The Role of School Quality and Students' Health on Academic Achievement: A Binary Probit Regression Study

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Abstract: The Role of School Quality and Students' Health on Academic Achievement: A Binary Probit Regression Study. Objectives: This study aims to show the effect of school quality, students' health and s control variables on students' academic achievement in Tangerang Municipality. **Methods:** The authors used a representative sample of students who were registered and active in public high schools; 332 samples. The data was obtained by a valid and reliable research instrument through questionnaire. The authors employed Likert scale to measure the variables, while the questionnaire has been distributed to the samples determined by simple random sampling. **Findings:** The current student's academic achievement needs to be improved, because the level of achievement was 75% of the predetermined standard. By using a Binary Probit Analysis model, the authors found that the variables of school quality, socioeconomic status, students' health, and age had significant effect on academic achievement, except the gender. **Conclusion:** The quality of school and students' health are important instruments for improving student academic achievement. The findings of this study suggested that school principals and their policy makers to always maintain education services by fulfilling school resources, facilities, and teachers' quality.

Keywords: academic achievement, school quality, socioeconomic status, students' health.

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◼ INTRODUCTION

Academic achievement is one of the essential instruments in educational attainment. Academic achievement can be utilized to predict the quality of education, economic growth, the quality of life, and adaptation to change and development (OECD, 2016). In addition, it requires both students' behavioral and cognitive involvement (Kutlu & Kartal, 2018). Students' academic achievement supports their engagement in global competition. The students' capitals that should be possessed are innovation and knowledge as the result of education (Dyba, 2012), because contributing to the benefits for individuals, organizations, and society as a whole (Madigan, 2019).

The measurement of the educational achievement is through the score of students learning outcomes. Many previous researches have examined and measured the learning results

by the score, such as the importance of knowledge and skill for students under 15 years old to participate in the society in the upcoming years (OECD, 2020). Moreover, the students' cognitive learning result served as academic achievement priority (Priddy, 2018), score, and standard evaluation, assessment scale (emphasized on the behavior and academic achievement), and the combination (Madigan, 2019; Wilder, 2014). The measurement of testing result included the expected and predicted scores (Guo, Parker, Marsh, & Morin, 2015; Meyer, Fleckenstein, & Köller, 2019; Trautwein et al., 2012).

Several factors affect the achievement, such as students' internal and external factors, learning approaches (Rockoff & Turner, 2010; Suwardi, 2012), school's involvement and interests (Kutlu & Kartal, 2018), school quality (Ahinful, Tauringana, Bansah, & Essuman, 2019; Deming, Hastings, Kane, & Staiger, 2014; Khusaini & Mulya, 2021; Lucas & Mbiti, 2014; Mappadang, Khusaini, Sinaga, & Elizabeth, 2022; von Stumm et al., 2021), the timing of teaching and classroom quality (Rivkin & Schiman, 2015), and as well as socioeconomic status (Liu, Peng, & Luo, 2020; Sentosa, 2023; Simamora, Harapan, & Kesumawati, 2020; Syafi'i, Marfiyanto, & Rodiyah, 2018; White, Reynolds, Thomas, & Gitzlaff, 1993; Yuxiao & Chao, 2017; Zhao, Valcke, Desoete, & Verhaeghe, 2012). Besides, the previous researchers stated that students' health both psychologically and physically affected their academic achievements (Bharadwaj, Løken, & Neilson, 2013; Eitland & Allen, 2019; Evans, Smokowski, Rose, Mercado, & Marshall, 2019; Ickovics et al., 2014; O'Connor, Cloney, Kvalsvig, & Goldfeld, 2019; Stea, Knutsen, & Torstveit, 2014). Based on these factors, the authors empirically measured the factors affecting students' academic achievements, such as school quality, parents' socioeconomic status (SES) and students' health.

One of educational products of high school is students' academic skill measured by the result of final exam. The result of students' outcomes from national-based school exam of high school in Tangerang municipality in 2017 obtained the average of 54.19 and increased in 2019 by 2.58 points to 57.04. This score, compared with the requirement of minimum passing grade 55.00 (assuming 2015 passing grade), has not meet the required passing grade, which is 98.52% in 2017 and exceed 3.71% in 2019. The national exam result in Tangerang municipality is higher than both Banten Province and National results. The average score in Banten province is 47.55 in 2017 which increase to 51.37 in 2019. Nevertheless, these results were under 55.00 (minimum passing grade). While the average of national score was higher than the Banten Province accomplishment, which is 50.40 in 2017 and decrease by 1.8 point in 2019, becoming 50.22 (Kementerian Pendidikan dan Kebudayaan, 2017, 2018, 2019).

The quality of schools is assumed to be good because they accept a small number of outstanding students annually. The school costs are expensive and coveted by both students and parents. These schools commonly gain achievements and the students get superior accomplishment in national examination (Lucas & Mbiti, 2014). This type of schools has adequate resources and posing target for teaching certain students to improve their reputation and rank for better than other schools. A school with good quality will not only improve the students' score but also enhancing student chance to have prosperous life.

