

A Multilevel Analysis of Factors Influencing Bullying Victimization at School among Indonesian Students with Binary Outcome

Zalfa Jihan Luthfi¹, Kismiantini¹

¹ Statistics Study Program, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

Abstract:

Bullying is an aggressive act toward someone who cannot defend themselves. Students who experience bullying victimization are treated badly by their friends, such as by being teased, ostracized, or kicked. Therefore, this study aims to determine the influencing factors of students being bullied among Indonesian students. The data used is secondary data from the 2022 Program for International Student Assessment (PISA) for Indonesia, with a sample comprised of 11,479 students from 403 schools. Data analysis uses a multilevel model with a binary response because the data is hierarchically structured, and the response variable is binary. The results show that male students, who have missed school, are late for school, repeat a grade, have low grade levels, low teacher support, low discipline, rural schools, and those with small class sizes will have a higher chance of experiencing bullying victimization more often. Overall, this study helps explain the influencing factors of students being bullied so that these factors can be given more attention to improving school policies.

Keywords: Bullying Victimization, Students, Binary Multilevel Model

1. Introduction

Bullying has become one of the most worrying issues, both in the home, in the community, and in school. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) reaffirms that violence and conflict in schools are a major problem for the world [39]. Nationally representative data on bullying from the Global School Health Survey (GSHS) in 2015 showed that about 20% of Indonesian children from grades 7 to 12 reported being bullied in the last month [45]. According to the results of the Programme for International Student Assessment (PISA) survey in 2018, Indonesia is placed sixth out of 78 countries in terms of the percentage of students who report being bullied many times a month (41.1%) [25]. Then, the result of the Programme for International Student Assessment (PISA) survey in 2022 reported that 10.5% of Indonesian students were bullied at least a few times a month [26].

Bullying is an intentional and repetitive act of aggression directed towards someone unable to protect themselves due to an imbalance of power [21]. Common forms of bullying include verbal aggression (insulting or mocking), physical aggression (kicking or causing harm), relational aggression (excluding friends), and cyberbullying. Victims of bullying will face various consequences so this is an important issue for the educational community. Students who have been bullied may also have low academic achievement, social integration problems such as poor classmate relationships, a lack of school belonging, and feelings of loneliness [44]. Being bullied can be caused by several individual factors, such as age, gender, alcohol, smoking, loneliness, grade repetition, and teacher support [18],[45],[48]. Then, other factors, such as the school level where the individual is gathered in a group cannot be ignored as they will lead to a misinterpretation of the relationship between variables in a model [9]. Data that is collected by an individual nested in a group is referred to as hierarchically structured data, or data whose lower-level units are nested within a higher-level unit. When data has a hierarchical structure, ordinary linear regression is not suitable

because it only accommodates variations between individuals [24]. Data with a hierarchical structure is not suitable for analysis using ordinary regression models or single-level analysis because individuals in a group may be more similar to each other so treating individuals as if they are separate from their social group creates potential bias [9]. To solve problems with hierarchically structured data, multilevel models can be applied because this model allows learning effects of variation between individuals and groups.

Using multilevel analysis found that the intra-class correlation (ICC) for high school students in New Zealand who experienced bullying victimization was 0.07, which means that 7% of the variance was caused by differences between schools [6]. Additionally, younger students, male students, and students from families with high levels of socio-economic deprivation are more likely to suffer bullying. Besides, women's special schools report fewer students being bullied compared to students in male special schools. Another study also found results that student-level factors such as gender, grade repeat, truancy, lateness, socioeconomic status, teacher support, and parental support, as well as school-level factors such as the disciplined atmosphere in schools and the competitive atmosphere between students significantly influence the bullying victimization by school students in four provinces and cities in mainland China [42]. In another study in Indonesia, researchers found two studies regarding factors that influence bullying victimization among Indonesian students using hierarchically structured data. Using a multilevel model, found that the intra-class correlation (ICC) of the prevalence of bullying victimization among Indonesian students was 0.18, which means that 18% of the variance was caused by differences between schools [14]. The results of the study show that a sense of belonging at the student level and school level influences the prevalence of bullying experiences among students. Regarding the influence of social norms on bullying in Indonesia using multilevel analysis found that negative behavior that is considered normative by students will increase student involvement in bullying, both as perpetrators and as victims [46].

Based on several studies, it can be said that a few studies are exploring the influencing factors of students being bullied in Indonesia using hierarchically structured data. For this reason, this study aims to examine factors at the student level and school level that affect bullying victimization in Indonesian students using a multilevel approach with binary responses. A binary response approach will be used in this study because the dependent variable or response of bullying victimization is made in binary form (not often or often).

2. Materials and Method

2.1 Data

This study uses data from the Programme for International Student Assessment in 2022 for the country of Indonesia. The Programme for International Student Assessment (PISA) is a survey organized by the OECD to assess the extent to which students have acquired knowledge and skills. The PISA target sample is a 15-year-old student, and a two-stage sampling procedure is used. PISA 2022 for the country of Indonesia was followed by 13,439 students from 410 schools. Out of the total population, this study used a sample of 11,479 students from 403 schools who provided complete answers to each variable used in this study.

