MATHEMATICS ACHIEVEMENT - INTELLIGENCE QUOTIENT (IQ): A STUDY OF SIMPLE RELATIONS IN CLASS 10 HIGH SCHOOL STUDENTS

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Abstrak: Penelitian ini bertujuan untuk menguji apakah prestasi matematika siswa mempengaruhi tingkat IQ dengan melihat korelasi antara prestasi matematika serta regresinya. Sampel penelitian terdiri dari 81 siswa baru salah satu Madrasah Aliyah di Kota Surakarta, dimana data diperoleh dari dokumen sekolah. Penelitian menggunakan pendekatan kuantitatif dengan desain penelitian survei. Teknik analisis data menggunakan teknik analisis statistik deskriptif dan statistik inferensial, meliputi: uji prasyarat berupa uji normalitas dan uji lineritas, uji asumsi klasik berupa uji multikolinieritas dan uji herteroskedastisitas. Dilakukan uji hipotesis berupa uji analisis regresi sederhana. Hasil penelitian menunjukkan bahwa rata-rata nilai matematika siswa yaitu 45.78, nilai terkecil 8, dan nilai terbesar 92. Sedangkan rata-rata skor IQ siswa sebesar 112.43 dengan skor terendah 100 dan skor tertinggi 126. Hasil menunjukkan prestasi matematika siswa berpengaruh terhadap tingkat IQ siswa dengan persamaan regresi Y=107.739+0.103X menunjukkan bahwa setiap penambahan 1% nilai prestasi matematika, maka nilai IQ akan bertambah sebesar 0.103. Dapat dikatakan bahwa ketika prestasi matematika siswa meningkat maka IQ siswa akan meningkat juga. Besarnya pengaruh prestasi matematika siswa terhadap IQ yaitu 16% dengan nilai korelasi sebesar 0.4.

Kata kunci : *Hubungan sederhana, Intelligence quotient (IQ), Prestasi matematika*

Abstract: This study aims to test whether students' mathematics achievement affects their Intelligence Quotient levels based on the correlation and regression. Its sample consisted of 81 new students from one Madrasah Aliyah in Surakarta City. IQ data were obtained from school documents. This study used a quantitative approach with a survey design. It were analyzed using descriptive statistical analysis and inferential statistics, covering prerequisite tests in the form of normality tests and linearity tests, classical assumption tests in the form of multicollinearity tests and heteroscedasticity tests, and hypothesis tests in the form of simple regression analysis. It showed that the mean score was 45.78, the smallest is 8, and the highest is 92. While the mean score of student's IQ was 112.43 with the lowest score of 100 and the highest score of 126. Students' mathematics achievement was affected their IQ level with the regression equation of Y=107.739+0.103X which indicated that for every 1% addition of math achievement scores, the IQ score will increase by 0.103. Therefore, when students' mathematics achievement increases, their IQ will also increase. The influence of students' mathematics achievement on IQ is 16% with a correlation value of 0.4.

Keywords: *Intelligence quotient (IQ); Mathematics achievement; Simple relationship*

INTRODUCTION

Intelligence is a fundamental factor in predicting academic achievement at schools (Hegelund et al., 2018), and has an important role in the future success of students. Intelligence has an important role in the future success of students. Intelligence plays a role in students' ability to absorb new information or knowledge and make it the basis for processing and solving a problem (Chowdhary, 2020). Intelligence has a strong correlation with individual cognitive abilities such as thinking, remembering, reading, learning, problem-solving, and language use. Mathematical literacy is also essential in developing children's mathematical intelligence (Natsir & Munfarikhatin, 2021). Intelligence can be measured using a psychometric tool known as an intelligence quotient test (IQ test). Intelligence quotient (IQ) is a general term used to describe the attributes of the mind covering some abilities, such as reasoning, planning, problem-solving, abstract thinking, concept understanding, language use, and learning (Fangyao et al., 2021). IQ is an individual's ability to enable the individual to provide an appropriate response to a received stimulus (Fukai et al., 2019).