Other researchers assumed that a qualified school is the school that maintaining and ensuring the quality in the process of school implementation. Fuadi (2020) found that a school which has a good quality tends to have better quality in students both academic and non-academic achievement. These schools are

imposing internal quality assurance to create innovative teaching and learning activities, orienting in students and school achievements, focusing on the customer satisfaction both internal and external as well as fulfilling 8 national standard for education (Gustini & Mauly, 2019). Otherwise, there is little evidence that a reputable school (qualified) brings positive impact toward students' learning outcomes, as a good and qualified school prefers to be chosen than improving students' score (Lucas & Mbiti, 2014). In line with Brown, McNamara, & O'Hara's (2016) finding that teaching quality less contribute for improving students' score.

The students' academic success is also determined by parents' socioeconomic status. Previous researches claimed that parents' socioeconomic status has a strong relationship with students achievements in all school levels (Liu et al., 2020; Stinebrickner & Stinebrickner, 2003; Syafi'i et al., 2018; Zhao et al., 2012), and having higher expectancy (McConney & Perry, 2010; Yuxiao & Chao, 2017). Socioeconomic status mentioned previously could be in the form of parents' educational background, family earnings, and the level of unemployment (Toutkoushian & Curtis, 2005). Recent studies also show that SES contributes significantly to increasing academic achievement (Boman, 2023; Chevalère et al., 2023; Erdem & Kaya, 2023; Finch & Finch, 2022; Liu, Peng, Zhao, & Luo, 2022; Zhao, Liu, & Li, 2023). Sirin (2005), employing the research's frame work of (White et al., 1993), founded that school success was strongly affected by the socioeconomic status of the student's family, where the school success was also related to the student's success, except for weak/less correlation level.

However, a few researches found the opposite result where socioeconomic status did not significantly contribute to the improvement of students' achievement (Simamora et al.,

2020). Students with low academic achievement from prosperous family were caused by their reluctance to learn (Suardi, 2018). Otherwise, students, who come from low SES but having good academic achievement (McConney & Perry, 2010), were caused by their higher learning motivation as the effort to enhance their learning achievements.

Students' learning achievement could be affected by individual health. The health refers to both physical and mental wellness. Glewwe & Miguel (2008) argued that students' health, measured both physical and mental (e.g. Nutrition status, the absence of nutrition in school, age, vision and hearing problems), was proven to have an effect on the learning result. Other researchers claimed that mental health such as stress, depression, anxiety, etc. impacted learning result (Anderman, 2002). The pressure experienced by students commonly occurred during their period of physical and mental development. Students at this age are having unstable condition. The internalization symptoms of mental health are measured by the symptoms of anxiety and depression (Evans et al., 2019). Student's health is fundamental to improve their thinking skill and performance (Eitland & Allen, 2019). Moreover, students with sleep deprivation increased the risk of physical health, hence, decrease their academic achievements at school (Stea et al., 2014). Meanwhile, healthy lifestyle also have significant impact for student's academic achievement (Bradley & Greene, 2013).

It is important for schools to utilize non-traditional learning strategies in improving students' health, as proven to not only increase students' academic achievement, but also decrease the gaps between wellness and academic achievement (Ickovics et al., 2014). In a different research, a study conducted by (Bharadwaj et al., 2013) focused on examining students whom facilitated with good medical care since birth. The result showed that students given

extra medical attention were having lower mortality rate and higher academic achievement at school. A criticism of health variable used by (Langford et al., 2014) stated that the inconsistence of the research result is due to the previous researches have not determined the impact of health (holistic approach) toward academic result and student's presence. A current research by O'Connor et al. (2019) employed mental health variable as predictor variable to predict academic achievement. The finding showed that mental health has positive correlation to academic achievement. However, the contribution is low (weak).

Based on the literature, the authors found inconsistencies of previous research findings examined the variables of school quality and parents' socioeconomic status. The inconsistent results were caused by the different SES variable measurements to predict learning result in the form of student's academic achievement, as well as predictor variable of school quality and health. In this research, the measurement of mental health variable is focused on the aspects of mental, physical, and healthy lifestyle to predict students' academic achievements. According to the perspective of analysis model, a few researches employed qualitative response variable, namely logistic regression (Ickovics et al., 2014), therefore, the authors complement the previous analysis model by employing probit regression which aimed to test the probability of school quality, parent's SES, student's health and variable control toward student's academic achievements. Various analyses model employed by previous researches are explained by the authors in the research method section.

Meanwhile, the population of this research is the registered and active high school students in Tangerang. The public high schools' selection is based on the public opinion, that the schools are homogeny in academic achievement, graduation level, accreditation level, and school

status. To produce research that confirmed theories and previous research, the analysis model employed was the nonlinear binary probit model, commonly called the Normit model. The use of this model is caused by students's academic achievement, which is divided into the categories of academically excelling and underachieving. The result of this research was expected to be that school variable quality, parents' SES, students' health, and control variable as predictor variables would significantly increase students' academic achievements in high school. In addition, the researchers formulated the research hypothesis as follows:

H1. School quality has a positive and significant effect on academic achievement.

H2. Parents' socioeconomic status has a positive and significant effect on academic achievement

H2. Student health has a positive and significant effect on academic achievement.

