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Principal component analysis on bullying measurement models in schools

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Abstract

Cases of bullying in schools are still a major problem in many countries and must be resolved immediately because they are closely related to student morale. So far, schools are still focused on strategies to overcome bullying, but have not focused on exploring the right measurement model to identify bullying. This study aims to identify bullying systematically in schools. This is a quantitative research using principal component analysis (PCA). The questionnaire was developed based on the findings of previous studies. Internal factors and consistency were examined by involving 96 students from senior high schools in Indonesia. This study concludes that the model for measuring bullying in schools is measured by four indicators, namely setting, bullies, reasons for bullying and forms of bullying. This measurement model is measured by a total of 21 items that have been tested through PCA.

Keywords: PCA, bullying measurement, schools.

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1. Introduction

Mental health is one of the most important things in building public health in a country. Mental health or well-being is difficult to define, but the substantial literature on adult well-being shows that mental well-being is closely related to psychological and functional well-being, including sub-constructs such as self-acceptance, positive relationships, autonomy and life purpose (Biswas et al., 2020; Melendez-Torres et al., 2019). The World Health Organisation has an integral goal of maintaining mental health in every country by 10% between 2012 and 2020. Mental health is also very closely related to cases of bullying (Koyanagi et al., 2019).

Bullying can be defined as unwanted repetitive aggressive behaviour carried out by peers or a group of peers in which they take advantage of an imbalance of power that benefits the perpetrator so that the victim is intimidated (Koyanagi et al., 2019). Bullying is an interpersonal phenomenon that can be interpreted as a negative and harmful act that is carried out intentionally and repeatedly by people who have unequal power and by at least two people (Keelan et al., 2014).

Bullying is a case that has not been fully resolved even though there have been various policies and regulations such as the law on child protection that has been implemented in Indonesia, including Law Number 23 of 2002 Article 3 which reads that child protection aims to ensure the fulfilment of children's rights so that they can live, grow, develop and participate optimally with human dignity and protection from violence and discrimination to create quality, noble and prosperous Indonesian children. With this regulation, it is increasingly clear that Indonesia commits to recognising and protecting the rights of Indonesian children (Nurhayati et al., 2021).

The sustainability of pre-existing policies is important as the basis for formulating policies, programs and activities, their implementation and evaluation. Sustainability is an important aspect of the design, implementation and evaluation of all types of health promotion interventions, including school-based anti-bullying interventions (Chalamandaris et al., 2017). This is important to do as a step to overcome the problem of bullying itself. Based on the Strategic Plan of the Ministry of Education and Culture 2020–2014 summarises data related to bullying where 41% of Indonesian students reported experiencing bullying several times a month. This figure is higher than the OECD country average of 23%. This means that all aspects and the educational environment consisting of the government, families, schools and communities must work together and be more serious in solving this bullying case (Kemdikbudristek Team, 2020).

Bullying can take various forms, including verbal (teasing and name calling), relational (getting rid of and spreading rumours) or physical (physical threats) (Koyanagi et al., 2019). Al-Raqqad et al. (2017) state that there are six forms of bullying, namely: 1) physical bullying (slapping, kicking or being forced to do something); 2) verbal bullying (cursing, insulting and threatening); 3) sexual harassment (touching, threats of actions and obscenities); 4) psychological bullying (harassment, humiliation and rejection of the group); 5) bullying in social relationships (preventing some individuals from doing certain activities or refusing to make friends) and 6) property bullying (taking other people's things and throwing and destroying them).

Various forms of bullying can be life-threatening for the victim of bullying (Keelan et al., 2014). The impact of this bullying behaviour can be very diverse. Students who are bullied tend to have mental health problems and internal problems within themselves (e.g., anxiety, depression, post-traumatic stress disorder and even suicide) (Kim et al., 2020; Koyanagi et al., 2019; Shaw et al., 2019). This situation certainly has a bad impact on the victim.