2.2 Measures

The variable of bullying victimization was measured from a student questionnaire on students' exposures to school bullying with 4 scales of answers ("never or almost never", "a few times a year", "a few times a month", and "once a week or more"). This variable is constructed from 9 question items, such as "Other students left me out of things on purpose", "Other students made fun of me", and "I was threatened by other students". The scale showed good levels of reliability with a Cronbach's alpha score of 0.761. Following the cutoff point on bullying experiences of "two or three times a month" as a reasonable and useful bottom line by previous studies [18],[36] the bullying victimization was made into category variables (not often or often). If each question is answered with "never or almost never" or "a few times a year", and coded as 0

(not often). If it answered with "a few times a month" or "once a week or more", then coded to 1 (often).

In PISA 2022, students were asked, "Are you a female or a male?" and then made a gender variable dichotomy with 0 = female and 1 = male. Truancy was obtained from the SKIPPING variable that was measured from student questionnaires of students' truancy all day long and several classes' truancy. Truant behavior was categorized into never and ever missing all day or several classes. Lateness was derived from a TARDYSD variable about student lateness. In this study, lateness was categorized as never and ever too late if students chose answers "one or twice" or "three or more times". Grade repetition is obtained from a REPEAT variable that measures how often students have ever repeated grades at ISCED level 1, ISCED level 2, and ISCED level 3. REPEAT with category never repeat a grade if the student chooses "No, never" on the three question items, and the category has ever repeated a grade at least once if the students choose "Yes, once" or "Yes, twice or more" on at least one of the three question items. The grade levels variable contains the grade levels of students from 7 to 12.

Teacher support is obtained from the TEACHSUP index in PISA 2022 measured from four question items (e.g. "The teacher shows an interest in every student's learning" or "The teacher gives extra help when students need it"). Family support was obtained from a FAMSUP index in PISA 2022 about how often parents or other family members do something that indicates family support (e.g. "Discuss how well your performance is at school", "Eat your main meal with you", or "Spend time only talking to you"). Socio-economic status was derived from the variable of the ESCS index. ESCS is calculated by giving the same weight to the three indicators (PAREDINT, HISEI, and, HOMEPOS). Student discipline behavior is obtained from the discipline index (DISCLIM) which is created based on students' answers about how often certain things happen in their class (e.g. "Students don't listen to what the teacher says" and "There is noise and chaos"). The final TEACHSUP, FAMSUP, ESCS, and DISCLIM variable is standardized with an average of zero and a standard deviation of one across OECD countries. A positive value on the index means that the student reports better than the average student in OECD countries

Education type is obtained from the ISCEDP. Based on information from the ISCEDP, the student educational type variable was categorized into two categories, namely general and vocational. The general category includes students at the junior and senior high school levels, while the vocational category consists of students at the vocational school level. School location, school types, and class size were measured from a school questionnaire. The school locations are categorized as rural or urban schools. Based on previous studies [16],[42],[44] the classification is rural if the population is less than 100,000 people and urban if the population is more than 100,000 people. School types are categorized as public or private schools. The class size contains the average grade of the math class size, from 13 to the lowest to 53 to the highest.

The response variable in this study is the student's bullying victimization with a binary scale (not often or often). Predictor variables at level 1 (student level) are gender, truancy, lateness, grade repetition, grade, teacher support, family support, socio-economic status, student disciplinary behaviors, and student education types, while predictor variables at level 2 (school level) are school location, school type, and class size.

2.3 Statistical analysis

The analysis started with descriptive statistics and conducting independent tests for categorical variables. As the data has two levels and the response variable is binary, so a multilevel model with binary responses needs to be used to accommodate these two levels. A multilevel model with a binary response variable uses a link logit function. A multilevel approach with binary responses to students' experiences of bullying is a suitable framework for accounting for multiple levels of variation so that the impact of explanatory variables at the student and school levels can be tested. Analyses were performed in the R statistical program [28], using the *glmer* function in the *lme4* package [4] to test the multilevel model. The binary multilevel model can be written as follows [29].

$$\eta_{ij} = \ln\left(\frac{\pi_{ij}}{1 - \pi_{ij}}\right) = \beta_{0j} + \sum_{q=1}^q \beta_{qj} X_{qij} + \varepsilon_{ij} \quad (1)$$

$$\beta_{qj} = \gamma_{q0} + \sum_{s=1}^{s_q} \gamma_{qs} W_{sj} + u_{qj} \quad (2)$$

Equation (1) is a level 1 model and Equation (2) is a level 2 model. η_{ij} is binary outcomes variable of the i th individual within j th group, π_{ij} the probability of success of the i th individual within j th group, β_{0j} is intercept at level 1, β_{qj} is q th coefficient at level 1, X_{qij} is q th predictor on level 1, ε_{ij} is the random effect at level 1 with $\varepsilon_{ij} \sim \text{logistic}(0, \pi^2/3)$, γ_{q0} is intercept or log odds between groups, γ_{qs} is s th coefficient at level 2, W_{sj} is s th predictor on level 2, u_{qj} is level 2 random effect with $u_{qj} \sim N(0, \tau_{00})$ [29]. In this study, three models were built, a null model, a random intercept model with student-level variables, and a random intercept model with student and school-level variables. The Intraclass Correlation (ICC) and Design Effect (DE) calculations were carried out to determine the proportion of variance produced and used to measure independent effects and violations in standard error estimates. The formulas used to calculate ICC and DE are respectively as follows.

