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Students' Profiles with Interpersonal and Intrapersonal Intelligence in Solving Mathematical Problems

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Abstrak

Kecerdasan interpersonal dan intrapersonal diperlukan dalam memecahkan masalah matematika. Penelitian ini bertujuan menganalisis profil siswa dengan kecerdasan interpersonal dan intrapersonal dalam memecahkan masalah matematika. Penelitian ini merupakan penelitian deskriptif kualitatif dengan subjek penelitian berjumlah dua. Pemilihan subjek berdasarkan pada skala kecerdasan majemuk. Teknik pengumpulan data menggunakan teknik tes, wawancara dan skala penilaian. Instrumen utama adalah peneliti sendiri, sedangkan instrumen pendukung yaitu lembar tes pemecahan masalah, pedoman wawancara dan lembar skala kecerdasan majemuk. Keabsahan data menggunakan triangulasi waktu. Analisis dilakukan dengan reduksi data, penyajian data dan simpulan. Berdasarkan hasil analisis data dan pembahasan diperoleh kesimpulan bahwa subjek berkecerdasan interpersonal dalam memecahkan masalah barisan aritmatika adalah subjek melakukan semua tahapan pemecahan masalah dengan benar tetapi kurang lengkap. Subjek mengkomunikasikan semua ide pemecahan masalah secara lisan dan tulis dengan lancar. Subjek berkecerdasan intrapersonal dalam memecahkan masalah barisan aritmatika adalah subjek melakukan semua tahapan pemecahan masalah dengan keyakinan dan berdasarkan waktu. Subjek menunjukkan kepercayaan diri dan manajemen waktu yang efektif.
Kata Kunci: Kecerdasan Interpersonal; Kecerdasan Intrapersonal; Pemecahan Masalah.

Abstract

Interpersonal and intrapersonal intelligence are required to solve mathematical problems. This study aims to analyze the profiles of students with interpersonal and intrapersonal intelligence in solving mathematical problems. This qualitative descriptive study involved two participants selected by multiple intelligences tests. The data collection techniques utilized tests, interviews and rating scales. The main instrument was the researcher himself, while the supporting instruments were the problem solving test sheets, interview guidelines and multiple intelligences scale sheets. The time triangulation was used to validate the data. The data reduction, data presentation and conclusions were conducted in the analysing process. Based on the results of the data analysis and discussion, the study concluded that in solving arithmetic sequence problems the participant with interpersonal intelligence performed all stages of problem solving correctly, but incomplete. The participant communicated all the problem solving ideas in written and spoken forms fluently. The participant with intrapersonal intelligence in solving arithmetic sequence problems confidently and efficiently conducted all problem solving stages. The participant demonstrated good self-confidence and an effective time management.
Keywords: Interpersonal Intelligence; Intrapersonal Intelligence; Solving Problem.

I. INTRODUCTION

Intelligence is the ability to adapt to new environments or changes in the environment, and to provide the capacity to obtain knowledge and the ability to acquire it, to provide the capacity of reasoning for abstract thinking, to understand relationships, to evaluate and assess, and to generate productive and original thoughts (Yaumi, 2012; Dellermann et al., 2019). It is not pre-made because intelligence will undergo developments through some intellectual steps. Intelligence encompasses biological adaptation, individual and environmental balance, gradual development, mental activities and competence (Suparno, 2007; Xiang et al., 2021). Intelligence is emphased as the ability to think abstractly, to perfrom motor activities, to adapt to new environments and to solve problems.

Multiple intelligences are various skills and aptitude to solve problems in learning (Yaumi, 2012; Rohmawati & Afriansyah, 2022). Gardner discovered nine multiple intelligences, namely verbal-linguistic, logical-mathematical, visual-spasial, music, kinesthetic, interpersonal, intrapersonal, and naturalistic. After sufficient evidence, and justification, Gardner, then, added another intelligence, namely existential intelligence (Kuswana, 2013; Cavas & Cavas, 2020). Based on the nine multiple intelligences, the researcher limited the study to interpersonal and intrapersonal intelligence due to their significant influence towards the students' personality development and problem solving ability (Hikmah & Eva, 2020).