The role and various forms of support from parents, peers and schools in overcoming bullying are very necessary because they function as protective factors to maintain the mental health of students who are victims of bullying and bullies. This is in accordance with Biswas et al. (2020) study, which states that the risk factors associated with bullying victims are very broad and include family dynamics, school factors and peer support. In addition, the Student Health Survey reported that monitoring and attention from parents and schools can reduce the risk of children becoming victims of bullying. This is quite risky for children, schools and families if they do not get immediate attention from various related parties, including the school.

Based on the various forms of bullying, the role and support from the surrounding environment, the bully, the reasons for bullying and the setting of the bully, there has been no measurement model used to identify bullying systematically in schools until now. The bullying measurement model so far has only been based on simple observations that do not have adequate information on the validity and reliability of measuring instruments.

In addition, studies on the development of bullying measuring tools in schools have not examined specifically related bullying measuring instruments in schools still. This is very important to study because bullying activities must be prevented as early as possible through the identification of bullying through a more objective measure. Therefore, this study is very important. This study aims to identify bullying systematically in schools.

2. Method

2.1. Types of research

This is a quantitative research using a descriptive approach. This study aims to describe the measurement model of bullying in schools using data reduction to explore the position of measurement items in the measuring indicators. This was done to obtain a model framework for measuring bullying in schools through theoretical and empirical evidence in the field. This evidence is the basis for standardising the bullying measurement model in schools.

2.2. Setting and research subject

This research was conducted in a high school in Yogyakarta. This research was conducted in the 2018 academic year. The number of samples used was as many as 96 students. The sample taken considers all grade levels in the school. The sample selection was based on a simple random technique. Even though it is done randomly, the selected respondents still consider the representation of each characteristic of the population area. Area considerations are based so that the selected sample can represent each population area used, namely Yogyakarta, Indonesia.

2.3. Data collection technique

Research data collection was carried out using a questionnaire. The questionnaire used consists of 4 indicators and is measured by 22 question items. The four indicators in question are settings, bullies, reasons for bullying and forms of bullying. This questionnaire was used by all samples without exception to measure the same thing. Table 1 presents the distribution of indicators and measuring items on the bullying measurement model in schools.

Table 1. The distribution of indicators and measuring items on the bullying measurement model in schools

Indicators	Codes	Questions	Item number
Settings	S1	Bullying at school happens before class starts	1
	S2	Bullying occurs during lessons	2
	S3	Bullying occurs during school breaks	3
	S4	Bullying happens after school	4
Bullies	B1	I'm bullying	5
	B2	My friend is bullying too	6
	B3	Bullying is done by classmates/classmates	7
	B4	Bullying is done by upperclassmen	8
	B5	Bullying is done alone	9
	B6	Bullying is done together	10
Reasons for bullying	R1	Bullying is done by a more powerful friend	11
	R2	Bullying happens because the victim is weak	12
	R3	Bullying occurs because of low self-esteem	13
	R4	Bullying occurs because the victim is physically different	14
	R5	Bullying occurs because the victim is different economically	15
Forms of bullying	F1	Students at my school mock other students	16
	F2	Students yell at other students	17
	F3	Students humiliate other students in front of their friends	18
	F4	Students slandering other students from behind	19
	F5	Students ask their friends for money	20
	F6	Students hitting other students	21
	F7	Students bullying on social media	22

2.4. Data analysis technique

The data analysis technique used in this research is quantitative data analysis. Data reduction was carried out using exploratory factor analysis with the principal component analysis (PCA) method. The focus of the analysis consists of calculating the Kaiser–Meyer–Olkin (KMO) measure of sampling, measure sampling adequacy (MSA) and loading factor considerations.

3. Results

The results of this study are based on the main focus of this study, namely the exploration of the model for measuring bullying in schools. This focus is translated into several sub-sections, namely testing the adequacy of the sample, identifying the number of factors formed and testing the factors formed. These results are the basis for the formation of a bullying measurement model in schools based on the findings of this study.

