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December 2016

Online at <https://mpra.ub.uni-muenchen.de/75555/>  
MPRA Paper No. 75555, posted 13 Dec 2016 15:50 UTC

**Bullying as the main driver of low performance in schools: Evidence from Botswana, Ghana, and South Africa**

Anton-Erxleben, Katharina and Kiriya, Shahriar and Zhang, Yu<sup>1</sup>

Worldwide, at least 20% of students are regularly bullied in school. Research from developed countries has associated bullying with several negative outcomes, but little is known about the relationship between bullying and academic achievement, especially in developing countries. Here, data from three African countries participating in the 2011 Trends in Mathematics and Sciences Study and Progress in Reading and Literacy Study were analyzed, including 36,602 participants aged 12 to 16. Results show that bullying is pervasive in all three countries, is one of the root causes of low academic performance, and is more influential than other variables commonly associated with low achievement. This indicates that school violence must become a priority for international development and country level efforts in education.

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Violence in and around educational settings is a global phenomenon. While school violence can take many forms, bullying is particularly common. According to Olweus (1993), a student is bullied “when he or she is exposed, repeatedly and over time, to negative actions on the part of one or more other students.” Bullying can be physical, verbal, or relational, which refers to children being systematically excluded from social activities by their peers. Recent estimates by the non-governmental organization Plan International suggest that at least 246 Million children worldwide are affected by bullying, corresponding to around 20% of the global student population (Greene et al., 2013). In the 2011 Progress in Reading and Literacy Study (PIRLS), which includes more than 300,000 students from 48 developed and developing countries, more than 50% of students reported that they experienced bullying at school; furthermore, 33% said

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that they were bullied “approximately weekly” (Mullis, Martin, Foy, & Drucker, 2012). Analyzing data from a representative sample of 15,686 U.S. students in sixth through 10th grade, Nansel et al. (2001) show that almost 30% of the students in the sample reported moderate or frequent involvement in bullying.

In developed countries, the negative consequences of bullying on students have been explored extensively: many studies have shown that bullying leads to school avoidance and poor attendance, inability to concentrate, negative attitudes, lack of academic engagement, depression and reduced self-esteem, and even physical health problems (e.g. Barrett et al., 2012; Ammermueller 2012; Brown & Taylor 2008; Eriksen et. al 2012; Ponzo 2013; Hazel, 2010; Hemphill et al., 2011; Kosciw et al., 2013; Ouellet-Morin et al., 2011; Ripski & Gregory, 2009). Brown and Taylor (2008) show that there is a connection between bullying and academic achievement using a sample from the British National Child Development Study data. Ammermueller (2012) used a broader dataset, comprising data from 11 European countries, to analyze the determinants of bullying and its effects on student attainment and similarly found that being bullied has a significantly negative impact on students’ contemporary and later performance in both school and the labor market. Ponzo (2013) investigated the Italian sample of the PIRLS and TIMSS and concluded that bullying decreased student performance.

Lower income countries face even steeper challenges in improving the performance of their education systems and continue to lag behind international standards. However, few studies (e.g. Dunne 2013) have systematically and empirically analyzed the drivers of low performance as well as the effect of bullying on academic achievement in the Global South (Smith et al., 1998).

Additionally, while existing studies have shown a significant correlation between bullying and academic achievement in developed nations, the causal direction remains unclear. In other words, it is possible that a student has lower academic performance due to being bullied, or that the likelihood of a student being bullied is higher if he or she performs poorly. The ability to distinguish between these possible interpretations is necessary to develop the right approaches to address both issues adequately through programmatic interventions. To address these gaps, we analyze nationally representative datasets from Botswana, Ghana, and South Africa to investigate the effects of bullying on academic achievement in these countries. We use a combination of different statistical techniques to move beyond a correlational study and shed light on the causal relationships between bullying, student, teacher, school, and household characteristics, and performance in school. This research will not only contribute to the academic literature on bullying, international education, and child development, but will also enable us to make evidence-based recommendations for education programs in these countries.

## **METHOD**

We use data from two international assessments, the Trends in Mathematics and Sciences Study (TIMSS) and the Progress in Reading and Literacy Study (PIRLS), conducted in 2011 by the International Association for the Evaluation of Educational Achievement (IEA) in 48 countries. These include assessments of students' reading, math, and science skills and knowledge as well as school environment and demographic measures. We use different estimation and matching techniques to compare academic achievement between bullied and non-bullied students and use

an analysis of Directed Acyclic Graphs (DAGs) to support an interpretation of the causal relationship between being bullied and low achievement.

### Participants

The PIRLS and TIMSS use nationally representative samples of students in the fourth and eighth grade in each country. Of the 36,602 participants from the three participating African countries in 2011 - Botswana, Ghana, and South Africa - we excluded those participants for which control variables such as respondents' household and school characteristics were not available, leaving a total of 33,790 (3,108 participants are analyzed for reading performance, 15,130 for math, and 15,552 for science) The same students are surveyed for math and science performance of the same grade. However, due to lack of teacher characteristics data, the exact number of participants used in the analysis may be different for math and science performances. Ninth grade students, students participated in the TIMSS in Botswana and South Africa because the assessments were deemed to be too difficult for the eighth graders. In Botswana and South Africa, the pre-PIRLS was administered, which is an easier and shorter version of the PIRLS. Table 1 shows the number of participants by country and by assessment.

