The relationship between interpersonal intelligence and linguistic intelligence with mathematics learning achievement in high school students

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Abstract. In teaching, the teacher emphasizes identifying the dominant intelligence and learning styles to improve student achievement. However, exploring interpersonal and linguistic intelligence and its relationship to student achievement is still rarely done. This correlational research was conducted to describe the relationship between interpersonal and linguistic intelligence with high school students' mathematics learning achievement. The samples of this study were students of class XI SMA Budi Dharma Cancar Indonesia (n=30). The data were collected using a questionnaire and the pure grades of the students' midterm exams. The data analysis technique uses Product Moment Correlation as a statistical test tool to test the hypothesis of the relationship between two variables after fulfilling the prerequisite test. The results showed a positive relationship between interpersonal and linguistic intelligence and students' mathematics learning achievement. Although this study was limited to two bits of intelligence, it is essential to note that the findings of this study indicate that the number of intelligence at the dominant level can predict learning achievement in school.

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INTRODUCTION

The theory of Multiple Intelligences in education is very broad (Yavich & Rotnitsky, 2020). Gardner (2011) explains that children's intelligence is not only based on standard scores (IQ tests), but also with measures of (1) the ability to solve problems that occur in an individual's life; (2) the ability to generate new problems to be solved; and (3) the ability to create or reward one's culture. In the literature, eight multiple intelligences can be possessed by students with heterogeneous levels (Abas et al., 2019). Two of them are interpersonal and linguistic intelligence.

One of the bits of intelligence that students must possess is interpersonal intelligence. Interpersonal intelligence is more related to the ability to understand and be sensitive to the feelings, intentions, motivations, character, temperament of others (Tirri at al., 2013). Sensitivity to facial expressions, voices, cues from other people is also included in this intelligence. In general, interpersonal intelligence is related to a person's ability to establish relationships and communicate with various people. Strong interpersonal intelligence people are usually straightforward to work with others, easy to communicate with others. In everyday life and at school, of course, this intelligence is needed by students.

Linguistic intelligence includes a person's ability to use language and words, written or

spoken, in various forms to express his ideas (Hasanudin & Fitrianingsih, 2020; Prawira, 2012). Someone with this intelligence can manage words, both in spoken or written form, and can interpret writing clearly. That includes the ability to understand the power of words in changing states of mind and conveying information.

Learning achievement is an educational assessment of the development and progress of students concerning the mastery of the subject matter presented to them and the values contained in the curriculum (Hamdani, 2011). Learning achievement leads to students' success in studying subject matter at school, expressed in scores obtained from test results on a specific subject matter. So learning achievement becomes the focus of learning and all activities in class.

In the literature, it has been stated that learning achievement is mediated by interpersonal intelligence (Abas et al., 2019; Sutarman et al., 2019; Yavich & Rotnitsky, 2020; Yerizon et al., 2018). The researchers revealed that interpersonal intelligence is positively related to student achievement. They recommend the importance of considering this variable to unlock students' potential. Furthermore, the literature has also revealed that linguistic intelligence is related to student learning achievement (Alhawamdeh & Arabia, 2016; Halil, 2017; Kusumawarti et al., 2020; Yusri, 2018).

However, further investigations in learning mathematics related to intelligence are very few. On the other hand, deep intelligence in learning mathematics is essential because it involves problem solving and communication activities that require students to understand the language of mathematical definitions, theories, and symbols. Therefore, the research aims to question the relationship between the two bits of intelligence and mathematics learning achievement. It will make a practical contribution for teachers to consider both if they prove to be dominant factors.

METHOD

The type of research used in this research is quantitative research with a correlational approach. According to Arikunto (2013), correlational research is research conducted by researchers to determine the level of relationship between two or more variables without making changes, additions or manipulations to existing data. In this study, the population in this study was all class XI students at SMA Budi Dharma Cancar, Indonesia. The number of students who make up the population is 120 people. The sampling technique used in this research is Simple Random Sampling. The number of students who became the sample was 30 people.

Data collection techniques in this study used a measuring instrument in the form of a questionnaire to determine the level of interpersonal intelligence and linguistic intelligence of students, as well as documentation data in the form of pure scores of students' midterm exams for mathematics subjects as data on students' mathematics learning achievement. Statistical hypothesis testing using t-test with the provision of rejecting H_0 or accepting H_1 means a significant relationship between students' interpersonal intelligence and students' mathematics learning achievement. Likewise, for other variables.

RESULTS AND DISCUSSION

In Based on the research data, a requirements analysis test was carried out where the data was taken randomly, knowing that the data were normally distributed and had a linear pattern, then continued with multicollinearity analysis and there was no relationship between the independent variables, so there was no multicollinearity. After testing the requirements analysis, it is continued with Pearson Product Moment correlation analysis and multiple correlation.