■ METHOD
Participants

The population target of this research is public high school students in Tangerang Municipality in 7 schools (out of 15 schools), for a total of 6,709 students in the 2022–2023 academic year. The researchers determined the criteria that the type of school was state-accredited grade A, represented the distribution of the West and East Tangerang areas, registered students with Dapodik, and represented the school's achievements. The sample was 332 students from the targeted population of all students of public senior high schools in Tangerang Municipality selected by simple random sampling. The sample size was determined by imposing Krejcie and Morgan's table with sampling error 5%. Questionnaires were distributed to participants through WhatsApp groups.

Research participants according to gender showed that there were more female participants

than male participants, namely 59.64% of the total 332 participants. Research participants by age were generally 17 years old at 54.2% and at least 14 years old at 1.2%, and the average age was 16.82 years. The education level of participants' parents generally has graduated from secondary school and tertiary education is 82.23% and the income level is generally between IDR 4,168,268 – IDR 10,000,000 which is 56.33%. The most participants according to school type were from SMA Negeri 5 Tangerang at 16.57% and the least came from SMA Negeri 11 Tangerang at 12.31%. The number of participants based on geographical area, the participants coming from East Tangerang were greater than West Tangerang, namely 53.61%.

Table 1. Participants profile

Characteristic, n = 332	Numbers	Percentages
Gender		
- Male	134	40.36%
- Female	198	59.64%
Age		
- <= 15 years	21	6.32%
- 16 years	77	23.13%
- 17 years	180	54.22%
- >= 18 years	54	16.26%
Parents' Income		
- < IDR 4,168,268	53	15.96%
- IDR 4,168,268 – IDR 10,000,000	187	56.33%
- > IDR 10,000,000	92	27.71%
Parents' Education		
- >= Basic Education	59	17.77%
- Secondary Education	132	39.76%
- Higher Education	141	42.47%
Schools		
- SMA Negeri 3 Tangerang	52	15.66%
- SMA Negeri 5 Tangerang	55	16.57%
- SMA Negeri 7 Tangerang	48	14.46%
- SMA Negeri 10 Tangerang	43	12.95%
- SMA Negeri 11 Tangerang	41	12.31%
- SMA Negeri 12 Tangerang	45	13.55%
- SMA Negeri 14 Tangerang	48	14.46%
Areas		
- West Tangerang	154	46.39%
- East Tangerang	178	53.61%

Research Design and Procedure

This research examined the effect of school quality, students' health, socioeconomic status and control variable to students' academic achievements using quantitative approach. Quantitative research uses statistical equations to predict or estimate the impact of one variable on another variable. Quantitative research methods are used to observe events that affect a group of sample or populations (Singh, 2007). This type of research includes a variety of numerical data that is collected through various methods and then

analyzed statistically to aggregate the data, compare them, or show relationships between the data. This method is a tool that allows researchers to conduct research and detect empirical regularities, causal chains, and explanations of social phenomena (Cohen, Manion, & Morrison, 2007) especially in the field of education or educational economics.

The design of the approach is cross-sectional survey. Cross-sectional studies are studies that produce a 'snapshot' of a population at a certain point in time. This survey is a survey that collects primary data from student groups. In education, cross-sectional studies involve indirect measurements of the nature and rate of change in the physical and intellectual development of a representative sample of children at age level (Stockemer, 2019). The procedure in this research refers to the stages proposed by Sugiyono (2018) who stated that procedures in research include identifying and formulating research problems, reviewing literature, proposing hypothesis formulation, establishing methods, compiling instruments, collecting and analyzing data, and finally drawing conclusions.

Instrument

In measuring the variables, some steps conducted by the authors were: initially, the authors identified empirical indicators on the items that were conceptually observable. Secondly, the authors determined the measurement scale. In making such a measurement scale, the authors needed to design a scale into range and change or map the object properties from the domain to the scale (Kothari, 2004). However, before determining the measurement scale, the authors generated conceptual and operational definition of the variable, consequently, a group of items was added to each construction. The relevance of the item and respondents' ability to comprehend each item were required to acquire

reliable data (Podsakoff, MacKenzie, & Podsakoff, 2012).

The variable operationalization of this research led the focus to arrange the construction of a variable. Academic achievement (aa) was the students' outcome, which referred to cognitive abilities and skills derived from assessments conducted by a teacher or school (Guo, 2016; Madigan, 2019; Meyer et al., 2019; OECD, 2020; Priddy, 2018; Trautwein et al., 2012; Wilder, 2014), which was measured by the assessment results in the 2019/2020 even semester. The score of the test was measured by a dummy scale, where the minimum standard score was 70; if the students got score greater than 70 (>70), it was given a score 1, while other was 0.

The students' health (SH) variable was measured by physical, mental, social, and economic aspects covered by 20 items of questions (Ickovics et al., 2014; Nurcahyo, 2008; O'Connor et al., 2019). Quality of the school (QS) was measured by school context, teachers, and classroom, which consisted of 24 questions (Bacolod & Tobias, 2006; Deming et al., 2014; Gustini & Mauly, 2019; Lucas & Mbiti, 2014; Miarso, 2008; Pemerintah-DPR, 2005). The assessment of socioeconomic status (SES) was represented by 22 items of questions synthesized from (Caldas & Bankston, 1997; Liu et al., 2020; OECD, 2020; Syafi'i et al., 2018; White et al., 1993; Zhao et al., 2012) indicated by parents' monthly allowance, parents' education, profession, and family's facilities to support students' learning. Likerts' scale was used to assess these three variables, ranging from 1 to 5 (strongly disagree to strongly agree).