Table 1: Number of participants by grade level and country.

	Pre-PIRLS 4 <sup>th</sup>	TIMSS 4 <sup>th</sup>	TIMSS 8 <sup>th</sup> /9 <sup>th</sup>	Total
Botswana	1,813	1,798	2,948	6,559
Ghana	N.A.	N.A.	4,469	4,469
South Africa	1,295	N.A.	6,007	7,302

N.A. = Test was not administered

All students and their associated schools were randomly chosen. The average age of fourth-grade students was approximately 12 years and the average age of eighth-grade students was approximately 16 years (Table 2). Schools with students from a variety of socioeconomic backgrounds and in rural as well as urban locations were included.

Table 2: Age of participants by assessment and country.

	Pre-PIRLS 4 <sup>th</sup>	TIMSS 4 <sup>th</sup>	TIMSS 8 <sup>th</sup> /9 <sup>th</sup>
Botswana	12.836 (mean) 1.023 (standard deviation)	12.835 1.025	15.849 0.894
Ghana	N.A.	N.A.	15.744 1.512
South Africa	11.452 0.826	N.A.	15.928 1.172

## Measures

### *Academic achievement: Reading*

To measure reading skills students are given passages to read and are then asked 13 to 16 multiple choice or constructed response questions about each passage. Items covered two categories of reading purpose; Literary Experience and Acquire and Use Information. Each category had the sub-categories: Focus on and Retrieve Explicitly Stated Information; Make Straightforward Inferences; Interpret and Integrate Ideas and Information; Examine and Evaluate Content, Language, and Textual Elements. The total number of items was 135 in the 2011 PIRLS and 123 in the pre-PIRLS. The pre-PIRLS assessment was developed for country contexts in which reading skills are too low to be adequately captured in the PIRLS. Hence, the pre-PIRLS

uses shorter texts with easier vocabulary as well as simpler grammar and syntax and places less emphasis on higher-order reading skills.

#### *Academic achievement: Mathematics*

The 2011 TIMSS mathematics framework included 175 items at the fourth and 217 items at the eighth grade level covering three content domains for the fourth grade assessment - Number; Geometric Shapes and Measures; and Data Display -, and four content domains for the eighth grade assessment - Number; Algebra; Geometry; and Data and Chance. TIMSS 2011 tested for three sets of behaviors expected of students as they engage with the mathematics content: Knowing; Applying; and Reasoning. Items were approximately equally divided between multiple choice and constructed response questions.

#### *Academic achievement: Science*

The 2011 TIMSS science framework included three content domains in the TIMSS 2011 fourth grade assessment - Life science, Physical science, and Earth science – and four content domains in the eighth grade assessment - Biology, Chemistry, Physics, and Earth science. The total number of items was 172 in the fourth and 217 at the eighth grade level and followed a similar format to the mathematics assessment.

Student achievement in reading, math, and science is reported on a scale of 0 to 1000 with typical scores in the range of 300 to 700. At each grade level, the scale centerpoint of 500 was set to correspond to the mean of the overall achievement distribution, and 100 points on the scale was set to correspond to the standard deviation. PIRLS and TIMSS set four threshold scores as

international benchmarks: advanced international benchmark (625); high international benchmark (550); intermediate international benchmark (475); and low international benchmark (400).

### *Bullying*

Experiences of bullying were measured through the PIRLS 2011 Student Questionnaire. The “Students Bullied at School” scale was constructed from students’ responses to the following six items:

- a) I was made fun of or called names
- b) I was left out of games or activities by other students
- c) Someone spread lies about me
- d) Something was stolen from me
- e) I was hit or hurt by other student(s) (e.g., shoving, hitting, kicking)
- f) I was made to do things I didn’t want to do by other students

Response options were: “At Least Once a Week,” “Once or Twice a Month,” “a few times a year,” or “Never.” From these responses, three categories of bullying frequency were created: “About Weekly”, “About Monthly”, and “Almost Never.” Students bullied “Almost Never” reported never experiencing three of six bullying behaviors and each of the other three behaviors “a few times a year,” on average. Students bullied “About Weekly” reported experiencing each of three of the six behaviors “once or twice a month” (bullied 3-6 times a month) and, in addition, each of the other three “a few times a year,” on average. In the PIRLS 2011 survey, an



international average of 33% of fourth grade students reported being bullied "About Monthly" and 20% being bullied "About Weekly". The TIMSS 2011 survey provides a similar measure of bullying: 32% of fourth grade students reported being bullied "About Monthly" and 20% being bullied "About Weekly; 29% of eighth grade students reported being bullied "About Monthly" and 12% being bullied "About Weekly".