Kullar et al., (2019) revealed that students with low IQ have significantly lower academic achievements compared to those with normal IQs. This shows that the students' IQ levels affect their academic achievement. The ability to use symbols and calculations in IQ lies within the scope of mathematics. A previous study by Guez et al. (2018) showed that students with high IQ levels have high learning achievements as well, but in some cases (Ihsan et al., 2021), students with high IQ have low mathematics learning achievements. The results of this study are interesting to prove in other settings. However, Syafi'i et al. (2018) explains that this condition is caused by psychological factors which are one of the causes of fluctuations in learning achievement.

In mathematics, a person's intelligence is not only measured in solving calculation questions. It is necessary to have good mathematical problem-solving skills for concrete certain problems (Purpura et al., 2017). Mathematics is needed to form a systematic mindset from various points of view. Thus, many think that mathematics is the basis of all sciences. This perception has encouraged countries to put mathematics in the Programme for International Student Assessment (PISA), namely a global-level event. Unfortunately, Indonesia always gets a low rank in mathematics in which in the last implementation in 2018, this country was only able to get a rank of 72 out of 75 countries (OECD, 2019). This provides concrete evidence that the Indonesian students' mathematics at the global level is still problematic.

The developing paradigm in society regarding IQ is that when someone has a high IQ then he will be able to achieve high achievements because intelligence will facilitate students in the learning process so that it will produce good learning achievements. However, most of the students with high academic

achievement are not proportionalto their IQ levels. It is possible that students with a good IQ level have low learning achievement, and vice versa. students can have high learning achievements once their intelligence is low. Therefore, Puspitacandri et al. (2020) argues that the factors influencing a person's learning success or learning achievement are not only the IQ level but also other factors.

The factors influencing academic achievement and intelligence are the subject of lengthy debate (Kriegbaum et al., 2018). Hua & Wang (2021) reveals that parents are now trying hard to make their children smarter or at least produce better IQ scores. Parents think students with high IQs will do better in school and life. Hence, they try to provide as many facilities and amenities as possible to make students smart and help their children develop cognitive abilities. Intelligence has a significant relationship and makes an essential contribution to other variables such as school curriculum, curriculum, teachers, school characteristics, and other relationships in school performance (Pascual et al., 2019) and is a reciprocal relationship. Therefore, individual learning outcomes must be taken into account by schools, families, and students themselves.
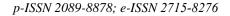
Many studies have revealed the extent to which students' IQ levels affect their learning achievement in mathematics. However, this present study aims to see the correlation between mathematics learning achievement and IQ level and its regression. More specifically, it will be seen whether students' learning achievement in mathematics affects their IQ levels or not as we know that a person's IQ will develop along with increasing cognitive and mental abilities.

RESEARCH METHOD

This study used a quantitative approach with a survey design. The sample consisted of 81 new students at one Madrasah Aliyah in Surakarta City. The sample in this study was taken by saturation sampling. The entire population was used as the research sample.

The independent variable used is students' mathematics learning achievement and the data were obtained from the mid-semester assessment score (PTS). The dependent variable was the students' IQ obtained from the IQ test conducted by a psychology institute called Anava Surakarta. The PTS instrument used by the teacher to assess students' mathematical achievement was in the form of multiple-choice and essay questions, all of which met the good criteria. Likewise, the instruments used to measure IQ issued by psychological institutions are credible.

Data analysis used descriptive statistical analysis techniques and inferential statistics including prerequisite tests of normality test and linearity test, classical assumption tests in the form of multicollinearity test and heteroscedasticity test, and hypothesis test in the form of simple regression analysis test. The hypothesis was that there is a significant effect of students' mathematics learning

achievement on their IQ levels. The researchers chose this analysis technique because, in addition to knowing the effect of students' mathematical achievement (X) on their IQ (Y), it is also to find out how much influence mathematics achievement has on their IQ.