$$\rho = (\tau_{00}^2) / (\tau_{00}^2 + \sigma^2) \quad (3)$$

$$DE = 1 + (n_c - 1)\rho \quad (4)$$

where τ_{00}^2 is the variance at level 2 and σ^2 is the variance at level 1. For the logistic model, the standard logistic distribution variance of $\pi^2/3$ or 3.289 can be used as an estimate of the variance at level 1 [9],[11],[29]. Then, n_c is the average number of individuals in each group. If the ICC is greater than 5%, it indicates that a multilevel model needs to be used [10]. Meanwhile, if DE is greater than 2, it indicates that there is an independent violation of the estimated standard error, so multilevel analysis is needed [37].

For each model, the coefficient of determination is also calculated. In a multilevel analysis with binary responses, the coefficient of determination (R^2) can be calculated by marginal R^2 and conditional R^2 [22]. The likelihood ratio test is used to compare the best model between the three models. After obtaining the best model, the contribution of each predictor in the model is tested with Wald statistics. The interpretation of each predictor variable in the best model uses the odds ratio. The odds ratio is the probability that an event (response variable) will occur under specific conditions (predictor variable) [12].

Results

3.1 Descriptive Statistics

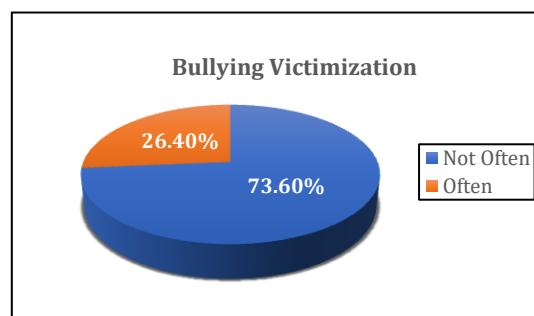


Figure 1: Percentage of bullying victimization

From the overall sample of 11,479 students in Indonesia, Figure 1 shows that 3,030, or 26.40%, of the

students are bullied frequently. Meanwhile, 8,449, or 73.60% of the students, were not frequently bullied. This indicates that while a sizable portion of Indonesian students are frequently bullied, the majority of Indonesian students are not.

Table 1: Statistics Descriptive

Variable	Bullying victimization		Total	Chi-Square (p-value)
	Not often	Often		
Gender %				
Female	76.42	23.58	51.43	49.417(0.000)**
Male	70.62	29.38	48.47	
Truancy %				
Never	76.56	23.44	80.28	209.360(0.000)**
Ever	61.57	38.43	19.72	
Lateness %				
Never	76.88	23.12	61.76	101.930(0.000)**
Ever	68.31	31.69	38.24	
Grade repetition %				
Never	74.60	25.40	91.22	61.045(0.000)**
Ever	63.19	36.19	8.78	
Education type %				
General	72.82	27.18	77.12	12.070(0.001)**
Vocational	76.25	23.75	22.88	
School location %				
Rural	71.87	28.13	72.71	47.172(0.000)**
Urban	78.23	21.77	27.29	
School type %				
Public	73.99	26.01	66.12	1.679(0.195)
Private	72.55	27.15	33.88	
Grade, mean (SD)	10 (0.633)	10 (0.670)	10 (0.650)	
Teacher support, mean (SD)	0.139 (1.017)	-0.004 (1.019)	0.100 (1.020)	
Family support, mean (SD)	-0.252 (1.115)	-0.340 (1.092)	-0.280 (1.110)	
Socio-economic status, mean (SD)	-1.416 (1.048)	-1.420 (1.058)	-1.420 (1.050)	
Student discipline behavior, mean (SD)	0.159 (0.964)	-0.155 (0.886)	0.080 (0.950)	
Class size, mean (SD)	33 (9.462)	33 (9.452)	33 (9.470)	

* $p < 0.05$

** $p < 0.01$

Table 1, based on the result of the chi-square test for categorical variables shows that gender, truancy behavior, lateness behavior, grade repetition, education type, and school location have a significant difference ($p < 0.05$). Male students had a higher percentage (29.38%) of being bullied than females. Truant students have a higher percentage (38.43%) of being bullied than students who have never been

truant. Students who were late have a higher percentage (31.69%) of being bullied than students who have never been late. Students who have repeated a class have a higher percentage (36.19%) of being bullied compared to students who have never repeated a class. Students with a general education type had a higher percentage (27.18%) of being bullied than students with a vocational education type. Also, students in rural schools had a higher percentage (28.13%) of being bullied than students in urban school areas.