### *Contextual information*

In addition to the Student Questionnaire, the Home Questionnaire (completed by parents or legal guardians), Teacher Questionnaire, School Questionnaire (completed by the school's principal), and Curriculum Questionnaire provide relevant information about other variables that may influence performance, including school resources, instructional approaches, teacher characteristics, student attitudes, and home support for learning. Further details on participants and measures, including construction of scales, can be found at <http://timssandpirls.bc.edu/>.

### Data analysis

Much of the literature on the effects of bullying and other types of school violence is limited by the necessity to rely on correlational or small scale qualitative studies in settings where conducting larger scale randomized control trials is too difficult or resource intensive, as is often the case in developing countries. These correlational studies, while valuable, do not allow inferences regarding the direction of the (potential) causal relationship between bullying and low

achievement, and cannot control for the influence of other variables. Ponzo (2013) used different statistical techniques to overcome this limitation in their analysis of the Italian PIRLS and TIMSS sample. Similar methods are used here to investigate the effects of bullying on academic achievement in the three participating African countries. Specifically, we use an Ordinary Least Square (OLS) estimation, a Propensity Score Matching (PSM) approach, and an analysis of Directed Acyclic Graphs (DAGs). The impact of bullying identified through PSM estimations is very similar to that from the OLS estimation, we report both the OLS and PSM results although the latter approach is more robust.

#### *Ordinary least square estimation*

We commence our analysis with an Ordinary Least Square (OLS) estimation. The dependent variable for the analysis is student performance, while the independent variables are bullying, students' age and sex, schools' geographic location and facilities, parents' education level, students' socioeconomic background, and various teacher attributes. The reduced form estimation equation becomes:

$$Y_i = \beta_0 + \beta_1 \text{bullied}_i + \beta_2 X_i + \varepsilon_i,$$

where  $Y_i$  denotes the academic performance of student  $i$  (including scores of reading literacy, math, and science),  $\text{bullied}_i$  is a dichotomous variable indicating whether or not the student has been bullied within a given period,  $X_i$  is a vector of student and school characteristics (such as sex, family socioeconomic background, enrollment), and  $\varepsilon_i$  is an error term capturing shocks and characteristics that are specific to the student or are unobserved.  $\beta_1$  is the expected mean gap in academic performance between bullied students and non-bullied students. The coefficient for the

constant,  $\beta_0$ , provides the intercept of the regression model's estimation. We also add control variables, such as students' and teachers' sex, in vector  $X$ .

### *Propensity Score Matching*

The propensity score is the probability of a unit (i.e., a student) being assigned to a treatment (i.e., being bullied), given a set of observed covariates. To obtain the unconfounded estimates, we include as many as possible control variables, including student, household, teacher, and school characteristics. Through PSM, students who are bullied are matched with students who share similar characteristics but are not bullied. The pair-matched individuals in control and treatment groups with the same propensity score are comparable because essentially their only difference is whether they belong to the treatment or the control group. We are able to identify the influence of bullying by comparing the average difference in academic performance between the two groups of students (Abadie and Imbens, 2016; Rosenbaum and Rubin, 1983). We obtain the average treatment effect (ATE) as the mean difference in outcome between the treated, i.e. bullied, and the control students, and the average treatment effect on the treated (ATT), which is the average effect from treatment for those who actually were treated. To formally define the ATE, we define two potential outcomes. The ATE is given by  $E(Y_{1i} - Y_{0i})$ , where  $Y_{0i}$  is the academic performance (in this case, test score) for individual  $i$  if he or she is not treated (i.e. bullied) and  $Y_{1i}$  is the value of the outcome variable for individual  $i$  if he or she is treated. The ATT is given by  $[(Y_{1i} - Y_{0i})|T=1]$ . Intuitively, the effect of bullying can be identified as the treatment effect shown by the difference in academic performance between the two groups. "Bullied weekly," which is a binary variable, is used for the analysis presented here. The same

analysis was performed using “bullied monthly” and showed similar results. We use a bootstrapping procedure to construct the standard errors for the ATT.

### *Directed Acyclic Graphs*

While the PSM approach reduces the risk of selection bias due to the lack of randomization, it is still possible that results could reflect a scenario in which students’ performance affects their likelihood of being bullied rather than an effect of bullying on performance. In order to differentiate between those two interpretations, we use a DAG analysis to reveal qualitative causal directions among variables (Pearl, 2009; Spirtes et al., 2000; Bessler et al. 2014; Chen et al. 2014; Haigh and Bessler, 2004; Bryant et al. 2009). Directed Acyclic Graphs (DAG) could be interpreted as nonparametric structural equation models (NPSEM), since they have no assumption about the functional form of the causal effects or distribution of the variables. In a DAG, directed arrows are used to represent contemporaneous causal flows. If variables are not connected by arrows, then it implies that there is no direct contemporaneous causal effect. Essentially, conditional probabilities calculated from the data are used to inform a Bayesian model for how several interrelated variables affect each other, illustrating the plausibility that certain causal relationships underlie the observed data.