Interpersonal intelligence indicates the ability to understand the motives and desires of others, and to work effectively with others (Kuswana, 2013; Sutarman & Mulyati, 2019; Yavich & Rotnitsky, 2020). Several interpersonal skills include social awareness, emphaty, leadership, communication, and teamwork (Widarto, 2011; Paolini, 2020). People with dominant interpersonal intelligence tend to be able to adapt, enyoy interacting with others and make friends. This socially intelligence allows them to skillfully communicate both verbally and nonverbally.

Intrapersonal intelligence relies on a person's ability to recognize and understand himself (Saleh, 2009; Alannasir, 2020). It involves self-confidence, self-assessment, self-control, and time management (Widarto, 2011; Pop & Khampirat, 2019). Lestari & Yudhanegara (2017) described self-confidence as an attitude of confidence in one's own abilities. This belief will influence the level of achievement or performance. It is necessary for students to have a good self-confidence in learning mathematics to be able to make decisions independently (Putra, dkk., 2018; Pratama, 2020). Time management as one of soft skill attributes needs to be developed to achive goals in learning mathematics (Hidayati dkk., 2021a).

Interpersonal and intrapersonal intelligence have important roles to solve

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both life and school problems. Hikmah and Eva's (2020) revealed that there was an influence of intrapersonal intelligence on mathematical problem solving ability. A problem is defined as a situation or question encountered by an individual when rules and algorithms to determine the answer do not exist (Siswono, 2018).

Problem solving is defined as a directed thinking process to determine solutions to a problem (Mairing, 2018). There are several theories of problem solving, including Polya, John Dewey, John Mason, and Krulik and Rudnick (Ma'rufi, 2015; Siswono, 2018). The problem solving steps used in this study are based on Krulik and Rudnick. The rationale was that the problem solving steps are clearly and spesifically described in that the researcher was able to identify one step from another. Based on Krulik and Rudnick, there are five phases in the problem-solving process called heuristic, namely: 1) read and think, 2) explore and plan, 3) select a strategy, 4) find an answer, and 5) review and discuss (reflect and extend) (Ma'rufi, 2015). Irhamna (2017) discovered that solving problem abilities were improving after implementing Krulik and Rudnick strategy in the learning process. Lidinillah (2011) concluded that one of heuristic problem-solving models utilized Krulik and Rudnick's. Problem-solving skills could be identified based on the phases of the problem solving (Trimahesti dkk., 2018).

Mathematics is one of the subjects that enoucrage students' problem solving skills. Mathematical understanding and communication are necessary in the process of solving mathematical problems, as revealed in Rochim's (2021a), Rochim (2021b), Rochim et al. (2021). The importance of students' problem solving skill means that it is the basic competencies in learning mathematics and developing perseverance, endurance, critical thinking, creativity, confidence, and communication skills (Mairing, 2018).

Each student has a chance to acquire different multiple intelligences with different developmental stages. Interpersonal and intrapersonal intelligences might appear in the learning process. Students often encounter difficulties in class activities, especially when they have to solve some problems. Students sometimes need to interact more with smarter students or teachers for assistance or need to create a quiet atmosphere and prefer to work individually to solve a problem.

The ground underlining the selection of interpersonal and intrapersonal intelligence is due to their significant characteristics affecting the problem solving process, as well as the findings of the previous studies that revealed that students' profiles with interpersonal and intrapersonal showed different strategies in solving problems, to mention: Faradina and Mukhlis's (2020), Rokhima and Fitriyani's (2017), Rizal and Sukayasa's

(2017), Nisa and Setianingsih's (2019), Sumadi et al. (2020), Mahfiroh et al. (2021), dan Wicaksono's (2020).