The first thing that is tested in this study is the sample adequacy test. This needs to be done as an initial requirement of the analysis. If this cannot be met, then further analysis cannot be carried out. This test is carried out by considering two things, namely KMO measure of sampling and MSA. The results of this study indicate that the KMO coefficient is 0.8. This shows more than the expected criteria limit, which is 0.5. Therefore, this data has met the requirements for sample adequacy based on general KMO indicators.

In addition to using test indicators through KMO, this study also tested using the MSA method. In contrast to KMO, this method describes more about testing the adequacy of the sample in terms of the item information used. The test results are presented in Table 2.

Table 2. The results of the sample adequacy test using the MSA method

Items (codes)	MSA	Cut-off value	Decisions
S1	0.85	> 0.5	Eligible
S2	0.86	> 0.5	Eligible
S3	0.84	> 0.5	Eligible
S4	0.81	> 0.5	Eligible
B1	0.67	> 0.5	Eligible
B2	0.89	> 0.5	Eligible
B3	0.86	> 0.5	Eligible
B4	0.87	> 0.5	Eligible
B5	0.83	> 0.5	Eligible
B6	0.91	> 0.5	Eligible
R1	0.90	> 0.5	Eligible
R2	0.80	> 0.5	Eligible
R3	0.84	> 0.5	Eligible
R4	0.81	> 0.5	Eligible
R5	0.84	> 0.5	Eligible
F1	0.88	> 0.5	Eligible
F2	0.87	> 0.5	Eligible
F3	0.90	> 0.5	Eligible
F4	0.90	> 0.5	Eligible
F5	0.80	> 0.5	Eligible
F6	0.80	> 0.5	Eligible
F7	0.82	> 0.5	Eligible

Table 2 shows the results of the sample adequacy test using the MSA method. These results indicate that all items have met the expected sample adequacy requirements (<0.5). These results show similarities with the test results using the KMO method. Therefore, it can be concluded that the data in this study have met the sample adequacy test and can be further analysed by factor analysis using the PCA method.

After the data meets the assumption of sample adequacy, the next thing to do is to conduct a core analysis of this study. The analysis in question is exploratory factor analysis using the PCA method. In this analysis, exploration and reduction of data are carried out based on the grouping of each measuring factor and based on the theory that has been built previously that this measurement model is formed based on 4 factors with a distribution of 22 items (Table 1). This is what is tested in this analysis.

The first proof that is done is the identification of the formed factors. The test is carried out by calculating and presenting the eigenvalues, which are a reflection of the number of factors formed. The criterion that can be used is that one factor will be formed if the eigenvalue is <1. This eigenvalue is then used to test the number of previous factors that have been formed based on the theoretical building. The results of factor testing based on the Eigen method can be seen in Figure 1.

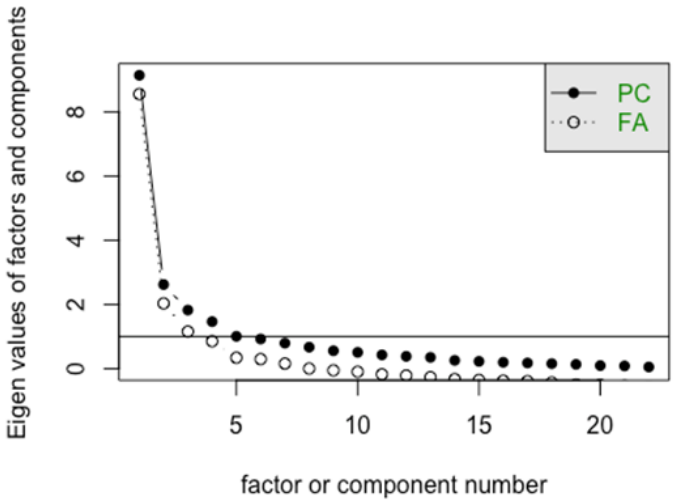

Figure 1. The results of factor testing based on the eigen method

Figure 1 shows the results of the identification of factors formed using the Eigen method. These results indicate that there are four groups of Eigen coefficients that have coefficients <1. These results prove that this data supports the measurement model that has been formed based on the theory building, namely as many as four factors. After proving that four factors are formed empirically, the next step is to identify the contribution of each item to the factors formed through empirical data. These results are shown in Figure 2.