## **RESULTS**

### *Prevalence of bullying and effects on academic performance*

Figure 1 shows the average test scores for each country and each discipline. Recalling that the international average is 500 points and the low international benchmark is 400 points, we confirm that academic performance in the three countries was not up to international standards. Figure 2 shows the percentage of students who were bullied weekly, disaggregated by sex. The figure shows that bullying is widespread in all three countries, with close to or more than half of all students reporting regular experiences of bullying. This compares to about 20% students in the international average. Figure 3 and 4 show the difference in performance attributable to bullying through OLS and PSM estimation, respectively. The results from the two approaches appear to be very similar; these effects correspond to a decrease in performance between 3% and 8% relative to each country's average score. In sum, these results show that bullying affects around half of all students in the three countries and has a detrimental effect on academic achievement.

#### *The relationship between bullying and contextual factors*

In addition to bullying, we explore some other factors that are often associated with effects on affect academic performance, such as teachers' experience, parents' education, geographical location, as well as teachers' sex and students' sex and age (Ponzo, 2013). Table 3 summarizes the individual effects of these variables on performance when controlling for bullying. Variables labeled "Increase" or "Decrease" indicate that there is a consistent relationship between the variable and academic performance that is statistically significant at the 1% level. "Inconclusive" indicates that the relationship may be statistically significant but the directionality differs across

tests. “Not Significant” indicates that a variable does not reach conventional levels of statistical significance in at least one algorithm of the PSM model

Table 3: Variables associated with academic performance when accounting for bullying.

	Botswana		Ghana	South Africa	
	4th grade	8th grade	8th grade	4th grade	8th grade
Students’ sex (female)	Positive*	Positive *	Inconclusive	Positive**	Negative**
Students’ age	Negative**	Negative**	Negative**	Negative**	Negative**
Teachers’ experience	Inconclusive	Inconclusive	Negative*	Not Significant	Inconclusive
Teachers’ sex (female)	Negative**	Negative**	Inconclusive	Negative**	Positive**
Parents’ education (more education)	Positive**	Positive*	Positive **	Positive**	Positive**
School location (urban)	Positive*	Positive**	Not Significant	Not Significant	Positive**

\*\* indicates statistical significance at the 1% level across all tests.

\* indicates statistical significance at the 10% level only in certain tests.

As Table 3 shows, we find significant effects of students’ age and sex on test scores. In all three countries, female and younger students generally perform better than male and older students. In addition, teacher, household, and school characteristics seem to affect learning, but in some cases the results differ between countries and or subject matter – for example, teachers’ experience in Botswana and South Africa is associated with higher performance in math but with lower

performance in science. This suggests that there are interactions between these variables and the specific country context, which were beyond the scope of this study but may be worthwhile to be explored further in future research.

### *Bullying is a key driver of low performance*

Figures 5 - 7 shows the results of the DAG analysis for each country. We simplified the DAG graphs by focusing on the variables that have a direct connection with the test score, and compile all the others into “Other Variables”. The DAG results illustrate that bullying is one of the key drivers of lower academic performance. It argues against the notion that lower academic performance making students more likely to be bullied. The graphical analysis also verifies that bullying in most cases is not driven by student-, teacher-, and school-specific attributes that were collected through the PIRLS and TIMSS surveys.

## **DISCUSSION**

Prior to the present study, bullying in developing countries had been reported (e.g. Liang, Flisher, and Lombard, 2007; Smith et al., 1998) but most empirical, quantitative, research had focused on Europe and North America. The present study sheds new light on the pervasiveness and effects of bullying on academic performance in three developing African nations-Botswana, Ghana, and South Africa. First, we find that bullying in these countries is pervasive and has severe effects on

student academic performance (Figures 1 -4). Second, we find that students' academic performance is also influenced by students' sex and age, teachers' sex and experience, parents' education, and geographical location (Table 3). However, in all three countries we find that the effect of bullying is more influential than the effect of these other variables that are often thought to be major drivers of success in school (e.g. Card & Krueger, 1992; Dearden et al., 2002; Ehrenberg & Brewer, 1994; Hanushek, 1986; Kukla-Acevedo, 2009). This is in line with previous studies, which found that the effects of bullying outweigh the effects of class size, which has been considered a key determinant of educational attainment in the economics literature (for example, see Card & Krueger, 1992; Dearden et al., 2002). Third, our analysis identifies country-, subject-, and age-specific effects that should be further explored in future research.

Our findings complement previous smaller scale and qualitative research that suggests that school violence is a major factor influencing school attendance and education outcomes in sub-Saharan Africa and elsewhere (e.g. Dunne et al., 2006, 2012; Ncontsa & Shumba, 2013). This is not limited to bullying: especially girls worldwide are often exposed to sexual harassment and abuse in and around educational settings, perpetrated by peers as well as teachers (e.g. Dunne et al., 2006; Jones et al., 2008; Mtonga, 2010). Furthermore, in many countries, corporal punishment is a common practice (Global Initiative to End All Corporal Punishment of Children, 2011) despite being associated with truancy and dropout (Ampiah & Adu-Yeboah, 2009; Dunne, 2007; UNICEF, 2001) as well as lower classroom participation (Humphreys, 2008).