To differ with previous studies, this study combined the framework of interpersonal intelligence that emphasizes written and oral communication aspects, the framework of intrapersonal intelligence that emphasizes self-confidence and time management, and Krulik and Rudnick's framework of problem solving. Most of the previous studies utilized general theories of interpersonal and intrapersonal intelligence, from Polya's problem solving framework perpective. Therefore, this study explored in-depth information concerning interpersonal intelligence that involves oral and written communication, and intrapersonal intelligence that involves self-confidence and time management ability in solving mathematical problems to provide comprehensive data in improving the quality of mathematics learning. The purposes of the study was to analyse 1) students' profiles with interpersonal intelligence in solving mathematical problems and 2) students' profiles with intrapersonal intelligence in solving mathematical problems.

II. METHOD

The study was included into descriptive qualitative research as the data collected was in form of description and pictures. The study was conducted in SMK Muhammadiyah 1 Baron in the even semester of academic year of 2021/2022 involving 13 students of class X as prospective participants. Two participants with highest score of interpersonal and intrapersonal intelligences based on the multiple intelligence test score were selected. The participant with dominant interpersonal intelligence had a prominent ability to communicate his idea of arithmetic sequence in written and oral forms, whereas the participant with dominant intrapersonal intelligence showed self-confidence and effective time management in solving arithmetic sequence problems. The data collection techniques employed were tests, interviews and rating scales. The instrument used were categoized as main instruments and supporting instruments. The main instrument was the researcher, while the supporting instruments were the problem-solving tests, interviews, and multiple intelligences scales. To validate the supporting instruments, this study employed expert judgements of mathematics lecturers and teachers. The data validity process was carried out using time triangulation. To obtain the data, the study utilized problem solving test and interviews conducted in two stages. The data analysis was conducted with data reduction stages, namely selecting and focusing on main data, presenting data in descriptions and images, and concluding and verifying the data based on the indicators of interpersonal and

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intrapersonal intelligence in solving arithmetic sequence problems.

III. RESULT AND DISCUSSION

The results of multiple intelligence test with a score of 0-10 to prospective participants:

Table 1.
The Score Resuts of the Multiple Intelligences Instrument

No	Name	MIS score of interpersonal intelligence	MIS score of intrapersonal intelligence
1	AF	7	8
2	AMF	9	7
3	DS	5	9
4	ESA	6	7
5	FDF	7	8
6	FR	8	8
7	GF	8	7
8	HR	6	6
9	MFA	5	8
10	MKM	5	8
11	NDS	6	8
12	NKW	7	8
13	RD	6	7

Based on the test results, two participants with the highest score were selected. The participant number 2 (AMF) was the interpersonal participant with highest score, 9, and hereafter was referred as S01. The intrapersonal participant was the participant number 3 (DS) with intrapersonal score 9 and was referred as S02.

To solve the arithmetic sequences, S01 read the problem carefully before proceeding to the next stage. The reading process was carried out two times. It was supported by the interview results in which the participant stated that the first step to solve arithmetic sequence was reading the problem first, and his reading was conducted twice as a cautious act. This finding was in line with Faradina and Mukhlis's (2020) concluding that students with higher interpersonal intelligence in the social communication aspects were able to understand the problem by reading repeatedly.

S01 answered correctly by providing what was known and what was stated from the given arithmetic sequence. The test result shows in Figure 1 below.

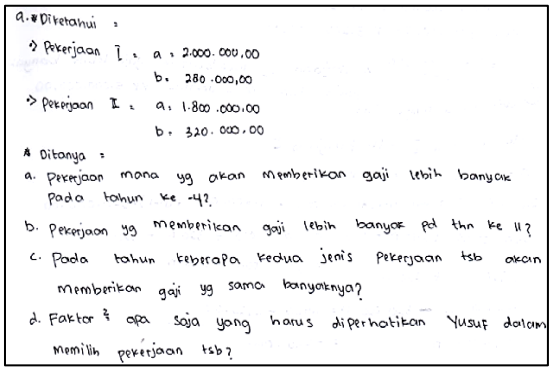

Figure 1. S01 wrote what is known and stated from the problem.

When confirmed through interviews, the participant provided the same explanation with the explanation of the problem-solving process that he wrote on the test. This finding was in line with Sumadi et al. (2020) concluding that students with dominant interpersonal intelligence solved mathematical problems starting from what they identify from the problem. Hidayati et al. (2021[b]) also

stated that verbal communication was developed in learning mathematics.