Meanwhile, the control variable used was the gender (G) variable measured with a dummy (Hauspie et al., 2023; Khusaini & Mulya, 2021), if female = 1, and others = 0. Age (G) was the number of ages calculated from the year of birth to the present which reflected maturity of thinking

and acting (Fang et al., 2020; Reyes et al., 2023). Researchers proxied age using an ordinal scale, namely 1 = age 14 years, 2 = age 15 years, 3 = age 16 years, 4 = age 17 years, 5 = age 18 years, 6 = age 19 years. Another control variable was ethnicity (E) which is measured with a dummy (Elish et al., 2022), if Java = 1, others = 0. Researchers also included a religion (R) variable which was measured with a dummy (Sumi, Mondal, Jahan, Seddeque, & Hossain, 2022), Islam = 1, others = 0. Distance (D) was the length in kilometers from the student's house to school (Damm, Mattana, & Nielsen, 2022). This variable is measured on an ordinal scale, namely if the distance was < 1.50 km = 1, 1.50-3.49 km = 2, 3.50 – 4.49 km = 3, and >= 5 km = 4. Specialization was a type of specialization program (PROG) offered by the school, namely the science social and natural sciences program (Jung, 2022). Mathematics scores (MATH) were mathematics subject scores obtained by students from test results at previous schools (Finch & Finch, 2022; Jin, Ma, & Jiao, 2022), which were measured using a ratio scale. The final control variable is the English score (ENG) variable, namely the score obtained from the test results (Jin et al., 2022), which is measured using a ratio scale.

The validity test of research instrument obtained an an r table value of 0.1946 with a significance level of 5% (2.5% two tailed) with n = 101 and df = 101 – 2 = 99, then the 65 question items (school quality = 24 items, SES = 21 items, students' health = 19 items) generate r_{-count} = 0.227 – 0.702 > 0.1946, it concluded that the three variables were valid. While the results of the reliability test and Cronbachs' Alpha resulted a coefficient value of 0.700 – 0.721 > 0.600, then, the research instrument was reliable with high reliability criteria (Guilford, 1957). Additionally, it could be concluded that all items in the questionnaire were valid and reliable.

Data Analysis

The authors have examined the factors affecting students' academic achievement by the probit regression model. The previous researchers have examined the factors affecting students' academic achievement utilizing a multiple linear regression (Caldas & Bankston, 1997; White et al., 1993), covariance analysis (von Stumm et al., 2021), binary logistic regression (Ickovics et al., 2014), structural equation modelling (Guo, 2016; Trautwein et al., 2012), descriptive qualitative (Gustini & Mauly, 2019; Syafi'i et al., 2018), iterative generalized least square (Yuxiao & Chao, 2017; Zhao et al., 2012), two stage least square (Deming et al., 2014), polynomial regression (Lucas & Mbiti, 2014), and semi-partial correlation (Madigan, 2019). From these analyzing models, the authors employed a model closest to the logistic regression model (Ickovics et al., 2014), namely probit regression. This model is one of the models with a binary dependent variable and develops from the regression logit model. The binary dependent variable is one example of a limited dependent variable or response variable (Wooldridge, 2018). Chester Blis first introduced this model in the 1930s with the term *probability unit.* A probit model is also known as the normit model or Normal Equivalent Deviate (*NED*). Furthermore, the probit model is developed based on *Utility Theory* or *Rational Choice Theory* (McFadden, 1982).

To examine the effect of the independent variable (*Xi*) and control variable (*Zi*) on the dependent variable (*Y*), we follow and adapt the produced function of the students' outcomes from (*Y*), it could be written as:

$$P_i = P(K = 1|X) = f_{pf}(Xi, Zi) \qquad (1)$$

The pf refers to students' perception, Xi is the main independent variables are quality of

school (QS), socioeconomic status (SES), and students' health (SH). Zi is a control variable covering gender (G), age (A), science program (PROG), distance (D), religion of Islam (R), Javanese ethnicity (E), math score in junior high school (MATH), and English score (ENG).

One of the advantages of using this model was the presence of normality assumption and multicollinearity classic assumptions assessments. The classic assumption test was no longer needed in this model, as was the presence of a weighting value for the research variable, as well as the improvement of the previous model, such as the Logit model. Meanwhile, the weakness of this model was the inefficiency of the estimation result when the data was derived from a small sample, it did not utilize the analysis requirements of the goodness model; and the effect of the predictor variables was probability. Hypothesis testing was carried out in several stages, namely simultaneous testing with the Likelihood Ratio test and partial testing by the Wald test. In addition, the researchers validated the model with the Hosmer-Lemeshow goodness-of-fit test, Sensitivity and Specification test, and Pseudo R^2.

