production by the price of a jacket. SA determines the gross profit in the seventh month first, which is the seventh month revenue minus the seventh month Cost of Goods Sold. Furthermore, SA calculates net profit in the seventh month, namely gross profit minus expenses. SA calculates the cost of expenses in the seventh month by summing up salary expenses, electricity and water costs, and taxes per month. Then, SV obtained the seventh month net profit of the "Suka Maju" factory which was 23,400,000. This shows that SA uses the linkage of mathematical concepts in solving arithmetic sequence and series problems related to other disciplines, namely economics.

3. Results and Data Analysis on Subjects with Kinesthetic Learning Style.
   a. Mathematical Connection Test No. 1.

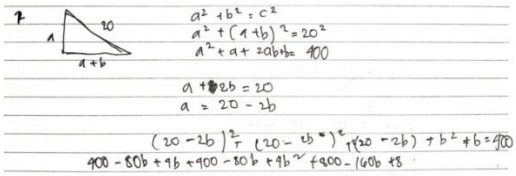

Figure 5. SK's Answer Sheet for Question Number 1

R : "try to state what is known in the question?"
SK : "the hypotenuse of triangle 20. Then the sides form an arithmetic sequence"
R : "then what is asked in the question?"
SK : "the length of the other unknown side of the triangle"
R : "there you draw a triangle, what is the purpose?"
SK : "to make it easier for me to understand the problem"
R : "what mathematical concepts are in the solution you wrote?"
SK : "geometry"
R : "There's more?"
SK : "arithmetic sequence"
R : "Try to mention what are the more specific geometry concepts?"
SK : "triangles and the concept of pythagoras"

Based on the results of the interview transcript and SK's answer sheet, SK identified the mathematical concepts of the problem regarding the arithmetic sequence and sequence by trying to read the problem many times, writing down what was known, describing a right triangle, SK also explained verbally about what was known and asked. SK explained what concepts were involved in solving problem number 1, namely the concept of triangles, the concept of pythagoras and arithmetic sequence.

R : "why you changed b to $a + b$?"
SK : "because $b = a + b$"
R : "then what is the difference b in the first row and b in the second row?"
SK : "the first line is the pythagoras formula, the second line is replaced because the sides form an arithmetic sequence"
R : "$a + b$, where did it come from?"
SK : "it's an arithmetic sequence, so the side that is a so the next side plus the difference is $a + b$"
R : "Is there a connection between the concept of pythagoras and arithmetic sequence? Explain it"
SK : "there is, I changed b to $a + b$ because the question explained that the sides of the triangle form an arithmetic sequence"

Based on the results of the interview transcript with SK, it shows that SK identifies the linkage between mathematical concepts from the problem. In the first line, SK was wrong in describing the form of $(a + b)^2$, should be $a^2 + a^2 + 2ab + b^2$. Then SK wrote $a + 2b = 20$, then moved $2b$ to the right segment so that $a = 20 - 2b$ was obtained. SV replaced a in the quadratic equation obtained with $a = 20 - 2b$. However, SK was wrong in processing the equation and did not continue the solution steps. This shows that SK used the connection between the concept of pythagoras

and the concept of arithmetic sequence, but did not reach the final solution because SK could not continue the equation that had been obtained.

b. Mathematical Connection Test No. 2

Figure 6. SK's Answer Sheet for Question Number 2

R : "Now in problem number 2, what concepts are there in the solution? Also mention concepts other than math?"

SK : "arithmetic sequence and series, then there is revenue and production lots, and profit"

R : "which concepts relate to everyday life and which to subjects other than math?"

SK : "income and production are related to daily life kak, if gross profit and net profit are related to economics"

R : "is there a connection between the concept of arithmetic sequence and other concepts in math that you have mentioned? Explain it"

SK : "the production of many jackets per month at the "Suka Maju" factory forms an arithmetic sequence because the difference in production each month is the same."

Based on the results of the interview transcript, SK mentions the concepts that exist in solving problem number 2, namely arithmetic rows and series, income and a lot of production. The next step is that SK substitutes the known things, namely $S_{10} = 3900$ and $u_1 = 300$ into the formula S_n, so SK found the value of $u_{10} = 480$. SK determines the amount of jacket production in the last month using the formula S_n. This shows that SK identifies the relationship of mathematical concepts from the problem of arithmetic sequence and series related to everyday life and SK uses this linkage in solving the problem.

