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Home and school resources as predictors of mathematics performance in South Africa

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The creation of an environment conducive to learning is vitally important in the academic achievement of learners. Such an environment extends beyond the classroom and school to include the home. It is from these environments that learners draw resources, both tangible and intangible, that impact on their educational experience. While current bodies of literature focus on either school or home resources, this paper looks at both. Multiple regression analyses were conducted on the 2011 Trends in International Mathematics and Science Study (TIMSS) data to determine the resources factors that influence South African learners' performance in mathematics. The findings reveal that both school and home environments play significant roles in learners' mathematics performance. This paper therefore suggests that it is not only the socio-economic factors of schools that impact learners' mathematics performance, but also that higher levels of parental education have a significant positive influence.

Keywords: home resources; learning environment; mathematics performance; predictors of performance; school resources; TIMSS 2011

Introduction

South Africa is the highest-ranked emerging economy in Africa, and is one of the most sophisticated, diverse and promising emerging markets globally (SouthAfrica.info, 2013). The high levels of unemployment and inequality in the country are considered by the government and a majority of South Africans to be the most salient economic problems facing the country (OECD, 2013). Employment rates remain low and unemployment is excessively high, which exacerbates a range of social problems and tensions. One characteristic of this fundamental problem is that educational outcomes are both poor on average and also extremely uneven; problems which further contribute to the excess supply of unskilled labour as well as to worsening income inequality (OECD, 2013).

The South African National Development Plan (NDP), as part of its Vision for 2030 (National Planning Commission, 2012), emphasises the importance of improved educational quality and outcomes in South Africa. It is expected that better educational outcomes will lead to higher employment and earnings, while more rapid economic growth will broaden opportunities for all and generate the resources required to improve education.

In the current highly technological economic world, mathematics education and mathematics performance are key resources in global competition (Carnevale, 2005). It is thus concerning that the TIMSS found average mathematics performance of South African learners in Grade Nine to be well below the international benchmark of 500 points (Mullis, Martin, Foy & Arora, 2012). Learners achieved an average score of 352 out of a possible 1,000 points. In fact, the country was placed in the bottom six of 63 participating countries in terms of mathematics performance. Towards the mission of improving mathematics performance, policy makers need to know what factors are currently influencing learner performance, as well as how strong those factors are.

International research has highlighted a number of factors that have an influence on mathematics performance among learners. These factors can be grouped into those arising from school resources and those arising from home resources (Fardin, Alamolhodaei & Radmehr, 2011). Hence, this paper aims to investigate these factors and how strongly they influence mathematics performance. Using data from TIMSS 2011, this paper investigates the following research questions:

1) Which home resource factors have a significant effect on learners' mathematics performance in South Africa?
2) Which school resource factors have a significant effect on learners' mathematics performance in South Africa?
3) Was mathematics performance affected more by the availability of home environment resources or by school environment resources?

The paper is presented in four parts. The first part provides some background on the investigation undertaken into the available literature. The methodological approach is then discussed, followed by the presentation of findings. The paper concludes by discussing the findings with specific reference to their implications.

Literature Review

School Factors associated with Performance in South African Schools

The consensus amongst South African studies is that the availability or scarcity of key school resources impacts educational outcomes, with higher levels of resources being linked to better educational outcomes. Economists reveal that the socio-economic status of a school has significant impact on learners' performance (Spaull, 2013; Van der Berg, 2008). In their findings, they highlight that school socio-economic status influences performance.

Whereas individual learners with higher socio-economic status perform poorly in poor schools, poor learners attending affluent schools improve in reading and mathematics. Spaull (2011, 2013) goes further in identifying the two kinds of school the system has, that is – wealthy functional schools and poor dysfunctional schools – and the roles they play in providing quality education to learners. These findings suggest that poorly resourced schools also have teachers with poor qualifications, while better-resourced schools are able to attract good quality teachers with higher qualifications. Sayed and Ahmed (2011) state that the South African education system is challenged by equity issues, diverse needs, as well as the challenges of meeting rights for fair education involvement and quality provision of education services. Mbugua, Kibet, Muthaa and Nkonke (2012) support the latter findings, by highlighting school factors as being highly influential in mathematics performance of Kenyan learners. In their findings, overcrowding and insufficient teaching materials were both found to impact on academic performance.

Howie's (2003) findings on factors that influence South African learners' mathematics performance in TIMSS 1999 proved socio-economic status to have less of an effect than home language and class size. However, according to Hattie (2009), class size has a close-to-zero effect on achievement. We argue that Howie's (2003) findings on class size were influenced by apartheid era education policies, which allocated higher resources to schools for white learners. However, since 1999, the socio-economics status gap has changed, and hence, for the purposes of this paper, resources from home and school are both important variables included to determine the influence of socio-economic status on mathematics performance.