■ RESULT AND DISCUSSION
Cross-tab analysis of academic achievement based on education, income, and parental employment

Cross tabulation analysis is used to describe students' academic achievement considering the parents' income, education, and occupation. This analysis is to identify the relationship between academic achievement with the level of income, education, and occupation of parents. We set the criteria for the relationship between these variables if the value of sig. < 0.05, then there is a significant correlation between these variables. The finding of the cross tabulation are presented in Table 2:

Table 2. Results of crosstab analysis

Variables	Less	Good	Pearson chi-square	Sig.
Parents' Education				
- Primary	6.3%	11.4%	4.197	.123
- Secondary	18.14%	21.4%		
- University	14.8%	27.7%		
Parent' income				
- Low	10.2%	17.2%	0.977	.613
- Middle	23.5%	32.8%		
- High	5.7%	10.5%		
Parent' occupation				
- Civil servant	7.5%	10.2%	1.715	.634
- Army/Police	15.4%	22.6%		
- Entrepreneur	10.5%	15.1%		
- Others	6.0%	12.7%		

Table 2 explains that the criteria for academic achievement are poor and good. The results of the cross tabulation test showed that the statistical value of Pearson Chi-Square = 0.977 – 4.197 and the value of sig. = 0.123 - 0.634 > 0.05. Thus, it can be said that there is no significant correlation between parents' income level, education level, and type of work with the achievement of students' academic achievement in public high schools in Tangerang Municipality.

The descriptive data analysis explained the number of respondents (332 samples) by formulating the mean [M] and standard deviation [SD] from each variable. Based on Table 3, the academic achievement (AA) could be interpreted as the students who acquired the lowest score in the year-end assessment obtained an average of 80.51, and the score >=70 was 73.8%. Therefore, 245 students were considered to be academically successful because their scores exceeded the standard. The school quality variable (QS) indicated a rate of school quality of 81.76%, which is categorized as moderate.

Table 3. Statistical description

Variables, n=332	Mean	Std. Dev.	Max.	Min.
AA	80.51	5.68	94.00	51.00
PROBIT_AA	0.74	0.44	1	0
QS	95.84	11.42	120	62
SSE	72.67	10.09	94	49
SH	71.19	9.74	100	45
A	3.03	0.82	6	1
G	0.60	0.40	1	0
E	0.39	0.49	1	0
R	0.96	0.19	1	0
D	3.14	1.03	4	1
PROG	0.48	0.50	1	0
MATH	79.91	6.34	93	56
ENG	78.94	9.69	98	34

Table 3 also explained that parents' socioeconomic status (SES) gained in the moderate category (78.9%). The variable of students' health (SH) meant that the students' health was in good condition, with a score of 72.9%. The percentage of the female respondents was 64.46% or 213 students, with an average age (A) of 16.03 years old. Furthermore, the chosen program (PROG) variable could be interpreted that there were 48.19% students of the entire sample who chose the science program. The distance of the school from the student's domicile (D) was 3.14 km. The variable of Islamic religion (R) could be interpreted that 96.08% of the samples were Muslim. The Javanese ethnicity variable (E) meant that the 38.55% were students Javanese. The mean and standard deviation of math score at junior high school (MATH) could be interpreted that the average score of math exceeded the standard criteria, i.e., 70 with small variance. The average English score is 78.94 with a relatively high standard deviation. This means that there is still a gap in students' English skills.

In using the regression probit model, it is necessary to consider the data normality test, the multicollinearity test, and the goodness of fit model. Whereas, the requirement of using a nonlinear model with a response variable was not as rigid as a linear regression model, which was necessary to fulfill the classic assumption test. Normality tests were imposed on certain variables, such as the student's academic achievement, school quality, parents' socioeconomic status, the student's health, and gender. The normality test results using Shapiro-Wilk showed that the academic achievement variable obtained a significance > 0.05. Therefore it could be stated that the data was in the normal

distribution. Additionally, the result of the multicollinearity test by correlating among independent variables gained the correlation value of all variables r < 0.80. It could be concluded that the models were freed from multicollinearity problems.

The goodness-of-fit test was intended to examine whether there were significant differences between the observation's result and the possibility prediction model result in terms of the test. The goodness of fit employed the Pseudo-R^2 value, the Hosmer-Lemeshow goodness-of-fit (gof), and the sensitivity/specificity test. The estimation result of the Pseudo-R^2 was 0.3942, which meant this model represented the rate of academic achievement at 39.42%. Furthermore, the authors conducted the Hosmer-Lemeshow goodness-of-fit test. The testing criteria are that if the probability Hosmer-Lemeshow goodness of fit test > 0.05, the probit regression model can be employed. The following table contains the results of the goodness-of-fit test, namely:

Table 4. Goodness-of-fit test results

Hosmer-Lemeshow chi-square	Group	Prob > chi-saquare
13.04	10	0.1107

Based on table 4 above, it showed that the result of the calculation of Hosmer-Lemeshow Chi-square statistics value = 13.04, refering to the number of group = 10, and probability alpha value = 0.1107 > 0.05. This means that the probit model was relevant to the research data. In having the complementary of goodness-of-fit test, the authors employed the sensitivity and specificity tests as showed by the following table:

Table 5. The results of sensitivity and specificity test of goodness-of-fit

Variables	Pr(+/-)	Results
Sensitivity	Pr(+|~D)	93.47%
Specificity	Pr(-|~D)	58.62%
Correctly classified		84.34%

Table 5 highlights the sensitivity value in gathering the success occurrence of academic achievement obtained 93.47%. Specification value or accurateness model in interpreting the failure occurrence of academic achievement was valid. The total observation rate of the failure occurrence was 58.62%. Meanwhile, the correctly classified value described the entire accuracy model in identifying the success occurrence (the improvement of academic achievement) as the success occurrence and identifying the failure occurrence (unimproved students' achievement) as failure occurrence values 84.34%. These findings inferred that there was suitability between model and data employed in this research.