From the calculation of the correlation coefficient of interpersonal intelligence (X_1) on learning achievement in mathematics (Y) obtained $rX_1 Y=$"0.6823". This shows that there is a positive correlation between interpersonal intelligence and student achievement in mathematics where the level of the relationship is quite strong based on the interpretation of the correlation coefficient r value. Thus, the amount of the contribution of the X_1 variable to Y is r^2 x 100% = $(0.6823)^2$ x 100% = 46.55%, which means the contribution of interpersonal intelligence to the

mathematics learning achievement of class XI SMA Budi Dharma Cancar teaching is 46.55% and the rest is determined by other variables. Based on the calculation of = 0.05 with two-tailed test and n = 30 with "dk = n-2" = "30-2" = 28, then we get t_{table} = 2.048. This shows that $t_{count} > t_{table}$ or 4,938> 2,048, so reject H_0 or accept H_1 means that there is a significant relationship between students' interpersonal intelligence and students' mathematics learning achievement. The magnitude and direction of the relationship indicate that the higher the student's interpersonal intelligence, the higher the student's mathematics learning achievement.

From the calculation of the correlation coefficient of Linguistic intelligence (X_2) on mathematics learning achievement (Y) obtained $rX_2 Y$="0.6041". This shows that there is a positive correlation between linguistic intelligence and students' mathematics learning achievement where the level of the relationship is quite strong based on the interpretation of the correlation coefficient r value. Thus, the amount of the contribution of the X_2 variable to Y is r^2 x 100% = $(0.6041)^2$ x 100% = 36.50%, which means that the contribution of linguistic intelligence to the mathematics learning achievement of class XI SMA Budi Dharma Cancar teaching is 36.50% and the rest is determined by other variables. Based on the calculation of = 0.05 with two-tailed test and n = 30 with "dk = n-2" = "30-2" = 28, then we get t_{table} = 2.048. This shows that $t_{count} > t_{table}$ or 4.011> 2,048, then reject H_0 or accept H_1 means that there is a significant relationship between students' linguistic intelligence and students' mathematics learning achievement. The magnitude and direction of the relationship indicate that the higher the student's interpersonal intelligence, the higher the student's mathematics learning achievement.

From the calculation of the correlation coefficient of interpersonal intelligence (X_1) and linguistic intelligence (X_2) on mathematics learning achievement (Y) obtained $rX_1 X_2 Y$=0.7490. This shows that there is a positive correlation between interpersonal intelligence and linguistic intelligence on students' mathematics learning achievement where the level of the relationship is quite strong based on the interpretation of the correlation coefficient value of r. Thus, the contribution of X_1 and X_2 variables to Y is r^2 x 100% = $(0.7490)^2$ x 100% = 56,10%, which means that the contribution of interpersonal and linguistic intelligence to mathematics learning achievement in class XI SMA Budi Dharma Cancar is 56.10% and the rest is determined by other variables. The results of the significance test obtained F_{count}=17.25 with and dk= {(1-0.05)(dk=2),(dk=30-2-1)} then F_{table}= 3.35. It turns out that $F_{count} > F_{table}$, or 17.25 > 3.35, then H_0 which states that there is no relationship is rejected or H_1 is accepted, which means that there is a significant relationship between interpersonal intelligence and linguistic intelligence on students' mathematics learning achievement.

The results of this study are supported by previous research findings that interpersonal intelligence is positively related to student achievement (Abas et al., 2019; Yavich & Rotnitsky, 2020). They believe that interpersonal intelligence is one of the dominant factors that mediate student achievement. However, Thus, to achieve more comprehensive results, several researchers recommend the need to conduct a meta-analysis to find moderator variables that might clarify between the two variables (Juandi, Kusumah, Tamur, Perbowo, & Wijaya, 2021; Juandi, Kusumah, Tamur, Perbowo, Siagian, et al., 2021; Suparman et al., 2021; Tamur et al., 2021; Tamur, Kurnila, et al., 2021; Tamur, Mandur, et al., 2021) including the relationship between interpersonal intelligence and learning achievement in mathematics.

Other findings reveal that linguistic intelligence is positively related to students' mathematics learning achievement. This result is supported by previous studies that linguistic intelligence is one of the factors on students' mathematics learning achievement (Alhawamdeh & Arabia, 2016; Halil, 2017; Hasanudin & Fitrianingsih, 2020; Yusri, 2018; Kusumawarti et al., 2020). Although midwives carried out previous research and mathematics education, these similar findings indicate that linguistic intelligence should be considered more in learning mathematics. Teachers need to provide a more expansive space, for example, by getting students to communicate to form their linguistic intelligence.

CONCLUSIONS

In general, in the concluding section the authors describe the answers to the research problems (research questions) that were studied as well as the theoretical implications of the results/findings of the research. Emphasis needs to be placed on findings that are seen as having a novelty value from the study, for example, the contribution of the results of this study to the related theory. Based on the research objectives and the results of data analysis, it can be concluded that there is a positive relationship between interpersonal and linguistic intelligence and high school students' mathematics learning achievement. In learning mathematics, teachers should pay attention to and optimize the intelligence possessed by students, including interpersonal intelligence and linguistic intelligence. Data processing and analysis showed that interpersonal intelligence and linguistic intelligence significantly contributed to students' mathematics learning achievement by 56.10%. That shows how vital these two bits of intelligence are to optimize the two bits of intelligence they have for better achievement in learning mathematics.

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