Then, question number 2 at point b is to determine the net profit of the "Suka Maju" factory in the seventh month. SK substituted $a = 300$ and $u_{10} = 480$ into the formula u_n to find the value of b or the difference in jacket production each month. SK obtained the difference in jacket production each month correctly is 20. Then SK determined the amount of revenue for the "Suka Maju" factory by finding the amount of jacket production in the seventh month using the formula u_7. After finding the number of jackets produced in the seventh month, SK multiplied the number of jackets produced by the price of a jacket. SK found the amount of revenue of the "Suka Maju" factory in the seventh month which was 63,000,000. However, SK did not continue the completion steps, SK had not determined what was asked in the

problem, namely the amount of net profit of the "Suka Maju" factory in the seventh month, so SK did not solve the problem given. This shows that SK used the connection between the concept of arithmetic sequence and income, but did not arrive at the final answer.

Discussion

Based on the explanation of the results of the data analysis above, a description of the profile of students' mathematical connection on the material about arithmetic sequence and series in terms of learning styles (visual, auditory and kinesthetic) is obtained as follows.

1. Profile of Mathematical Connection Materials in Arithmetic Sequence and Series for Student with Visual Learning Style.

The completion steps written by SV are very coherent, neat, organized and complete. There were many scribbles or circles drawn by SV. In each final answer, SV always gives a circle drawing and underlines it as a marker of the final answer. This is in accordance with the opinion of Haryanto (2012) that one of the characteristics of visual learning style students is usually neat and orderly, visual learning style students also better understand something accompanied by a picture.

The following is the description of SV's mathematical connection in the material of arithmetic series and sequence based on the aspects of mathematical connection and its indicators.

a. Aspect of connection between Mathematical Concepts.

Indicator 1: Identifying mathematical concepts from the given question. SV read the question twice to understand the meaning of the given question, SV presented the information in the question in the form of a triangle drawing, SV wrote the known thing but did not write the questioned thing in the question, but SV explained verbally about the known and questioned things in the question. SV also explained what mathematical concepts were involved in solving the given question.

Indicator 2: Identifying linkage regarding mathematical concepts from the given question. SV operated the interlinked mathematical concepts to solve the given question correctly. SV verbally explained the linkage between the concept of pythagoras and the concept of arithmetic sequence. SV can operate the general formula of pythagoras and relate it to the arithmetic sequence, as evidenced by SV writing the general formula of pythagoras, then replacing the length of the side of the triangle with the arithmetic sequence according to what is known in the question. This shows that SV identified the linkage between mathematical concepts from the given question.

Indicator 3: Using the linkage of mathematical concepts in solving the given question. SV used the connection to solve the given question correctly. SV used the concepts of pythagoras, factoring, and substitution to find the value of the first term and the difference of the arithmetic sequence, namely obtained $a = 12$ and $b = 4$,

so SV found the lengths of the sides of the triangle that were unknown in the question, namely 12cm and 16cm.

b. Aspect of Connection between Mathematical Concepts with Everyday Life.

Indicator 4: Using the linkage of mathematical concepts in solving question related to everyday life. SV wrote the known things into the form of mathematical model. SV verbally explained what concepts were contained in the question solving, namely the concept of arithmetic sequence and profit concept. Then SV also involved these mathematical concepts to solve the given question. SV operates interrelated mathematical concepts in solving the given problem correctly. SV substituted the known things into the formula S_n so that SV obtained the difference from the arithmetic sequence or the difference in jacket production each month at the "Suka Maju" Factory.

Besides being able to recognize the linkage of the concepts, SV also used the linkage to solve the question correctly. After obtaining the value of b or the difference in jacket production each month, SV used the formula u_{10}, the formula for finding the 10th term or the number of jackets produced in the tenth month. This shows that SV uses the linkage of mathematical concepts in solving question related to everyday life.

c. Aspects of Connection between Mathematical Concepts with Other Disciplines.

Indicator 5: Using the linkage of mathematical concepts in solving problems related to economics. SV uses the connection between the concepts of arithmetic sequences and series to solve problem number 2 point b which is related to the economic concept, namely regarding gross profit and net profit. SV uses a formula u_n namely the n-th term of the arithmetic sequence to determine the amount of factory jacket production "Suka Maju" in the seventh month. Then, SV determines the revenue of the "Suka Maju" factory in the seventh month by multiplying the number of jackets produced in the seventh month by the price of a jacket. Furthermore, SV determines the amount of gross profit in the seventh month using the income formula minus the COGS (Cost Of Goods Sold) that is already known in the question. Then SV determines the net profit of the “Suka Maju” factory in the seventh month using the formula for gross profit minus expenses. This shows that SV uses the linkage of mathematical concepts to solve question of arithmetic sequences and series related to economics.