The result of the estimation probit regression was used to test the hypothesis using the Wald test statistic. The test criteria; if a significant value (prob >|z|) < 0.05, therefore, partially, the independent variable affected the dependent variables. The Wald test can be seen in Table 6 as follows:

The table 6 above, the probit model, illustrated the coefficient value of school' quality, it was 0.044 positive and significant alpha value = 0.000 <0.01. In other words, school' quality contributes positively to improving the academic

Table 6. The regression and marginal effect results

Variables	Coefficient	Std. error	dy/dx	P>z
qs	0.044	0.009	0.010	0.000
sse	0.025	0.011	0.006	0.021
sh	0.044	0.012	0.010	0.000
g	0.292	0.199	0.068	0.142
prog	0.004	0.200	0.001	0.985
a	0.009	0.117	0.002	0.939
d	-0.004	0.096	-0.001	0.969
r	-0.349	0.647	-0.081	0.590
e	-0.069	0.200	-0.016	0.729
mat_js	0.075	0.018	0.017	0.000
eng	0.025	0.011	0.006	0.027
Cons.	-15.969	2.024		0.000
Obs	332			
Pseudo R^2	0.3942			
LR $ch^2(10)$	150.57			
Prob > ch^2	0.000			

achievement of high school students in Tangerang with a significance level of 1%, ceteris paribus. The coefficient value of socioeconomic status variable was 0.025 positive and significant alpha value 0.021 < 0.05. In other words, parents' socioeconomic status contributes positively to improving the academic achievement of high school students in Tangerang with a significance level of 5%, ceteris paribus. The estimation model produced the coefficient value of students' heath variable of 0.043 positive and significant alpha value = 0.000 < 0.01. The research results show that student health variables make a positive contribution to increasing the academic achievement of high school students in Tangerang with a significance level of 1%. Meanwhile, control variable, the math' score and junior high schools' English score, significantly contributed to students' high school academic achievement. It differed in the control variables; gender, science program, age, Islam, and ethnicity were not significant.

The first analysis investigated the calculation of marginal effect to interpret the probit model. Based on the hypothesis test, this result significantly revealed 5 (five) variables; school' quality, socioeconomic status, the students' health, junior high school math' score, and English score. The marginal effect values would be counted and investigated. Meanwhile, insignificant variable was not included on the total accumulation of dependent variable marginal effect calculation toward the independent variable. The data score described; the average score of school' quality was 95.84, socioeconomic status was 72.67, the students' health was 71.19, junior high school math' score was 79.91, and English score was 78.94. Then, it would be multiplied by their coefficients. The result of total marginal effect was 1.199 and z statistic was 0.8830. In investigating how much the total marginal effect, the probability data was calculated p = 1-0.8830 = 0.1170. It can be inferred the rate senior high school students' opportunity to attain their academic achievement was 11.70%, determined by school quality, socioeconomic status, the students' health, junior high school math' score, and English score.

In table 6, the result of marginal effect calculation was interpreted. It deciphered if the average value of school quality was 1 per-unit,

the rate of students' probability to improve their academic achievement was 0.017 times or 0.01%. It described the higher quality of school the greater contribution of students' chance to improve their academic achievement. The rate of parents' socioeconomic status improvement was 1% meant 0.005 times or 2.22%. Thus, the result was interpreted the higher value of parents' SES, encouraged the students' opportunity to attain higher academic achievement. In addition, the rate of students' health was 1%, indicated the rate of students' opportunity to improve their academic performance increased 0.10 times (0.01%) higher. It revealed the healthier of students' condition encouraged students' chance for better academic achievement. Moreover, the findings of gender variable, positive coefficient and probability marginal effect value by 0.06, illustrated insignificant statistics. Consequently, it implied that students' gender did not influence students' academic achievement. Both male and female have the equal opportunities to attain academic performance.

The Impact of School Quality on Academic Achievement

Students' academic achievement exceeded standard score of 70; the average students' score was 80.51, but the rate of achievement level was 73.8%. The standard of academic achievement, measured by the final result of the year-end assessment, was the students' score of 75%. It implied that the achievement' gap was 1.2%. The gaps occurred because each school established a different minimum standard of achievement and determining variables. Higher of students' academic achievement reflects better students' cognitive performance (Steinmayr, Crede, McElvany, & Wirthwein, 2016). Students' academic achievement reflected school quality; if there were differences students' academic achievement occurred, it would manifest the variant of school' quality (von Stumm et al.,

2021). Hence, these results were employed by school to intervene the students in improving their academic achievement.