Several pathways may lead from exposure to violence to low achievement. Bullying has been shown to correlate with school avoidance and low attendance (e.g. Chen, 2007; Barrett et al., 2012; Kosciw et al., 2013), which in turn could influence performance in tests. However, bullying has also been associated with depression and reduced self-esteem (e.g., Boulton, 2008; Hemphill et al., 2011; Kosciw et al., 2013) and the inability to concentrate (Abramovay & Rua, 2005; Hazel, 2010), so that performance may suffer even for those who attend regularly. Last but not least, teacher perception may play a role: Eriksen and colleagues (2012) have shown that teachers perceive bullies as well as bullied children as having worse moods, worse social competency, and weaker academic skills.

While the PIRLS and TIMSS data do not speak to different experiences of bullying by girls and boys, previous studies show that even though girls and boys are overall bullied at similar rates (Carrera-Fernandez et al., 2013; Due et al., 2005; Hussein, 2010), boys are more often perpetrators than girls (Hussein, 2010) and they experience different types of bullying (Carrera-Fernandez et al., 2013; Roman & Murillo, 2011). Future research should consider the gendered aspects of school violence and its effects on achievement. Another limitation of this study is that the data are collected at one point in time and there is no counterfactual. While we think that our analysis brings us one step closer to understanding the causal direction between bullying and achievement, future research should corroborate this finding with experimental designs such as randomized control trials.

We show through the example of Botswana, Ghana, and South Africa that bullying is equally, if not more, common in the Global South and that it is one of the root causes of low performance.

Country governments as well as international donors are spending large amounts of money each year with the goal of improving education outcomes, mainly focusing on teacher training, textbooks, curriculum reform, and other academically oriented activities. For example, in 2014 donors spent over 12 billion US dollars on official development assistance in education<sup>1</sup>. However, our results suggest that these important and much needed investments will not be effective unless the problem of violence in schools is also addressed.

In conclusion, we recommend that international aid in education include programs to enhance student safety and well-being as well as academic performance by reducing bullying. Furthermore, we suggest follow-up studies to better understand the drivers and effects of bullying as well as its interaction with other socioeconomic and demographic factors and to identify successful practices for reducing bullying and other forms of school violence. While the present study provides data that support the “business case” for addressing bullying and other school violence, it should be noted that protection from all forms of violence is also a child’s right, as laid out for example in the Convention of the Rights of the Child (1989).

1 Data from OECD:

<http://stats.oecd.org/qwids/#?x=1&y=6&f=3:3,4:1,5:4,2:1,7:1&q=3:3,4,9,13,16,G2+4:1+5:4+2:+7:1+1:1+6:2014>

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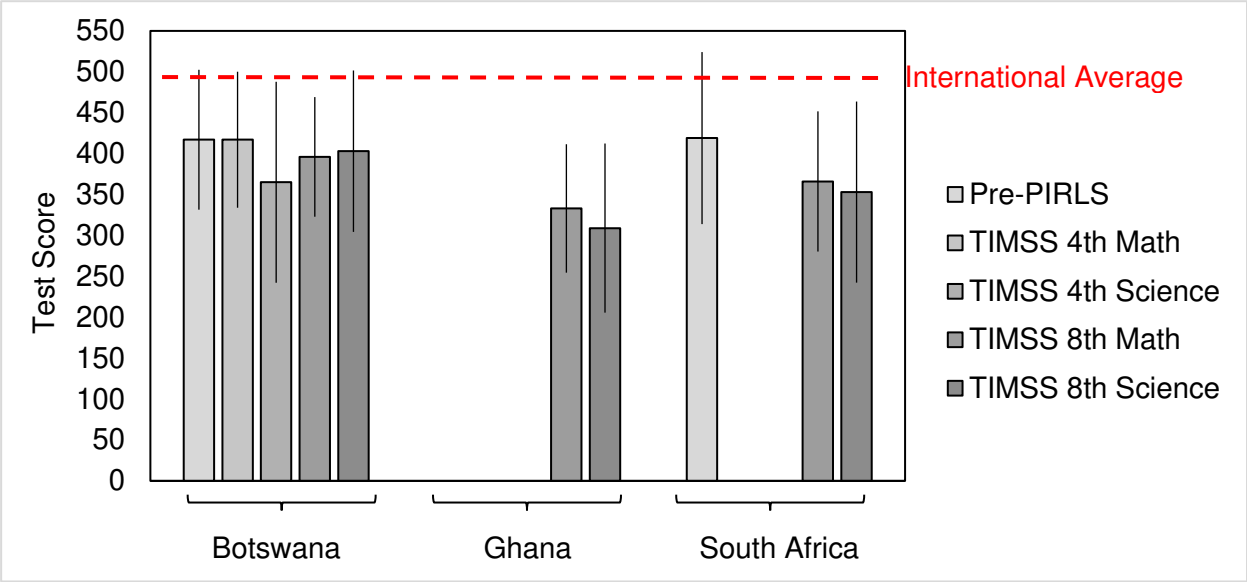


Figure 1: Average test scores by assessment and country.