Based on the explanation above, the results of this study show that SV fulfills all indicators in the aspect of connection between mathematical concepts. The results of this study are in accordance with Rahmih's research (2019) which says that visual learning style students can relate between mathematical concepts equipped with illustrative images to describe the situation in the problem. SV fulfill the indicators in the aspect of connection between mathematical concepts with everyday life. The results of this study are in line with

Aharuddin's research (2022) that visual students can relate mathematical concepts to other fields of study related to economics.

2. Profile of Mathematical Connection Materials in Arithmetic Sequences and Series for Student with Auditory Learning Style.

SA writes the steps of solving the question coherently and completely. The scribbles or circles drawn by SA are less than the scribbles or circles drawn by SV. When working on the Student Mathematical Connection Test, it was seen that SA read the questions out loud but not too loud and when other friends made noise or noises, SA felt disturbed and asked his friends to be quiet. This is in line with the opinion of Bobby De Porter and Mike Hernacki (Wahyuni, 2017) who say the characteristics of auditory learning style students are talking to themselves while working and are easily distracted by noise.

The following is a description of SA's mathematical connection skills in the material of arithmetic ranks and series based on aspects of mathematical connection.

a. Aspect of connection between Mathematical Concepts.

Indicator 1: Identifying mathematical concepts from the given question. SA read the problem once quietly and twice with a little voice to understand the meaning of the given question, SA presents the information in the question in the form of a triangular image, SA writes what is known but does not write what is asked in the question. SA explains verbally about what is known and asked in the problem. SA also explains what mathematical concepts are involved in solving the given question.

Indicator 2: Identifying linkage regarding mathematical concepts from the given question. SA operates interlinked mathematical concepts to solve the problem correctly. SA wrote the pythagoras formula, then changed the length of the sides of the triangle as described in the problem, because the length of the sides of the right triangle formed an arithmetic sequence, SA replaced it with $a, (a + b),$ and $(a + 2b)$. This shows that SA identifies the linkage between mathematical concepts in the problem regarding the given arithmetic sequence.

Indicator 3: Using the linkage of mathematical concepts in solving question. In addition to determining the relationship between the concepts of pythagoras and arithmetic sequence, SA also uses the relationship to solve the question correctly. SA uses the concept of pythagoras and relates it to the arithmetic sequence, then SA also uses factoring and substitution methods to obtain the values of a and b. After finding the values of a and b, SA found the length of the sides of the right triangle asked in the question. This shows that SA uses the linkage of mathematical concepts to solve question about arithmetic sequence.

b. Aspect of Connection between Mathematical Concepts with Everyday Life.

Indicator 4: Using the linkage of mathematical concepts in solving question related to everyday life. SA wrote down the known things in the question into the form of a mathematical model. SA verbally explained what concepts are contained in the solution of the question, namely the concept of arithmetic sequence and series

and financial concepts. SA verbally explained the linkage between the concept of arithmetic sequence and non-mathematical concepts of the given question. SA correctly relates or operates interlinked concepts. This shows that SA identifies the linkage of mathematical concepts from the question of arithmetic sequence and sequence related to everyday life. SA determines the difference from the production of "Suka Maju" factory jackets per month, namely 20 jackets by substituting the known things into the S_n formula or the formula for the sum of the first n terms of the arithmetic sequence.

In addition to determining the linkage between related concepts, SA also uses these linkage to solve question correctly. After knowing the b value or the difference in jacket production each month, SA uses the formula u_{10} in determining the number of jackets produced in the tenth month, namely 480. This shows that SA uses the linkage of mathematical concepts to solve question related to everyday life.

c. Aspects of Connection between Mathematical Concepts With Other Disciplines.