The average Indonesian student in PISA 2022 data is in grade 10 with a standard deviation of 0.650. The average teacher support for students is 0.100 with a standard deviation of 1.020. These results indicate that average teacher support for students is quite low. The average family support for students is -0.280 with a standard deviation of 1.110. The average socioeconomic status of students is -1.420 with a standard deviation of 1.050. Negative values on average family support and socio-economic status indicate that Indonesian students have low levels of family support and socio-economic status. The average student disciplinary behavior is 0.080 with a standard deviation of 0.950. These results indicate that the average student's discipline is quite low. The average Indonesian student is in a class with a class size of 33 with a standard deviation of 9.470.

3.2 Multilevel models with binary responses

The null model yielded a school variance of 0.207. The ICC is calculated by $\hat{\rho} = \hat{\tau}_{00}^2 / (\hat{\tau}_{00}^2 + \hat{\sigma}^2)$, is $0.207 / (0.207 + 3.289) = 0.059$. This indicates that 5.9% of the variance in student bullying victimization was at the school level. The ICC value of 5.9% > 5% indicates that multilevel analysis is necessary and can be applied to bullying victimization [10]. Then, the design effect is calculated by $DE = 1 + (n_c - 1)\rho$, is $1 + (28.484 - 1)0.059 = 2.63$. This value is greater than 2, indicating that a multilevel model is necessary and can be applied [37].

Table 2: The odds ratio of the multilevel model with binary outcome

Variable	Null Model	Random Intercept model with student-level variable $\exp(\hat{\beta})$ [95% CI]	Random Intercept model with student-level and school-level variable $\exp(\hat{\beta})$ [95% CI]
<i>Level 1</i>			
Intercept	0.361[0.339;0.385]**	1.211[0.491;2.985]	1.914 [0.775;4.731]
Gender			
Female (reference category)			
Male		1.190[1.089;1.302]**	1.178 [1.078;1.289]**
Truancy			
Never (reference category)			
Ever		1.607 [1.442;1.790]**	1.585 [1.423;1.766]**
Lateness			
Never (reference category)			
Ever		1.218 [1.110;1.338]**	1.212 [1.104;1.331]**
Grade repetition			
Never (reference category)			
Ever		1.256 [1.079;1.462]**	1.241 [1.066;1.444]**
Grade		0.859 [0.782;0.944]**	0.852 [0.777;0.934]**
Teacher support		0.867 [0.830;0.905]**	0.866 [0.830;0.905]**
Family support		1.007 [0.967;1.049]	1.008 [0.968;1.049]
Socio-economic status		1.024 [0.978;1.072]	1.043 [0.996;1.092]
Student discipline behavior		0.741 [0.707;0.776]**	0.742 [0.708;0.778]**

Education type			
General (reference category)			
Vocational		0.914 [0.781;1.069]	0.959 [0.821;1.119]
<i>Level 2</i>			
School location			
Rural (reference category)			
Urban			0.736 [0.643;0.842]**
School type			
Public (reference category)			
Private			1.065 [0.945;1.201]
Class size			0.991 [0.985;0.997]**
Random Effects			
τ_{00}^2	0.207	0.144	0.123
ICC	0.059	0.042	0.036
R_m^2		0.064	0.072
R_c^2		0.103	0.106
Deviance	13109	12645	12614

* $p < 0.05$

** $p < 0.01$

Table 2 shows that in the second model (the random intercept model with student-level predictor), 7 student-level predictors significantly influence the probability of being frequently bullied among students ($p < 0.05$). By including student-level variables in the model, the variance between schools decreased from 0.207 to 0.144. These results suggest that most of the differences between schools are caused by student-level factors. Then, the proportion of variance according to [22] shows a marginal R^2 value suggests that the student-level predictor explains approximately 6.4% of the variance in bullying victimization by only paying attention to the fixed effects. Meanwhile, the results of the conditional R^2 show that student-level predictor explains approximately 10.3% of the variance in bullying victimization by paying attention to the fixed effects and random effects.

In the third model (the random intercept model with student-level and school-level predictors). The results show that 7 student-level and 2 school-level predictors significantly influence the probability of being frequently bullied among students ($p < 0.05$). By including student-level and school-level variables in the model, the between-school variance decreased from 0.144 to 0.123. These results suggest that most of the differences between schools are caused by factors at the student and school level. The proportion of variance according to [22] shows a marginal R^2 value suggests that student-level and school-level predictor explains approximately 7.2% of the variance in bullying victimization by only paying attention to the fixed effects. Meanwhile, the results of the conditional R^2 show that student-level and school-level predictors explain approximately 10.6% of the variance in bullying victimization by paying attention to the fixed effects and random effects. The increase in the value of the marginal R^2 from 6.4% to 7.2% and conditional R^2 from 10.3% to 10.6% in the third model shows that the inclusion of student-level and school-level variables into the model is useful for explaining the differences in students' bullying victimization.

Table 2, shows that the random intercept model with student-level and school-level predictors has the smallest deviance value of 12614. In addition, based on the likelihood ratio test, from the three comparison tests between all models it was found that the random intercept model with student-level and school-level predictors had a significant test statistic with a chi-square value of 31.33 ($p < 0.05$) so that the random intercept model for student-level and school-level variables is the best model and most significant model according to the data.