These findings contributed to teachers' feedback in following up on the learning outcomes as well as diagnosing the strengths and weaknesses of students' capabilities. Assessment is used not only to find out students' requirements for attaining their completeness of learning but also to identify their strengths and weaknesses in mastering knowledge and competence in teaching and learning process (diagnostic). Therefore, it is important to give feedback to students. The assessment' results might be employed to improve the quality of learning. The completeness of learning and cognitive aspects, as determined by the institution or school, refers to considering the passing standard of the national exam score set by the government (Kemendikbud, 2016).

This result has further strengthened the hypothesis and probit regression that the schools' quality significantly influenced students' academic achievement at Tangerang. Significance levels were set at 1%. The higher rate of school' quality encouraged students' opportunity to obtain better academic achievement (H1 is accepted). A quality school provides good educational services, a good reputation or school ranking, adequate school resources, and competent teachers. For this reason, a quality school supports the changing and developing students cognitive performance. The results were in good agreement and consistent with previous findings by Deming et al. (2014) and Khusaini & Mulya (2021) which pointed out that the school quality not only improves the grades but also encourages students' prosperity. In addition, it is important for stakeholders to always maintain and preserve the quality of school because it creates good academic achievement for students (Fuadi, 2020).

In contrast to earlier findings by Lucas & Mbiti (2014) that school' quality defined as reference and consideration in choosing the best

school rather than in creating students' academic achievement. Moreover, supported by Brown et al. (2016), it explained the quality of learning does not contribute to enhance students' score. The contradiction between the current and previous research finding was found. This research has not confirmed previous research on the usage of schools' quality variable construction investigated by previous researchers. Although the research employed 3 indicators, it represented 8 national education standards to measure schools' quality in Indonesia.

The quality of a schools describes the fulfillment of the minimum national education standards. The assessment components arranged by the government, the eight national standards, was employed in measuring schools' quality. Those standards were also used as a sub-indicator in constructing schools' quality variable in this research. Generally, high schools in Tangerang exceeded the average schools' quality score, which is set by the government. In 2018, the mapping result for school quality was 5.51 (Kemendikbud, 2019). This rate is higher than the average of school quality rate for senior high schools in some regions of Banten Province. The lower scores were founded on the availability of standard facilities and infrastructure, as well as educators and education staff. These findings showed, the lack of teachers' quality was perceived by students in accordance with students' insufficient scores. However, schools' infrastructure was perceived as sufficient. Hence, schools at Tangerang Municipality should consider their teachers' competence. As explained previously, teachers play an important role in interacting with students either directly or indirectly. The higher teachers' quality affected students' academic achievement.

The Impact of Socioeconomic Status on Academic Achievement

The significant correlation obtained between parents' socioeconomic status and senior high students' academic achievement at Tangerang. The current findings confirmed the formulated hypotheses testing' result in the previous findings, the higher of parents' SES, supported students to improve better academic achievement (H2 is accepted). The higher parents' SES was described based on the level parents' educational background and parents' monthly income (IDR 5.989.038.35), type of work, and the availability of resources in choosing the best quality of public or private school that can support the improvement in academic achievement (Liu et al., 2020). In board, it is believed that students, with parents' SES in the medium to higher level, find easier ways in acquiring good learning environment at home. It is caused the availability of learning facilities provided. These results substantiate previous research findings in the literature (Boman, 2023; Chevalère et al., 2023; Erdem & Kaya, 2023; Liu et al., 2022; Sentosa, 2023; Zhao et al., 2023).

Nevertheless, a few studies, in contrast with what was previously thought, found the socioeconomic status insignificantly contributed in changing students' cognitive abilities (Simamora et al., 2020). Students, from prosperous families, tend to be inattentive to learning. It affects their low academic achievement (Suardi, 2018). However, students with lower socioeconomic status, perform better academically. Students at the lower level have higher motivation for learning to attain academic achievement. These findings have a number of similarities with previous research, while the different findings occurred in employing the SES standard. It was caused by the weakness correlation of both variables (Sirin, 2005).

Although this research findings corroborated the previous research about parents' socioeconomic status contributes to improving students' academic achievement in the senior high school at Tangerang, there were the weaknesses in the research population employed. As stated, the research population investigated

only the students in public senior high school and ignored the students in private school. Moreover, the measurement of SES was simpler than the previous research with similar findings (Liu et al., 2020). These findings appear to be well substantiated by the governments' effort to create the policies for improving family income, especially for lower-income families. The policy intended was to provide a higher allocation budget for underprivileged students from lower economic conditions. It built the educational equality. As a result, the policy facilitates access for students in the lower SES, as explained that SES strongly influences toward students' academic performance.

The Impact of Student Health on Academic Achievement

Students' academic achievement was significantly confirmed to influence the students' health factors (H3 is accepted). It can be interpreted that students' health, mentally, physically, socially, and economically, has the opportunity to improve students' academic achievement. The lack of nutrition for students also contributed to the students' problems in the learning process in the classroom. Consequently, the learning result was not optimal. The lack of nutrition made students lack of focus in learning, trigger parasitic infections, find problems in hearing and sighting, and encourage not ideal weight and height. There is strong agreement between these research findings and previous research. Good students' health strongly contributed to increasing their academic achievement (Glewwe & Miguel, 2008). Glewwe & Miguel (2008) stated that mental health is needed to prepare and support students in achieving optimal learning result. The students with mentally unhealthy is indicated by lack of motivation and enthusiasm for learning, lethargy, sadness, and stress. Consequently, it affects their learning outcomes.