Indicator 5: Using the linkage of mathematical concepts in solving question related to other disciplines, namely economics. SA uses the linkage of the concepts of arithmetic sequence and sequence to solve question number 2 point b which is related to the economic concept of gross profit and net profit. SA determines the amount of revenue of the "Suka Maju" factory in the seventh month first. In determining the amount of revenue, SA determines the amount of jacket production in the seventh month using the formula for the 7th term of the arithmetic sequence. Then SA multiplies a lot of jacket production in the seventh month by the price of a jacket. After determining the revenue of the "Suka Maju" factory in the seventh month, SA looked for gross profit in the seventh month, then determined the net profit of the "Suka Maju" factory in the seventh month. This shows that SA uses the linkage of mathematical concepts to solve problems related to the economy given.

Based on the explanation above, the results of this study indicate that SA fulfills all indicators in the aspect of connection between mathematical concepts. The results of this study are in accordance with Rahmih's research (2019), namely auditory learning style students are able to relate mathematical concepts to solve problems related to everyday life, but the final results obtained are wrong. Whereas in this study, SA can relate mathematical concepts in solving problems related to everyday life to the correct final result. SA fulfills the indicators in the aspect of mathematical connections between mathematical concepts and other disciplines. This is in accordance with research by Diana (2021) which explains that auditory learning style students with high and moderate levels of independence can connect mathematical connections with other fields of science.

3. Profile of Mathematical Connection Materials in Arithmetic Sequences and Series for Student with Kinesthetic Learning Style.

The solution steps written by SK on the problem are less coherent and complete. SK's writing in writing the steps of solving the problem is less neat and a little random. When

working on the Mathematical Connection Ability Test, SK tends to move a lot and cannot be silent. This is in accordance with the opinion of Sundayana (2016) which explains that the characteristics of kinesthetic learning style students are often physically oriented and move a lot and cannot sit still for a long time.

The following is a description of SA's mathematical connection skills on the material of arithmetic ranks and series based on aspects of mathematical connection.

a. Aspect of connection between Mathematical Concepts

Indicator 1: Identifying mathematical concepts from the given question. SK reads the question many times to understand the meaning of the given question, SA presents the information in the question in the form of a triangular image, SA writes the known thing in the question but does not write the question. However, SA explains verbally about what is known and asked in the question. SA also explains what concepts are involved in solving the given question.

Indicator 2: Identify the linkage of mathematical concepts from the given question. SK operated the related concepts in solving the question correctly. SK wrote the general pythagoras formula, then changed b to $(a + b)$ because the question explained that the lengths of the sides of a right triangle were in the form of an arithmetic sequence. This shows that SK identifies the linkage of mathematical concepts from the given question regarding arithmetic series and sequence.

Indicator 3: Using the linkage of mathematical concepts in solving question. After determining the linkage of the concepts, SK could not continue the next steps of the solution. This shows that SK used the connection between the concept of pythagoras and the concept of arithmetic sequence, but did not reach the final solution.

b. Aspect of Connection between Mathematical Concepts with Everyday Life

Indicator 4: Using the linkage of mathematical concepts in solving question related to everyday life. SK wrote the known things in the question directly in the form of a mathematical model. SK mentions what concepts are contained in the question solving, namely the concepts of arithmetic sequence, production, and income. SK verbally explained the linkage between mathematical concepts and related non-mathematical concepts. In addition, SK also involved the concept to solve the question. SK correctly linked or operated the related concepts. This shows that SK identifies how the mathematical concepts from the arithmetic sequence question are related to everyday life.

After determining the linkages between related concepts, SK also uses these linkages to solve the problem correctly. SK determined how much jacket production the "Suka Maju" factory produced in the last month using a formula S_n or the sum of the first n terms of the arithmetic sequence, SK substituting the known items into the formula S_{10}. Then SK finds the value u_{10}, lots of jacket production in the tenth month.

This shows that SK uses known connections to mathematical concepts in solving question of arithmetic sequences and series related to everyday life.

c. Aspects of Connection between Mathematical Concepts with Other Disciplines.

Indicator 5: Using the linkage of mathematical concepts in solving question related to economics. In question number 2 point b, SK determines the amount of revenue for the "Suka Maju" factory in the seventh month in advance. In determining income, SK uses the formula u_n to determine the quantity of jackets produced in the seventh month. Then SK multiplied the number of jackets produced in the seventh month by the price of a jacket, so that SK found the amount of the "Suka Maju" factory's income in the seventh month. However, SK did not continue the completion steps to the end, so SK did not complete the problem given in point b. This shows that SK uses the link between the concepts of sequences and arithmetic series and the concept of income, but does not reach the final solution.