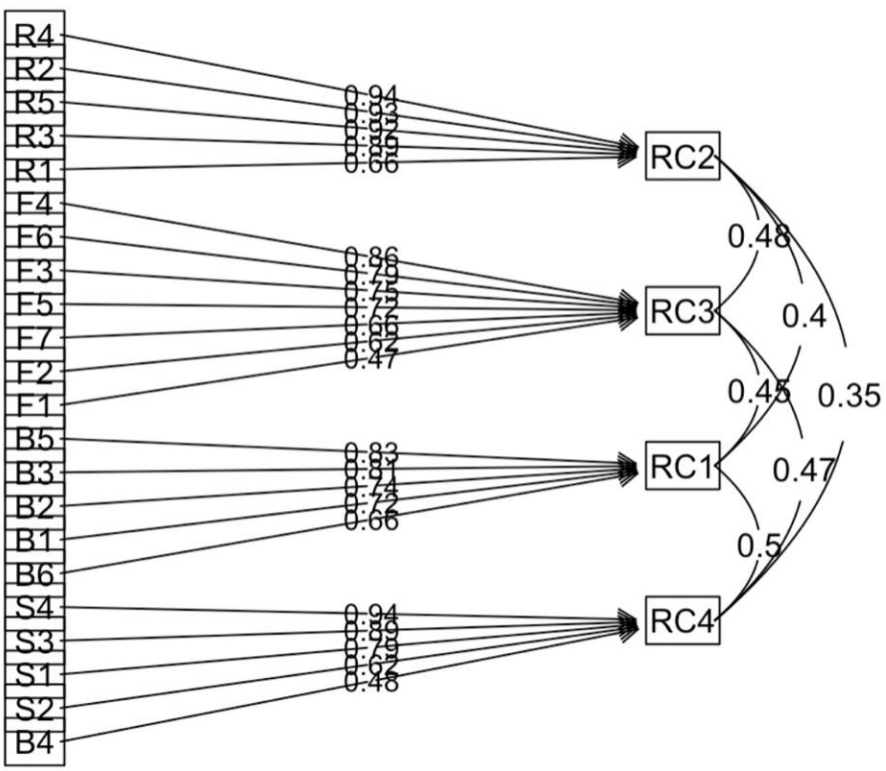

Figure 2. Principal component analysis results

Figure 2 shows the results of the PCA. Based on these results, it can be explained that four factors have been formed with item support for each factor. The figure shows the value of the loading factor which is a large correlation between the indicator and its latent construct. The criterion used in this study is 0.4. If the item exceeds 0.4, then the item is declared valid measuring the factor or indicator. The results of the analysis show that all loading factors exceed 0.4. For this reason, all items have met the expected loading factor requirements.

However, in Figure 2, there are interesting things to observe. That is the position of item B4. It is contrary to the initial concept building. Initially, item B4 measured the Bullies indicator. However, after being analysed and proven, it turns out that this item is out of its factor and measures other factors. Therefore, for reasons of inconsistency, this item was dropped and removed from the measurement model developed and the final model formed totalled 21 items.

The last thing to be analysed is the model's fit test. This test is carried out by calculating the coefficients of the comparative fit index (CFI) and the Tucker–Lewis index (TLI). The results of the analysis show that the CFI coefficient is 0.82 and the TLI coefficient is 0.80. These results indicate that the model for measuring bullying in schools that have been formed has fulfilled the assumption of model fit.

4. Discussion

This study is a PCA using exploratory factor analysis. The findings indicate that the sample adequacy test has met the criteria empirically. This shows that the results of this analysis are feasible to continue with factor analysis and the coefficient of 0.8 is a coefficient that is in the good category (Hadi et al., 2016). The sample adequacy criteria are intended to prove the suitability of the data for factor analysis. This means that the data that has met the sample adequacy test deserves to be analysed in factor analysis for each variable model (Shrestha, 2021). In addition, the sample adequacy test shows the basis of whether the sample data is adequate for further analysis (Chan & Idris, 2017; Maat et al., 2011).