RESULTS AND DISCUSSION

The students' mathematics learning achievement and IQ score data obtained are presented in Table 1. Data were processed using the SPSS version 21 software.

Table 1. Descriptive statistics

Variable	Mathematics achievement	IQ
N	81	81
Min	8	100
Max	92	126
Mean	45.78	112.43
Std. Deviation	25.116	6.438

The hypothesis test was preceded by a prerequisite test and a classic assumption test. The prerequisite test covers the normality test and linearity test as presented in Table 2

Table 2. Results of Prerequisite Analysis

Name of test	Sig. value
Normality test (Kolmogorov-Smirnov)	0.939
Linearity test (ANOVA)	0.000

The normality test in the regression model was used to test whether the residual value resulting from the regression is normally distributed or not. A good regression model has a normally distributed residual value. The Kolmogorov Smirnov One-Sample Test was carried out to determine the distribution of the data, whether it follows a normal, Poisson, uniform, or exponential distribution. In this case, it's to find out whether the residual distribution is normally distributed or not. The residuals are normally distributed if the significance value is higher than 0.05. Based on Table 2, the significance value (Asymp. Sig 2-tailed) is 0.939. As the significance is higher than 0.05 (0.939>0.05), then the residual value is normal.

Linearity is the nature of a linear relationship between variables. It means that any changes occurring in one variable will be followed by parallel changes in other variables. In this study, the linearity test used the ANOVA test. Based on Table 2, the two variables have a linear relationship by

looking at the sig value. which is less than 0.05. Thus, it can be concluded that the data meet the linearity requirements.

Moreover, the classical assumption test used the multicollinearity test and heteroscedasticity. The test results are presented in Table 3.

Table 3. Results of classical assumption test

Name of test	Criteria value
Multicollinearity test	Toleransi = 1.000 VIF = 1.000
Heteroscedasticity test	Sig. = 0.071

The multicollinearity test aims to test whether there is a high or perfect correlation between independent variables in a regression model. This test is based on the tolerance value and the variance inflation factor (VIF) value. Based on Table 3, the tolerance value is 1,000 and the VIF value is 1,000. Thus, it can be concluded that there is no multicollinearity problem.

The heteroscedasticity test aims to test whether there is an inequality of variance from the residual value of one observation to another observation in one regression model. If the variance from the residual value of one observation to another is fixed, it is called homoscedasticity, but if it is different, it is called heteroscedasticity. A good regression model is a homoscedasticity regression model with no signs of heteroscedasticity. One way to detect the presence or absence of heteroscedasticity symptoms is the Glejser test. The working principle of the heteroscedasticity test using the Glejser test is the regression of the independent variable to the Absolute residual value. Based on Table 3, the Sig. value is higher than 0.05. Thus, it can be concluded that the regression model is homoscedasticity.

Therefore, a hypothesis test can be carried out. The results of the hypothesis test using a simple linear regression test show that there is a significant effect of students' mathematical achievement on their IQ levels. These results are obtained from the SPSS output in the ANOVA section which shows the sig value. lower than 0.05 which is equal to 0.000. Based on the Coefficients table, the simple linear regression model obtained $Y=107.739+0.103X$ indicating that the IQ variable of 107.739 is positive. It means that for every 1% addition to the value of math achievement, the IQ value will increase by 0.103. Therefore, it can be said that when students' mathematics achievement increases, their IQ levels will also increase. The influence of students' mathematics achievement on IQ is 16% with a correlation value of 0.4. The correlation and the percentage of this effect is an interpretation of the "model summary" table which shows the value of R=0.400 and R Square of 0.160. Thus, 84% of students' IQ is influenced by variables other than math achievement.

IQ is an indicator to measure a person's intelligence (Kovacs & Conway, 2019). Intelligence refers to the intelligence formed from the learning process and life experience. IQ has a close relationship with intellectual, logical, analytical ability, mathematical problem solving, and strategy. Besides, IQ is also related to communication skills, responses to surrounding things (Ackerman, 2017), and the ability to study numbers including mathematics (Chan et al., 2022).