Based on this explanation, SK did not fulfill one indicator in the aspect of connection between mathematical concepts. SK can identify mathematical concepts and their relationship to each other, but SK does not use the relationship of these mathematical concepts to solve problems. The results of this study are in line with Ahiruddin (2022) who said that kinesthetic learning style students cannot use mathematical concepts used to solve problems. SK met the indicators in the aspect of connection between mathematical concepts and daily life. The results of this study are in accordance with the research of Agnes and Yunis (2021) who said that students with kinesthetic learning styles can solve math problems related to everyday life.

CONCLUSION AND SUGGESTIONS

Conclusion

Based on the presentation of the results of data analysis and discussion that has been carried out, the conclusions related to the profile of students' mathematical connection on the material about arithmetic rows and series in terms of learning styles are as follows.

1. Profile of Mathematical Connection Materials in Arithmetic Sequences and Series for Student with Visual Learning Style.

   Students read the question twice to understand the meaning of the question, present the information in the question in the form of a picture, write down what is known in the question, explain orally what is known and asked in the question, explain orally about what mathematical concepts are involved in solving the question, namely the concept of the phytagorass theorem, arithmetic sequence, factoring and substitution method. Students explain orally the linkage between the mathematical concepts that have been mentioned, substituting the known things into the formulas used. The pythagoras formula and factoring are used to find the value of b or the difference of the arithmetic sequence, the substitution method is used to find the value of a or the first term of the arithmetic sequence, then the first term and the second term are used to determine the length of the side of the triangle asked in the question.

Students use the linkage of mathematical concepts with non-mathematical concepts in solving arithmetic sequence question related to everyday life, students change the given question into the form of a mathematical model, substitute known things into the arithmetic sequence formula. The concept used to solve the problem is the concept of arithmetic sequence and production, the formula S_n is used to find the difference of the arithmetic sequence, the formula u_n is used to find the n-th term of the arithmetic sequence, the value of the n-th term is used to solve question related to everyday life, namely calculating the amount of production.

Students use the linkage of mathematical concepts with non-mathematical concepts in solving question of arithmetic sequence and series related to economics, students write down the known things in the question, the concepts used in solving the question are the concepts of arithmetic sequence and series, income, and net profit. u_n formula is used to determine the n-th term of the arithmetic sequence. Then students substitute the known things into the formulas of income, gross profit and net profit. So that SV solved the problem correctly.

2. Profile of Mathematical Connection Materials in Arithmetic Sequences and Series for Student with Auditory Learning Style.

Students read the question three times, present the information in the question in the form of a picture, write down what is known in the question, explain orally what is known and asked in the question, explain orally about what mathematical concepts are involved in solving the given problem, namely the concepts of the pythagoras theorem, arithmetic sequence, factoring and substitution. Students verbally explain the linkage between the mathematical concepts that have been mentioned, substituting the known things into the formula used. The pythagoras theorem formula and factoring are used to find the difference of the arithmetic sequence, the substitution method is used to determine the first term of the arithmetic sequence. The first term and the second term of the arithmetic sequence are used to find the length of the unknown sides of a right triangle.

Students use the linkage of mathematical concepts with non-mathematical concepts in solving question of arithmetic sequnce and series related to everyday life, student change the given question into the form of a mathematical model, substitute the known things into the arithmetic series formula, SA uses the concept of arithmetic sequence and series to solve question, the S_n formula is used to determine the difference of the arithmetic sequence, the u_n formula is used to determine the n-th term of the arithmetic sequence, the value of the n-th term is used to solve question related to everyday life, namely calculating a lot of production.

Students use the linkage of mathematical concepts with non-mathematical concepts in solving question of arithmetic sequence and series related to economics, the concepts used are the concepts of arithmetic sequence and series, income, and net profit. The u_n formula is used to find the n-th term of the arithmetic sequence, students substitute the

known things into the revenue, gross profit and net profit formulas. So that SA solves the question correctly.

3. Profile of Mathematical Connection Materials in Arithmetic Sequences and Series for Student with Kinesthetic Learning Style.

   Students read the question many times, present the information in the question in the form of a picture, write the known things but do not write the things asked in the question. However, verbally explains what is known and asked in the question, explains what concepts are involved in solving the problem, namely the concept of triangles, phytagoras theorem and arithmetic sequence. Students verbally explain the linkage between the mathematical concepts that have been mentioned, substitute the known things into the formula used. Students do not continue the solution steps completely, students use the relationship between the concept of pythagoras and the concept of arithmetic sequence but do not arrive at the final solution.