S01 provided the data sufficiency of the arithmetic sequence problem correctly during the interview. After writing what was known and asked from the problem, the participate immediately solved the problem. This meant the data was already complete to solve the arithmetic sequence. The participant also wrote and explained the model or mathematical idea correctly from the sequence by using arithmetic sequence formula. This finding was in line with Sumadi et al. (2020) revealing that students with dominant interpersonal intelligence solved mathematical problems with variables and making an equation.

S01 explained the problem-solving strategy by following the arithmetic formula of $U_n = a + (n-1)b$. This deductive strategy was a common strategy to solve the problem. This finding was in line with Sumadi et al. (2020) revealing that students with dominant interpersonal intelligence solved mathematical problems with variables and making an equation.

S01 also used algebra operation to solve the problem. It involved sum, subtraction, multiplication and division to find in addition, the participant substituted the variables in the arithmetic sequence formula in the calculation process. It was showed by Figure 2.

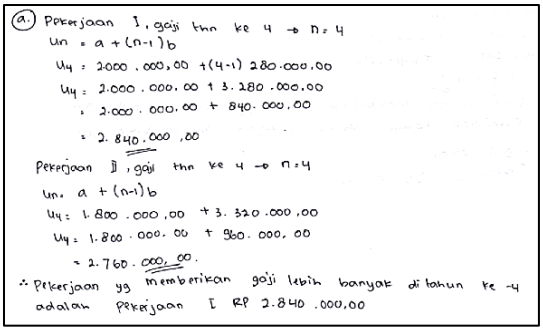

Figure 2. S01 wrote algebra operation.

According to the interview results, the participant were able to explain his answer correctly. He also put double strikethrough marks at the end of each calculation. This was to mark the result of the calculation. This finding was in line with Hidayati's (2016) that the description of verbal mathematical communication was to pronounce mathematical objects correctly and underline the mathematical objects that were preferred. Faradina and Mukhlis's (20220) concluded that students with interpersonal intelligence in the aspect of social communication had the ability to argue and perform calculations in solving problems.

S01 wrote the conclusion of the answer correctly, but did not mention the factors that should be considered durng the calculation completely. It was showed in Figure 3.

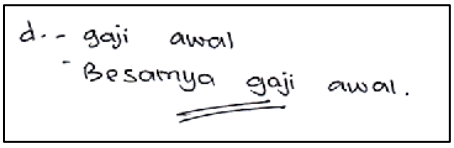

Figure 3. S01 wrote the conclusion.

The participant re-checked the answer from the arithmetic sequence problem twice. This was in line with Mahfiroh et al.

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(2021) concluding that students with interpersonal intelligence were having difficulties in the problem-solving process. Wicaksono et al. (2017) stated that they tended to solve the problem a little bit longer. Another study from Wicaksono et al. (2017) stated that participants with interpersonal intelligence tended to take a rather long time in problem solving.

S02 with intrapersonal intelligence initiated the problem solving by reading and understanding the arithmetic sequence confidently and quietly. The reading process was carried out twice. This finding was in line with Wicaksono et al. (2017). They revealed that students with intrapersonal intelligence tended to be more careful in understanding problems, read repeatedly, and need relatively shorter time to solve problems in a quiet place.

S02 write down correctly what was known and asked of the arithmetic sequence problem.

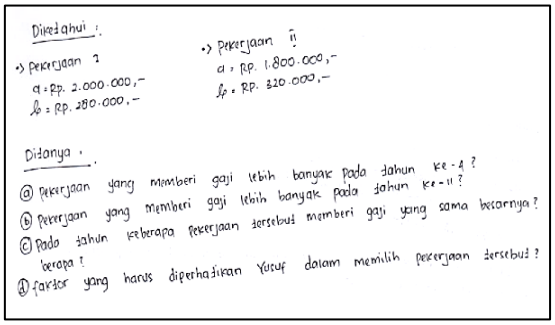

Figure 4. S02 wrote what was known and asked from the problem.