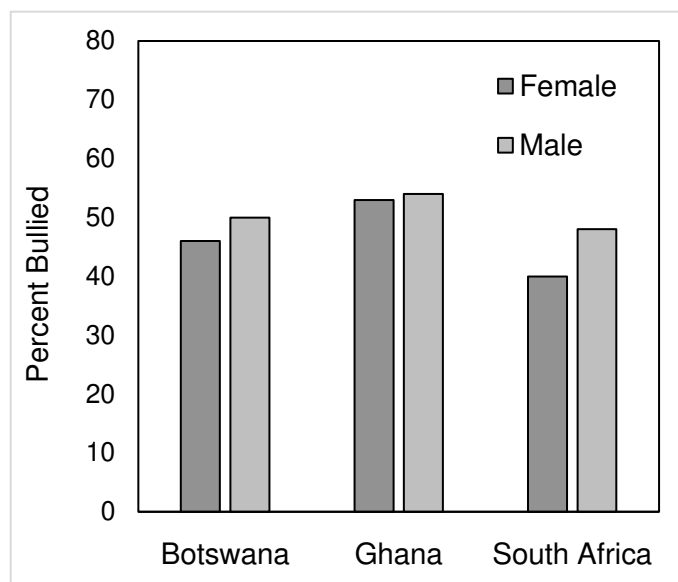


Figure 2: Percentage of students reporting that they have been bullied weekly in each country.

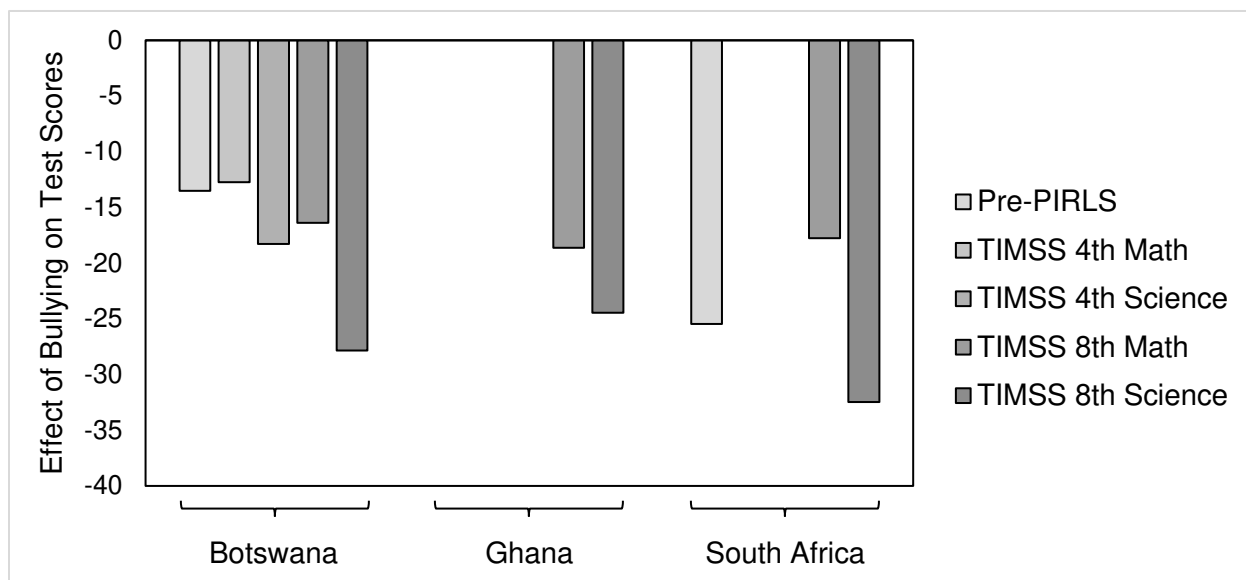


Figure 3: Difference in test scores attributed to bullying through OLS, by assessment and country.