   Students use the linkage of mathematical concepts with non-mathematical concepts to solve question regarding arithmetic series and series related to everyday life, students change the given question to its mathematical model, write down what is known in the question, substitute the known things into the arithmetic series formula, the S_n formula is used to calculate the number of the first n terms in the arithmetic series, the u_n formula is used to find the difference of the arithmetic series, the value of the n-th term is used to solve question related to everyday life, namely calculating a lot of production.

   Students use the linkage of mathematical concepts with non-mathematical concepts in solving problems of arithmetic sequence and series related to economics, SK uses the formula u_n for the n-th term of the arithmetic sequence, but students do not solve the question until the final solution.

Suggestions

Based on the research that has been conducted, the researcher puts forward the following suggestions.

1. For Teachers

   From the research results, it can be seen that students with kinesthetic learning styles cannot solve problems to the final solution. Therefore, it is recommended for teachers to often provide story problem exercises or contextual problems related to other fields of science to students with kinesthetic learning styles tailored to their level and provide scaffolding for students with kinesthetic learning styles so that these students can solve problems until the final stage.

2. For Other Researchers
   a. For other researchers who conduct other studies on mathematical connections, it is recommended to use different reviews so that more efforts to improve mathematical connection skills in students are made.
   b. In this study only focused on mathematical connections in the material about arithmetic sequence and series. Therefore, it is recommended for other researchers to

choose other materials such as logarithms, Two-Variable Linear Equation Systems, and others.

REFERENCES

Ahiruddin, Pathuddin, & Hasbi, M. (2022). Profil Kemampuan Koneksi Matematis Siswa Kelas VIII SMPN 3 Tolitoli Dalam Menyelesaikan Soal Cerita Ditinjau Dari Gaya Belajar. *Jurnal Elektronik Pendidikan Matematika Tadulako*, 14-24.

Amaliyah, R. I. (2019). *Pengaruh Gaya Belajar Terhadap Hasil Belajar Aqidah Akhlak Siswa Mts Darul Falah Bendiljati Kulon Sumbergempol Tulungagung.* Tulungagung.

Apipah, S., & Kartono. (2017). Analisis Kemampuan Koneksi Matematis Berdasarkan Gaya Belajar Siswa pada Model Pembelajaran Vak dengan Self Assessment. *Unnes Journal of Mathematics Education Research*, 148-156.

Apriyono, F. (2016). Profil Kemampuan Koneksi Matematika Siswa SMP Dalam Memecahkan Masalah Matematika Ditinjau Dari Gender. *Jurnal Pendidikan Matematika STKIP Garut*, 159-168.

Baiduri, Putri, O. R., & Alfani, I. (2020). Mathematical Connection Process Of Students With High Mathematics Ability In Solving Pisa Problems. *European Journal of Educational Research*, 1527-1537.

Bakoban, F. I. (2019). Analisis Pemahaman Konsep Dalam Pembelajaran Matematika.

Daut, M. (2016). Kemampuan Koneksi Matematik Dalam Pembelajaran Matematika. *MES (Journal of Mathematics Education and Science), 2*.

Febriana, R., & Delyana, H. (2022). Analisis Keterampilan Koneksi Matematika Ditinjau Dari Gaya Belajar Peserta Didik. *Jurnal Karya Pendidikan*, 82-87.

Hana, A. T., & Sulistyorini, Y. (2021). Analisis Kemampuan Koneksi Matematis Ditinjau Dari Gaya Belajar Siswa. *LAPLACE: Jurnal Pendidikan Matematika*, 158-168.

Hastari, N. (2018). *Kemampuan Koneksi Matematis Siswa Dalam Materi Barisan Dan Deret Aritmetika Di Kelas XI SMK.*

Hedriana, H., Slamet, U. R., & Sumarmo, U. (2014). Mathematical Connection Aility And Self – Confidence (An Experiment On Junior High School Students Through Contextual Teaching And Learning With Mathematical Manipulative. *International Journal of Education*, 1-11.

Hikmah, R. (2017, April 3). Penerapan Model Advance Organizer Untuk Meningkatkan Kemampuan Pemahaman Siswa. *Jurnal SAP, 1*, 271-280.