The results of this study indicate that a person's IQ can be increased. This is in line with Swartz & Perkins (2016) that a person's abilities can be improved, including IQ. This is also based on the fact that a person's mathematical ability can be improved which ultimately affects mathematical achievement (Dowker et al., 2016).

An IQ test tests four components namely verbal intelligence, numerical intelligence, spatial intelligence, and logical intelligence (Berkowitz & Stern, 2018). A study by Morsanyi et al. (2018) revealed that the relationship between mathematical ability and IQ is linear, i.e. the higher the mathematical ability, the higher the IQ, and vice versa. Thus, it is logical that a person's mathematical ability affects the IQ level.

Furthermore, Susanti & Wulandari (2021) emphasizes that mathematical intelligence can be characterized by the ability to explain in detail the information from the questions, mention the steps for completion, convey answers correctly, and carry out the process of re-checking the questions to ensure the correctness of all these stages. These stages are carried out quickly and carefully, showing a high level of mathematical intelligence. Meanwhile, students who cannot give the final touch properly, which incorrectly causes the answers to questions, are categorized as having low mathematical intelligence. In many cases, students with high mathematical intelligence correlate significantly with students with high IQ (Lynn, 2010).

Morsanyi et al. (2018) show that the relationship between mathematical ability and IQ is linear, i.e., the high mathematical ability has a high IQ and vice versa. So it is logical that a person's mathematical ability affects IQ. The difficulty of mathematics subjects to learn is experienced by both children and adults. Many of us lack mathematical literacy, which often leads to our ignorance of the positive impact on life. The manifestation of good mathematical intelligence, which is linear to a person's high IQ, contributes directly to the ability to cope with various functional demands in society. Indeed, even without a high IQ, we can live well. However, it is undeniable that to answer the challenges of the world in the future in long term. Strong intelligence is needed to at least be able to survive and maintain the next generation. Deary et al. (2007) emphasizes the various evidence of the relationship of intelligence with solid learning outcomes. This ability will later help as a predictor of many learning outcomes that can represent handling massive problems in life.

This research approach emphasizes that IQ can develop simultaneously. It is necessary to increase mathematics learning outcomes to build mathematical intelligence in the future. Increasing mathematics learning is quite difficult because persistence in learning is not enough capital to improve learning achievement, let alone IQ (He et al., 2021). Furthermore, Mayes et al. (2009) The importance of IQ is needed in advanced mathematics material to predict problems through computational mathematics (math computation achievement). This material is very relevant to the development of modern science, which is highly complex. IQ intelligence is needed to build a good civilization in the future. There is a strong correlation between learning achievement in mathematics and influencing students' IQ levels, which is a common thread about the importance of efforts to improve achievement in this context. In the end, research to find the strong relationship between the two variables is undoubtedly not enough to overcome various challenges. However, it is sufficient as a predictor of which ones are important to improve and improve services.

CONCLUSIONS AND SUGGESTIONS

Based on the findings and test results, the mean score of students' mathematical achievement is 45.78 with the smallest score of 8 and the highest score of 92. While the mean IQ score is 112.43 with the lowest score of 100 and the highest score of 126. Moreover, based on a hypothesis test using simple regression, the results show that students' mathematical achievement affects their IQ levels with the regression equation of Y=107.739+0.103X. This means that for every 1% addition to the math achievement score, the IQ score will increase by 0.103. Thus, it can be concluded that when students' mathematical achievement increases, their IQ will also increase. The influence of students' mathematics achievement on IQ is 16% with a correlation value of 0.4.

Students' mathematical achievement needs to be continuously improved to increase their IQ levels. Improving students' mathematical achievement can be done in various ways, such as by improving the quality of learning and teaching materials. The results of this study can be the basis for teachers and other researchers to conduct further research on improving students' mathematical achievement.

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