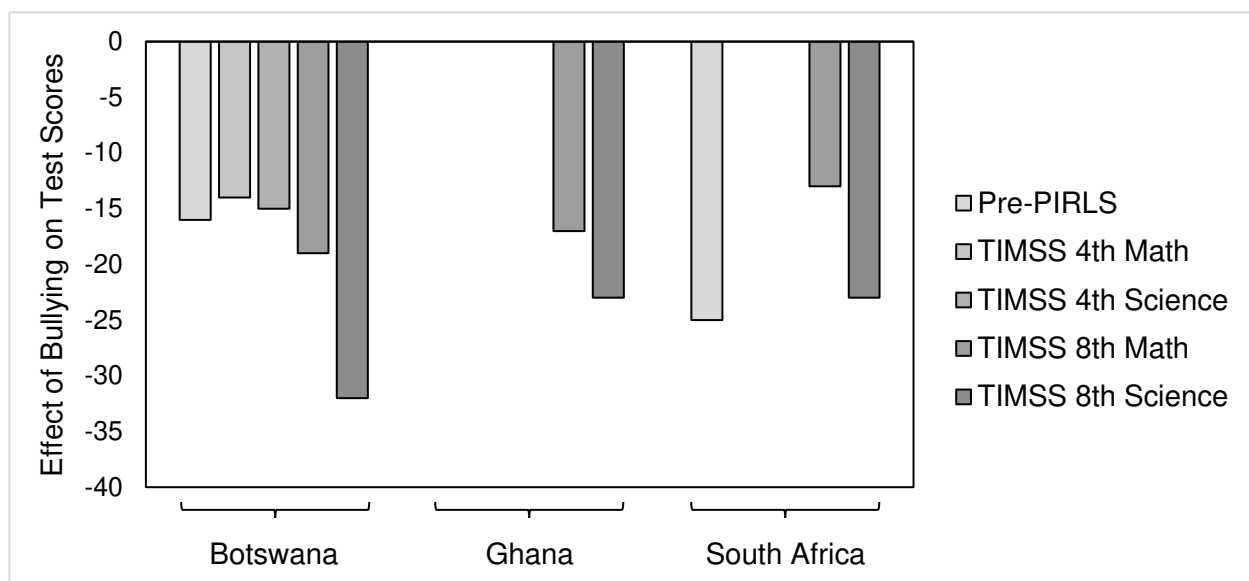


Figure 4: Difference in test scores attributed to bullying through PSM, by assessment and country.

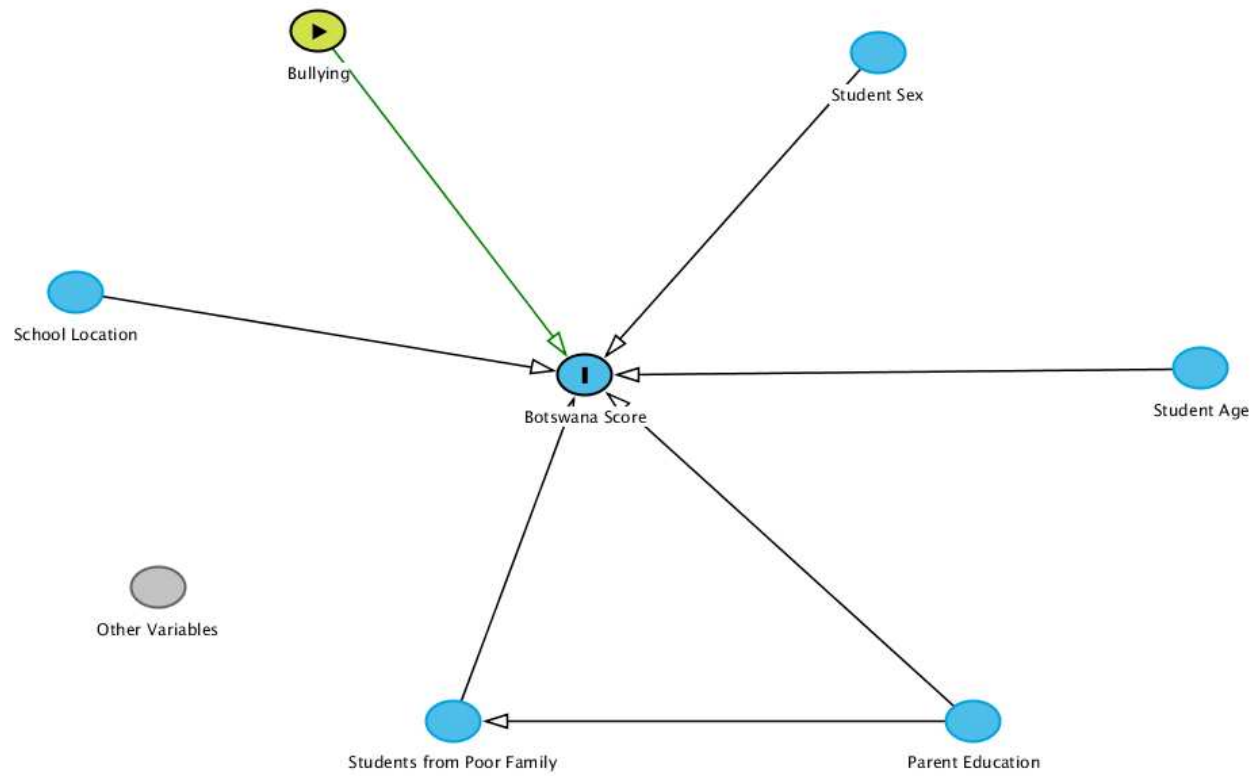


Figure 5: DAG Results for Botswana.