Irrelevant of environmental demands and actual resources possessed by students, this burdened students with facing various pressures and school demands. It encouraged students' mental illnesses, such as academic stress in learning. In board, the level of students' stress vulnerability occurred in the physical and psychological development phase. As a result, it influenced learning outcomes and students' thinking skills (Bharadwaj et al., 2013; Eitland & Allen, 2019; Evans et al., 2019). Even students will experience failures in improving their academic achievement, such as inappropriate assignments for students' capacity, having problems with friends, and feeling bored with the subject matter. Higher academic stress, depression, anxiety, and suicidal ideation are significant problems for students in middle school; therefore, good mental health is needed (Anderman, 2002). Thus, it is important for students to always maintain their health or have a healthy lifestyle (Bradley & Greene, 2013) by managing their time sufficiently (Stea et al., 2014).

These findings also confirmed the research conducted by Ickovics et al. (2014) which concluded that students' health plays an important role in improving students' academic achievement. As well as the research findings conducted by O'Connor et al. (2019), the researchers employed the mental health variable as a positive and significant predictor variable to predict academic achievement. Even though the contribution was small, these findings illustrated the explicit overview that the health variable is important in contributing to the improvement of students' academic achievement.

Despite the research investigated pure cross-sectional, the analysis unit processed was wider. It means the subjects of the research were not only focused on one school. It created generalizations about the research results easier. On the other hand, this research was not as remarkable as the previous research. The

previous research employed three time periods in investigating the relations between the students' health variables and academic achievement (O'Connor et al., 2019). In ensuring the students' health, it is not sufficient to merely provide medical facilities at home; they are also needed at school (Trisanti, Almuzani, & Suhartini, 2019). It will be useful for schools to prepare first aid to avoid students' health problems.

Research limitations

In investigating the research, some obstacles were founded by the researchers during the research process. There was the usage of research variables, samples, sampling' strategies, instruments of uncontrolled variables, and others for internal as well as external validity. Particularly, the usage of core variables directly promoted the changing students' academic achievement in the process of teaching and learning; methods of teaching and delivering the materials were not investigated in the research. Meanwhile, methods of learning have a strong correlation in promoting students' academic achievement (Schneider & Preckel, 2017). The researchers realize that the target research population focused on analyzing senior high school students at public schools, so they ignored the students at private schools. Consequently, for further research, it is possible to analyze students at private schools to gather wider data and information because the researcher can explore the data through a comparison process between public and private schools.

Although the usage of variable indicators in SES is simpler than in previous research, then, future work will concentrate on investigating SES indexes and parents' positions in the community as the additional to construct a wider variable. Furthermore, it can be useful to employ longitudinal survey data to seize the development of variables and complete the current research. The researchers explore in depth the factors that influenced students' academic achievements at Tangerang. The use of personal variables such as gender (an insignificant result) and age (a significant result) are the control variables. Meanwhile, the main variables—schools' quality, parents' SES, and students' health—seem to simplify the analysis because they ignore other important variables that contribute to the changes in students' academic achievements. Other important variables are the method of teaching, previous academic achievement, self-confidence, and academic intelligence (Liu et al., 2020).

■ **CONCLUSION**

In conclusion, the researchers infer schools' quality contributes positively and meaningfully in promoting students' high school academic achievement in Tangerang municipality. This result is obtained, after investigating schools' quality, parents' socioeconomic status, students' health and control variables in students' academic achievement by using *probit* regression model. The higher schools' quality means the larger probability of students to improve their academic achievement. Furthermore, Parents' SES positively and meaningfully contributed in changing students' high school academic achievement in Tangerang. The higher of parents' SES encourage the larger of probability students to attain their academic achievement. Meanwhile, students' health is measured to mental, physical, social and economic health significant contributed in promoting students' academic achievement. It means, the result of research confirmed that students' health was the important variable to decrease learning problem. The students can improve their academic achievement larger.

The school' quality significantly influenced students' academic achievement. It can be indicated the implication of school' awareness in improving educations' quality; improve school' service optimally by providing learning, administrative and others service to students.

Quality of school becomes an enticements and references for parents in selecting the best school to manifest their expectation in improving academic achievements better for their students. Regarding to parents' SES, these findings implicated parents' contribution in providing resources to support teaching and learning activity at home. Parents, not only providing the household needs but also the educational needs at home, support educational facilitation to their children. Besides, the result provided the useful overview for parents and students about the importance of health awareness to support their learning achievement. If the health condition is not maintained properly, it will encourage some problems in learning process as well as problems in attaining better academic achievement.

Schools are supposedly maintained their quality consistently, by providing and complementing school' resources, replacing the damaged resources, improving teachers' training to enhance teacher' knowledge and competence, as they were found to be significantly correlated to academic achievement. The authors suggest the government to provide more resources and learning opportunities not only in the school but also in the public area (e.g. literacy program, library, museums, and free language training). The government needs to facilitate underprivileged students in the lower parents' SES in experiencing the resources and improving educational equity in the future. Finally, the authors suggest parents and school to periodically or incidentally control the students' health i.e. physical, mental, social and economic aspect. As explained that they have important role in promoting students' academic achievements.

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