The results of the PCA test show that all measuring items have a loading factor of more than 0.4. This shows that all measuring items that build a model for measuring bullying in schools have significantly measured the indicators (Herwin & Nurhayati, 2021; Prudon, 2015). This shows that the items that build the bullying measurement model are valid. This is very important because the accurate measurement is the main capital in obtaining objective and accountable results (Adom et al., 2020; Herwin, 2022). Another thing that can be explained in this finding is that with the fulfilment of the loading factor of all items, all of these items can be said to be able to build an empirical measurement model (Hoyle, 2004). Therefore, empirical evidence can underlie the early theoretical models that have been built.

Another finding that is examined in this study is the finding of the model fit. Based on the model fit test, the findings of this study concluded that the model fit was fulfilled. This shows that there has been a match between the theoretical model and the empirical model that has been tested (Herwin et al., 2022; Shi et al., 2019). Another thing can be said that the research findings are in accordance with the theoretical model (Otaya et al., 2020; Tungkunanan, 2020). This is the basis for standardising the assessment model to be used.

Bullying is aggressive behaviour carried out by someone through repetition and an imbalance of power (Mohan & Bakar, 2021). Bullying is growing rapidly in the school environment at various levels. It is proven that in every case of bullying, the perpetrators and victims are both students. Generally, victims who are bullied cannot defend themselves from various things such as physical strength, lack of resilience or other deficiencies. This usually happens when the activities are not under the supervision

of the teachers. The perpetrator is almost unknown if the victim does not report it. But some victims and perpetrators were reported by witnesses as resistant to the acts of bullying. In this situation, the role of the school is needed, especially the teacher because the teacher is the central point in learning activities at school (Herwin et al., 2020, 2021; Pujiastuti et al., 2021; Senen et al., 2021, 2021; Tjabolo & Herwin, 2020; Herwin, et al., 2022; Wuryandani & Herwin, 2021; Tjabolo & Herwin, 2020). Good character education needs to be strengthened in the educational process in schools (Intania & Sutama, 2020). In addition, parental involvement is also needed as a form of family partnership with the school (Sujarwo et al., 2021; Herwin & Dahalan, 2022).

Negative effects can threaten both victims and perpetrators of bullying. People who engage in bullying are potentially at risk for depression (Duan et al., 2020). Generally, victims of bullying usually feel angry and sad (Soimah et al., 2019), and also experience some physical problems (Andrade & Alves, 2019). Possible long-term risks include drug abuse (Baiden & Tadeo, 2019), decreased life satisfaction of victims (Nozaki, 2019) and perpetrators (Walters & Espelage, 2018). At certain levels and situations, bullying can trigger the victim's desire to commit murder (psychological behaviour related to murder) (Zhang et al., 2019). Thus, bullying is a very important thing to the attention of all parties in the school. One form of attention is to provide a valid measuring tool to identify bullying in schools.

5. Conclusion

This study concludes that the model for measuring bullying in schools is measured by four indicators, namely setting, bullies, reasons for bullying and forms of bullying. This measurement model is measured by a total of 21 items that have been tested through PCA. In addition, the bullying measurement model in schools that has been developed has met the fit of the model based on considerations of the CFI and the TLI. This finding recommends the application of the measurement model that has been developed in this study to measure bullying that occurs in schools based on several characteristics that have been formed based on measuring indicators.

Because this measurement model is very useful for teachers, students, schools and society, in general, it is recommended that this measurement model be used on an ongoing basis to detect the characteristics of bullying that occur in schools. This is very important to obtain a more effective model for dealing with bullying in schools. Although this research has been carried out optimally, the researcher outlines the limitations of this research that can be improved in the future. The limitation is that the research area only focuses on one province. For further development, it is recommended to expand the sample area by using the measurement model developed through this study.

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