Based on the best model, predictors such as gender, truancy, lateness, grade repetition, grade, teacher

support, student's disciplinary behavior, school location, and class size are statistically significant factors that influence the probability of being frequently bullied among students. Male students have a 1.178 higher chance of being bullied than female students. Students who have missed school have a 1.585 greater chance of being bullied than students who have never missed school. Students who have been late have a 1.212 higher chance of being bullied more often than students who have never been late. Students who have repeated a grade are 1.241 times more likely to be bullied than students who have never repeated a grade. In a higher grade level, the student has a 0.852 lower chance of being bullied compared to lower-class level students. The higher teacher support index for students has a 0.866 lower chance of being bullied. The higher the student's discipline index, the lower the chance of being bullied. Students in urban school areas have a 0.736 lower chance of being bullied compared to schools in rural areas. The resulting odds ratio on the class size value is 0.991, which means that the larger the student's class size, the lower the chance of being bullied compared to a smaller class size.

3. Discussion

This study aimed to examine the factors that influence bullying victimization among students. The study obtained several results.

Gender is statistically significantly related to bullying victimization among students, which is consistent with several previous studies [1],[6],[15],[17],[33],[42],[48]. Another similar study conducted by [44], states that male students have a higher chance of experiencing verbal, relational, and physical bullying. By comparing five surveys, HSBC, TIMSS 2011, GSHS, and PISA 2015 showed that male students were more often victims of bullying than female students [34]. The involvement of male students in bullying is because men tend to behave aggressively physically compared to female students, so by behaving aggressively, they will be considered more masculine [5].

Lateness and truancy are statistically significantly related to bullying victimization among students. This finding is consistent with previous studies [42], which state that students who have been late or missed school have a higher chance of being bullied more often than students who have never been late or missed school. Similar findings by [23],[27],[44], stated that students who had missed school had a higher chance of experiencing verbal, relational, and physical bullying. Lateness and truancy may be signs of students' refusal to learn, making it difficult for them to achieve good academic performance [41]. In this regard, [13] found that students with poor academic performance are more likely to be victimized. This shows the connection between lateness, truancy, and their experiences of being bullied.

This study found that grade repetition is statistically significantly related to bullying victimization among students. Students who have repeated a grade are more likely to be bullied. These results are in line with the previous study by [18],[42],[48] which states that students who have repeated a grade more often experience and become victims of bullying compared to students who have never repeated a grade. Similar findings by [44] stated that students who had repeated a grade had a higher chance of experiencing verbal, relational, and physical bullying. The negative view of students who experience academic failure often makes this a shame for students. This negative view causes students who repeat a grade to be labeled as failures and are therefore more vulnerable to intimidation or bullying than other students who do not repeat a grade [18].

The grade variable is statistically significant. Students at a higher grade level have a lower chance of being bullied than students in lower grades. Previous studies by [7],[15],[40] also found that grade level is a significant factor influencing bullying victims among students, where higher grade levels report fewer victims of bullying than lower grade levels. Another study by [30] obtained similar results that as students' grade levels increased, their chances of being involved as victims of verbal and physical bullying decreased. The existence of seniority carried out by students who are at a higher grade level towards students who are at a lower grade level creates a distance between the two. Seniority refers to power that cannot be separated from violence and ends up bullying students at lower grade levels [2]. This means that students at lower

grade levels will experience bullying more often.

Teacher support is statistically significant. The higher the teacher support index for students, the lower the chance of being bullied. These results are in line with previous studies by [41],[42],[48] which stated that the higher the level of teacher support, the lower the level of bullying experienced at school. Another study by [32], also found similar results that teacher support proved to have a significant effect on preventing bullying victimization in students. Teacher support for students regarding their academics makes students feel close, accepted, and respected. This closeness will create a good relationship between teachers and students so that students can easily seek teacher help if they experience difficulties and can help reduce the possibility of negative behavior such as bullying [42].

Family support is not significant, so family support is not related to bullying victimization among students. These results are consistent with the study by [15], which states that family support does not significantly influence the experience of being a victim of peer bullying. In contrast, students who received family support were less likely to experience bullying in the form of verbal bullying and cyberbullying [17],[33].

The student's socioeconomic status is not significant. Previous studies by [35],[38],[43] also found that socioeconomic status did not significantly influence bullying experienced by students. This fact indicates the absence of granting privileges for certain students based on socioeconomic status. Every student is equally susceptible to becoming a victim of bullying, regardless of their socioeconomic level. However, another previous study found that the higher the level of socio-economic status of students, the lower the level of being bullied by students at school [6],[42],[44].

Students's disciplinary behavior has a statistically significant effect on bullying victimization. The higher the student's discipline index, the lower the chance of being bullied. Consistent with previous studies [3],[42],[48] that student discipline behavior has a negative effect on bullying, so the higher the level of student discipline, the lower the level of bullying experienced at school. Student discipline will make the classroom and school atmosphere safe so that students will feel comfortable when studying and interacting [42]. High student disciplinary behavior will protect students and can reduce aggressive student behavior that refers to bullying so that fewer students experience bullying.