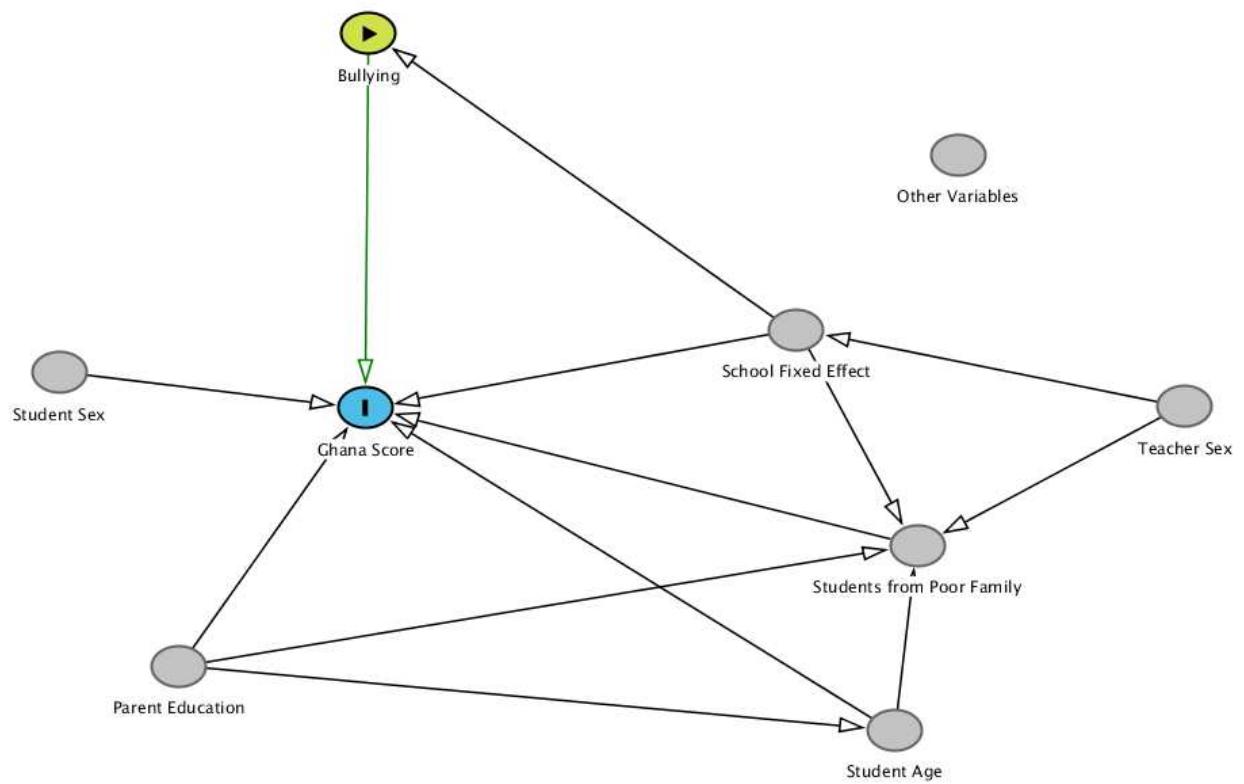


Figure 6: DAG Results for Ghana.

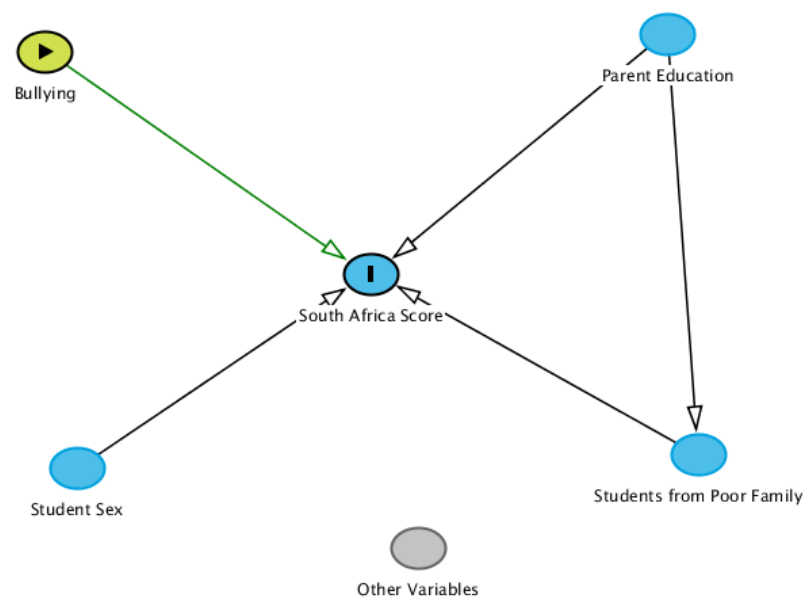


Figure 7: DAG Results for South Africa.