This finding was in line with Sumadi dkk. (2020) that concluded that students with intrapersonal intelligence could mathematical problems by identifying information stated in the problems with confidence. After writing what was known and asked from the problem, the participant immediately solve the arithmetic sequence. This meant the data was suffiecient to solve the problem. The participant wrote and explained the mathematical moder or idea of the arithmetic sequence problem, namely the arithmetic sequence formula with confidence. The participant answered the interview questions clearly, without hesitation and repetition. This finding was in line with Sumadi et al. (2020) that concluded that students with dominant intrapersonal intelligence solved a mathematical problem by using variables and equations.

S02 explained the problem-solving strategy using the arithmetic sequence formula with confidence. The problem-solving strategy carried out was $\mathrm{U_n} = \mathrm{a} + (\mathrm{n}-1)\mathrm{b}$. This deductive strategy was a problem solving using a general formula that was in accordance with the given problem, namely the arithmetic sequence problem. This finding was in line with Mahfirou et al. (2021) concluding that intrapersonal students were highly confident in transforming the mathematical problems into symbols.

S02 provided an accurate algebra operation. He conducted the calculation involving sum, substraction, multiplication, and division to find the correct solution. The participant also substitutes the

variables in the arithmetic sequence formula, showed by Figure 5.

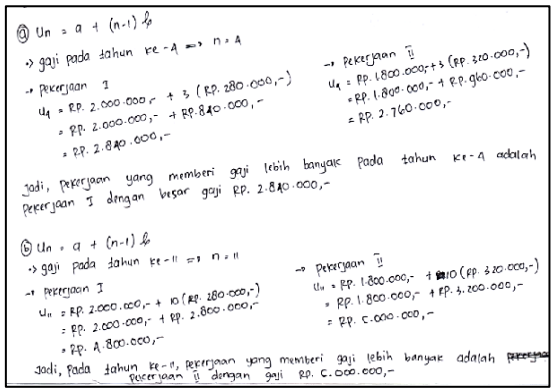

Figure 5. S02 wrote algebra operation.

This finding was in line with Rokhima & Fitriyani's (2017) that found that students with intrapersonal intelligence used conceptual knowledge to work the problems.

S02 provided the conclusion of the answer correctly. The participant reexamined his answer confidently and solved the problem rather quickly before the given time. It took him 28 minutes out of 45 minutes given to work on the problem. This finding was in line with Mahfiroh et al. (2021) stating that students with intrapersonal intelligence were able to solve the problem according to their plan, and believe in their own ability. Hidayati et al. (2021[b]) mentioned that time management was one of the soft skills attributes in learning mathemitics. Wicaksono et al. (2017) also stated that students with intrapersonal intelligenece needed a relatively short time to do solving problem processes in a quiet environment, talked less, checked the answer repeatedly.

IV. CONCLUSION

According to the results of the data analysis and discussion, the study concluded that the participant with interpersonal intelligence would first read the arithmetic sequence problems carefully. The participant wrote the information of what was known and asked in the problem and provided the data sufficiency fluently during the interview. The participant mentioned and explained the mathematical model or idea correctly using an arithmetic sequence formula. The problem-solving strategy used was deductive strategies. Despite rechecking the answer, the algebra operation and the conclusion provided was not complete yet. The participant provide the same answer when confirmed through interviews. The participant with intrapersonal intelligence would first read and comprehend the problem confidently and quietly. The participant wrote what was known and asked in the problem, provided the data sufficiency confidently, and explained the mathematical model or idea of the problem using an arithmetic sequence formula. The participant used deductive strategy, performed the algebra operation, mentioned the conclusion of the problem correctly, and double checked his work. The participant gave the solution a rather more quickly. The findings of the study were expected to provide uselful

information, an overview and insight concerning interpersonal and intrapersonal intelligence in solving mathematical problems. Therefore, this study was expected to contribute in the quality improvement of the mathematics learning.

The study suggested that teachers should consider students' multiple intelligences in learning mathematics. Furhter research might explore the topics concerning problem solving, interpersonal and intrapersonal intelligence, combined with other aspects that might be related to the topics.

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