Based on the student education type, students with vocational education types are not statistically significant, so they have the same chance of being bullied as students with general education types. These results are in line with the study [42], which found that the type of student education did not affect bullying at school. In contrast, other results were found by study [20],[49] which state that students who attend health vocational schools (SMK) experience bullying at school more often than students who attend public schools (SMA), which refers to the type of education that vocational students experience bullying more often than general education students.

The school location has a statistically significant effect on bullying victimization. This value shows that students in urban school areas have a lower chance of being bullied compared to schools in rural areas. These results are in line with the study [44], which states that the probability of students experiencing relational and physical bullying in urban schools is lower than students in rural schools. Students who live in rural areas will increase the possibility of experiencing bullying in the form of intimidation [6],[31],[47]. Poor quality and low academic achievement in several rural schools can increase the possibility of a negative school climate, which can trigger bullying among rural school students [47].

In this study, the private school type variable is not statistically significant and consistent with previous [19],[42]. In contrast, a study by [44] found that students in public schools had a lower chance of experiencing bullying than in private schools. The class size has a statistically significant effect on bullying victimization. The larger the student's class size, the lower the chance of the student experiencing bullying compared to a smaller class size, and this finding is consistent with a study by [8]. In the larger class size, there will be several groups of students, making it at least easier for students to escape from bullies and their

followers, as well as reducing the power of groups of student bullies. Then, students who have status in a small class will cause these students to act arbitrarily, making it possible for bullying to occur frequently [8].

4. Conclusion

Based on the application of the multilevel binary response model to bullying victimization among Indonesian students, it obtained an Intraclass Correlation (ICC) value of 5.9% and a design effect (DE) value of 2.63. These results ($ICC > 5\%$ and $DE > 2$) indicate that a multilevel model is necessary and can be applied. Furthermore, based on the likelihood ratio test, the random intercept model using student and school-level predictors was the best model. Student-level variables that significantly affect students' experiences of bullying are gender, truancy, lateness, grade repetition, grade, teacher support, and disciplinary behavior. However, other variables at the student level, like family support, socioeconomic status, and education type, did not have a significant influence on students' experiences of bullying. Then, the school-level variables showed that school location and class size had a statistically significant effect on students' experiences of bullying, while the school-type variable did not affect students' experiences of bullying.

Acknowledgment

We would like to thank the OECD for providing free access to the PISA 2022 data used in this study.

References

1. Afriani, & Denisa. (2021). Bullying victimization among junior high school students in Aceh, Indonesia: Prevalence and its differences in gender, grade, and friendship quality. *Jurnal Ilmiah Peuradeun*, 9(2), 251–274. <https://doi.org/10.26811/peuradeun.v9i2.518>
2. Andini, P. W., Amirudin, & Purnomo, M. H. (2019). Bullying sebagai arena kontestasi kekuasaan di kalangan siswa SMA Jakarta. *Endogami: Jurnal Ilmiah Kajian Antropologi*, 2(2).
3. Avanesian, G., Dikaya, L., Bermous, A., Kochkin, S., Kirik, V., Egorova, V., & Abkadyrova, I. (2021). Bullying in the Russian secondary school: Predictive analysis of victimization. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.644653>
4. Bates, D., Maechler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using {lme4}. *Journal of Statistical Software*, 67(1), 1–48. <https://doi.org/doi:10.18637/jss.v067.i01>
5. Borualogo, I. S., Wahyudi, H., & Kusdiyati, S. (2020). Prediktor perundungan siswa sekolah dasar. *Jurnal Ilmiah Psikologi Terapan*, 8(1), 26–42. <https://doi.org/10.22219/jipt.v8i1.9841>
6. Denny, S., Peterson, E. R., Stuart, J., Utter, J., Bullen, P., Fleming, T., Ameratunga, S., Clark, T., & Milfont, T. (2015). Bystander intervention, bullying, and victimization: A Multilevel Analysis of New Zealand high schools. *Journal of School Violence*, 14(3), 245–272. <https://doi.org/10.1080/15388220.2014.910470>
7. Duong, T. T., Ha, L. T. H., Oanh, T. T. M., & Huong, N. T. (2018). Associated factors of bullying victimization among Tien Chau secondary school students in Phuc Yen town, Vinh Phuc province. *Journal of Health and Development Studies (JHDS)*, 2(1).
8. Garandeau, C. F., Yanagida, T., Vermande, M. M., Strohmeier, D., & Salmivalli, C. (2019). Classroom size and the prevalence of bullying and victimization: Testing three explanations for the negative association. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.02125>
9. Heck, R. H., & Thomas, S. L. (2020). An introduction to multilevel modeling techniques. In *An Introduction to Multilevel Modeling Techniques* (4th ed.). Routledge. <https://doi.org/10.4324/9780429060274>
10. Heck, R. H., Thomas, S. L., & Tabata, L. Naomi. (2014). *Multilevel and longitudinal modeling with IBM SPSS*. Routledge.
11. Hedeker, D. R., & Gibbons, R. D. (2006). *Longitudinal data analysis*. John Wiley & Sons, Inc.