Huda, N. (2018). *Profil Kemampuan Koneksi Matematika Siswa Dalam Menyelesaikan Masalah Trigonometri Ditinjau Dari Kemampuan Matematika.* Surabaya.

Iswara, R., N.R., D. (., & A., N. C. (2019). Kemampuan Koneksi Matematis Siswa Melalui Model Pembelajaran Preprospec Menggunakan Edmodo. *Prosiding Seminar Nasional Pascasarjana UNNES*, 274-277.

Juleha, S., Mustangin, & Fathani, A. H. (2020). Profil Kemampuan Koneksi Matematis Peserta Didik Dalam Menyelesaikan Soal Cerita Ditinjau Dari Kemampuan Matematika. *Jurnal Cendikia: Jurnal Pendidikan Matematika*, 800-810.

Kesumawati, N. (2008). Pemahaman Konsep Matematik Dalam Pembelajaran Matematika. *Semnas Matematika dan Pendidikan Matematika*, 2-235.

Lestari, N. P. (2018). *Analisis Pemahaman Konsep Pada Materi Barisan Dan Deret Berdasarkan Teori Apos(Action, Process, Object, Scheme) Di Kelas XI SMK Muhammadiyah Kartasura Tahun Pelajaran 2017/2018.*

Nasional, D. P. (2008). Kamus Bahasa Indonesia. Jakarta.

Nasution, N. A., Rosiyanti, H., & Ismah. (2022). Analisis Kemampuan Koneksi Matematis Siswa Pada Materi Bangun Ruang Ditinjau Dari Perbedaan Jenis Kelamin. *FIBONACCI: Jurnal Pendidikan Matematika dan Matematika*, 85-97.

Pebriyanti, L. D., & Najibufahmi, M. (2021). Analisis Kemampuan Koneksi Matematis Siswa Ditinjau Dari Gaya Belajar Dan Kemandirian Belajar Siswa Kelas VII C SMPN 2 Wonopringgo. *Konferensi Ilmiah Pendidikan*, (hal. 135-139). Pekalongan.

Petronela, R., Jamiah, Y., & Sayu, S. (2018). Kemampuan Koneksi Matematis Siswa Dalam Materi Barisan Dan Deret Aritmetika di Sekolah Menengah Atas.

Puteri, J. W., & Riwayati, S. (2017, Desember). Kemampuan Koneksi Matematis Siswa Pada Model Pembelajaran Connected Mathematics Project (Cmp). *Jurnal Pendidikan Matematika dan Matematika, 3*, 161-168.

Raharjo, D., Kasim, J., Susanti, W., Guntoro, S. T., & Suwaji, U. T. (2020). *Penerapan Barisan dan Deret.*

Rahmih, N. (2019). *Deskripsi Kemampuan Koneksi Matematika Ditinjau Dari Gaya Belajar Pada Siswa Kelas VII SMP Buq'atun Mubarakah Kota Makassar.* Makassar.

Rohendi, D., & Jojon. (2013). Connected Mathematics Project (CMP) Model Based on Presentation Media to the Mathematical Connection Ability of Junior High School Student. *Journal of Education and Practice*, 17-22.

Rohmah, H. F., & Warmi, A. (2021, Maret). Analisis Kemampuan Koneksi Matematis Siswa SMA Pada Materi Barisan Dan Deret Aritmetika. *Jurnal Pembelajaran Matematika Inovatif, 4*, 469-478.

Saputri, F. I. (t.thn.). Pengaruh Gaya Belajar Visual, Auditori, Dan Kinestetik Terhadap Prestasi Belajar Siswa.

Sari, F. D. (2019). *Kemampuan Koneksi Matematis Ditinjau Dari Gaya Belajar Peserta.* Semarang.

Sudjana, N. (1995). *Penilaian Hasil Proses Belajar Mengajar.* Bandung: Remaja Rosdakarya.

Sugiman. (2008). Koneksi Matematika Dalam Pembelajaran Matematika Di Sekolah Menengah Pertama. *PYTHAGORAS*, 56-66.

Suprianto, U., & Pujiastuti, H. (2020). Students' Mathematical Connection Skills Reviewed From Learning Styles. *Jurnal Ilmiah Pendidikan MIPA*, 47-56.

Widayanti, F. D. (2013). Pentingnya Mengetahui Gaya Belajar Siswa Dalam Kegiatan Pembelajaran Di Kelas. *ERUDIO*, 7-21.