12. Hosmer, David. W., & Lemeshow, S. (2000). *Applied logistic regression* (2nd ed.). John Wiley & Sons, Inc.
13. Hosozawa, M., Bann, D., Fink, E., Elsdén, E., Baba, S., Iso, H., & Patalay, P. (2021). Bullying victimisation in adolescence: Prevalence and inequalities by gender, socioeconomic status and academic performance across 71 countries. *EClinicalMedicine*, 41. <https://doi.org/10.1016/j.eclinm.2021.101142>
14. Johansson, S., Myrberg, E., & Toropova, A. (2022). School bullying: Prevalence and variation in and between school systems in TIMSS 2015. *Studies in Educational Evaluation*, 74. <https://doi.org/10.1016/j.stueduc.2022.101178>
15. Košir, K., Zakšek, M., & Kozina, A. (2023). School belongingness and family support as predictors of school bullying perpetration and victimization in adolescents: Are relations the same for students with an immigrant background? *Victims and Offenders*. <https://doi.org/10.1080/15564886.2023.2181251>
16. Lee, H. (2022). What drives the performance of Chinese urban and rural secondary schools: A machine learning approach using PISA 2018. *Cities*, 123. <https://doi.org/10.1016/j.cities.2022.103609>
17. Lee, J., Roh, B. R., & Yang, K. E. (2022). Exploring the association between social support and patterns of bullying victimization among school-aged adolescents. *Children and Youth Services Review*, 136. <https://doi.org/10.1016/j.childyouth.2022.106418>
18. Lian, Q., Yu, C., Tu, X., Deng, M., Wang, T., Su, Q., & Zuo, X. (2021). Grade repetition and bullying victimization in adolescents: A global cross-sectional study of the Program for International Student Assessment (PISA) data from 2018. *PLoS Medicine*, 18(11). <https://doi.org/10.1371/journal.pmed.1003846>
19. Maharjan, M., & Shrestha, S. (2022). Bullying victimization and its associated factors among adolescent students. *Medical Journal of Shree Birendra Hospital*, 21(1), 29–36. <https://doi.org/10.3126/mjsbh.v21i1.39815>
20. Matsani, S. R. (2022). Investigation of bullying in high school students by gender and school type. *Investigation Of Bullying In High School Students By Gender And School Type Vision International Scientific Journal*, 7(1). <https://doi.org/10.55843/ivisum2271061r>
21. Muhopilah, P., & Tentama, F. (2019). Faktor-faktor yang mempengaruhi perilaku bullying. *Jurnal Psikologi Terapan Dan Pendidikan*, 1(2), 99–107.
22. Nakagawa, S., & Schielzeth, H. (2013). A general and simple method for obtaining R^2 from generalized linear mixed-effects models. *Methods in Ecology and Evolution*, 4(2), 133–142. <https://doi.org/10.1111/j.2041-210x.2012.00261.x>
23. Neupane, T., Pandey, A. R., Bista, B., & Chalise, B. (2020). Correlates of bullying victimization among school adolescents in Nepal: Findings from 2015 Global School-Based Student Health Survey Nepal. In *PLoS ONE* (Vol. 15, Issue 8). Public Library of Science. <https://doi.org/10.1371/journal.pone.0237406>
24. O'dwyer, L. M., & Parker, C. E. (2014). *A primer for analyzing nested data: multilevel modeling in SPSS using an example from a REL study*. <http://ies.ed.gov/>
25. OECD. (2019). *PISA 2018 results (Volume III): What school life means for students' lives*. OECD Publishing.
26. OECD. (2023). *PISA 2022 results (Volume II): Learning during – and from – disruption*. OECD Publishing.
27. Peltzer, K., & Pengpid, S. (2021). Prevalence and correlates of frequent and infrequent bullying victimization among school adolescents from five southeast asian countries. *Makara Journal of Health Research*, 25(2), 94–100. <https://doi.org/10.7454/msk.v25i2.1282>
28. R Core Team. (2022). *R: A language and environment for statistical computing*. <<https://www.R-project.org/>>.

29. Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: applications and data analysis methods* (2nd ed.). Sage Publications.
30. Rezapour, M., Khanjani, N., & Mirzai, M. (2019). Exploring associations between school environment and bullying in Iran: Multilevel contextual effects modeling. *Children and Youth Services Review*, *99*, 54–63. <https://doi.org/10.1016/j.chidyouth.2019.01.036>
31. Salmon, S., Turner, S., Taillieu, T., Fortier, J., & Afifi, T. O. (2018). Bullying victimization experiences among middle and high school adolescents: Traditional bullying, discriminatory harassment, and cybervictimization. *Journal of Adolescence*, *63*, 29–40. <https://doi.org/10.1016/j.adolescence.2017.12.005>
32. Segovia-González, M. M., Ramírez-Hurtado, J. M., & Contreras, I. (2023). Analyzing the risk of being a victim of school bullying. The relevance of students' self-perceptions. *Child Indicators Research*, *16*(5), 2141–2163. <https://doi.org/10.1007/s12187-023-10045-x>
33. Shaheen, A. M., Hamdan, K. M., Albqoor, M., Othman, A. K., Amre, H. M., & Hazeem, M. N. A. (2019). Perceived social support from family and friends and bullying victimization among adolescents. *Children and Youth Services Review*, *107*. <https://doi.org/10.1016/j.chidyouth.2019.104503>
34. Smith, P. K., López-Castro, L., Robinson, S., & Görzig, A. (2019). Consistency of gender differences in bullying in cross-cultural surveys. In *Aggression and Violent Behavior* (Vol. 45, pp. 33–40). Elsevier Ltd. <https://doi.org/10.1016/j.avb.2018.04.006>
35. Sofya, R., Putri, A. M., Syafril, R., Kurniawati, T., Ritonga, M., & Sofia, N. (2023). Analisis kondisi sosial ekonomi keluarga dan dampaknya terhadap perilaku bullying. *Jurnal Ecogen*, *6*(4), 596–604. <http://ejournal.unp.ac.id/students/index.php/pek/index>
36. Solberg, M. E., & Olweus, D. (2003). Prevalence estimation of school bullying with the olweus bully/victim questionnaire. *Aggressive Behavior*, *29*(3), 239–268. <https://doi.org/10.1002/ab.10047>
37. Sorra, J. S., & Dyer, N. (2010). Multilevel psychometric properties of the AHRQ hospital survey on patient safety culture. *BMC Health Services Research*, *10*(1), 199. <https://doi.org/doi:10.1186/1472-6963-10-199>
38. Thornberg, R., Wegmann, B., Wänström, L., Bjereld, Y., & Hong, J. S. (2022). Associations between student–teacher relationship quality, class climate, and bullying roles: A Bayesian Multilevel Multinomial Logit Analysis. *Victims and Offenders*, *17*(8), 1196–1223. <https://doi.org/10.1080/15564886.2022.2051107>
39. UNESCO. (2023). *School violence and bullying a major global issue, new UNESCO publication finds*. <https://www.unesco.org/en/articles/school-violence-and-bullying-major-global-issue-new-unesco-publication-finds>
40. Vidourek, R. A., King, K. A., & Merianos, A. L. (2016). School bullying and student trauma: Fear and avoidance associated with victimization. *Journal of Prevention and Intervention in the Community*, *44*(2), 121–129. <https://doi.org/10.1080/10852352.2016.1132869>
41. Wang, M. S., Hong, J. S., Wei, H. S., & Hwang, Y. T. (2019). Multiple level factors associated with bullying victimization in Taiwanese middle school students. *Journal of School Violence*, *18*(3), 375–387. <https://doi.org/10.1080/15388220.2018.1506927>
42. Wang, Y. J., & Chen, I. H. (2023). A multilevel analysis of factors influencing school bullying in 15-year-old students. *Children*, *10*(4). <https://doi.org/10.3390/children10040653>
43. Wicaksono, H. (2019). Socio-economic status and social capital: A multicausal analysis of bullying among high school students in Karawang, West Java. *Jurnal Sosiologi*, *24*(1). <https://doi.org/10.7454/mjs.v24i1.10134>
44. Yu, S., & Zhao, X. (2021). The negative impact of bullying victimization on academic literacy and social integration: Evidence from 51 countries in PISA. *Social Sciences and Humanities Open*, *4*(1). <https://doi.org/10.1016/j.ssaho.2021.100151>

45. Yusuf, A., Habibie, A. N., Efendi, F., Kurnia, I. D., & Kurniati, A. (2019). Prevalence and correlates of being bullied among adolescents in Indonesia: Results from the 2015 Global School-based Student Health Survey. *International Journal of Adolescent Medicine and Health*, 34(1). <https://doi.org/10.1515/ijamh-2019-0064>
46. Zaneva, M., Minnick, E., Nahar, Ginting, V., Aryani, F., Ohan, F., Haryanti, R. H., Winarna, S., Arsianto, Y., Budiawati, H., Widowati, E., Saraswati, R., Kristianto, Y., Suryani, Y. E., Ulum, D. F., & Bowes, L. (2023). Social norms predict bullying: Evidence from an anti-bullying intervention trial in Indonesia. *International Journal of Bullying Prevention*. <https://doi.org/10.1007/s42380-023-00176-8>
47. Zhu, Y., & Chan, K. L. (2015). Prevalence and correlates of school bullying victimization in Xi'an, China. *Violence and Victims*, 30(4), 714–732. <https://doi.org/10.1891/0886-6708.VV-D-14-00006>
48. Zhu, Y., & Teng, Y. (2022). Influences of teachers, students and school climate on bullying victimization: Evidence from China. *Best Evidence in Chinese Education*, 12(1), 1547–1571. <https://doi.org/10.15354/bece.22.or065>
49. Zsila, Á., Orosz, G., Király, O., Urbán, R., Ujhelyi, A., Jármi, É., Griffiths, M. D., Elekes, Z., & Demetrovics, Z. (2018). Psychoactive substance use and problematic internet use as predictors of bullying and cyberbullying victimization. *International Journal of Mental Health and Addiction*, 16(2), 466–479. <https://doi.org/10.1007/s11469-017-9809>