Another factor that makes this context unique, and that has a significant role in mathematics performance among South African learners, is the language of teaching and learning when this is different from the home language (Howie, 2003). These studies reveal that learners perform better if the language of learning and teaching is the same as the language spoken at home. With South Africa being a multilingual country, this variable needs to be acknowledged in practice for the benefit of the learners. Unfortunately the socio-economic differences in the South African education system are strongly connected to ethnicity, and gender (Wabiri & Taffa, 2013).

Home Factors that influence Mathematics Performance

Literature relating to the effect of home resources on academic achievement has highlighted a number of factors including parental education, parental income, and parental occupation (Sirin, 2005). Thus, parental socio-economic status plays a significant role in influencing mathematics performance. The findings of Okpala, Okpala and Smith (2001) support the results of Sirin's (2005) meta-analysis, which indicates that home socio-economic status is associated with achievement. A study that seems to challenge these findings explores the relationship between learners' home socio-economic background and their mathematics performance in Nigeria. It reveals that, regardless of socio-economic background, the majority of the students were of average academic ability in mathematics (Olatunde, 2010). The challenge with this latter study is that only frequencies were used to look at the relationships – a method that cannot provide a rigorous statistical assessment of relationships. For this reason, this paper cannot use these findings to support any argument. We therefore conclude that the literature supports the assertion that home factors do indeed influence learner performance.

Methodology

Data Source and Sample

Data for this paper was sourced from the TIMSS 2011 study conducted by the International Association for the Evaluation of Educational Achievement (IEA). TIMSS was first conducted in 1995 and the study has been repeated every fourth year since then. South Africa took part in 1995, 1999, 2003 and 2011.

From the population of 10,085 South African schools that offered Grade Nine classes in 2011, a stratified random sample of 298 schools was selected by the IEA Data Processing and Research Centre. The sample was stratified by province, language of instruction (Afrikaans, English, or dual medium – both Afrikaans and English) and type of school (independent, public-and-not-Dinaledi,[i] public-and-Dinaledi). A further random selection process of classes was applied for each sampled school after which intact classes participated in the survey. A total of 11,969 Grade Nine learners participated in the 2011 TIMSS study for South Africa.

Measurement of Mathematics Achievement

One of the consequences of TIMSS' ambitious reporting goals is that more questions are required for the assessment than can be answered by any one learner in the amount of testing time available (Mullis, Martin, Ruddock, O'Sullivan & Preuschoff, 2009). TIMSS 2011 used a matrix-sampling approach to package the entire assessment pool of mathematics and science items into a set of 14 booklets. The booklets were assembled from various combinations of these items. Each learner completed only one booklet. To summarise the achievement results on a common scale with a mean of 500 and a standard deviation of 100, TIMSS 2011 used item response theory (IRT) methods. The TIMSS IRT scaling approach used "plausible values" methodology to obtain achievement scores in mathematics for all learners. This was necessary as it was not feasible for each learner to answer every item, thus each learner responded to only a part of the assessment item pool. Achievement scores were calculated out of a possible 1,000 scale points.

The achievement tests represented the curricula of the participating countries. The process of ensuring non-biased testing included modifying specifications in accordance with data from curriculum analysis and piloting of the instruments.

Data Analysis

The data analysis for this paper was done with SPSS version 20 and the IEA International Database (IDB) Analyzer (Version 3.1.17), which is a plug-in for SPSS developed by the IEA Data Processing and Research Centre (IEA-DPC). The IDB Analyzer (Version 3.1.17) is developed to analyse data from IEA surveys that use a complex sample design and make use of plausible value technology (IEA, 2012; Neuschmidt, 2007).

The data was subjected to exploratory and inferential data analysis. Cluster robust multiple regression analysis (Strehl & Ghosh, 2002) was used to investigate the effects that exposure to certain selected home and school resources had on the performance of Grade Nine learners in mathematics. The aim was to identify and investigate the quantitative effect of independent variables upon mathematics performance as the dependent variable. The selected independent variables, their origin and the methods and procedures with which they were derived are provided in the Appendix. Statistics such as frequencies, mean scores, minimum and maximum values of each item is also provided as a source of reference.

A number of regression models were prepared for the purpose of searching for the best model. By using the "Enter" method, three multiple regression analyses were conducted to address the three research questions of the paper. The multiple regression analysis on the effects of home resources addressed the first research question; the multiple regression analysis on school resources relates to the second research question; and the third multiple regression analysis testing which of the two sets of independent variables (home or school resources) had the highest effect on learners' mathematics performance, addressed the third research question.

Results

In this section, the main findings of the research are presented. Findings on the regression analyses are ordered by home resources first, then by school resources and, lastly, by the effects of both home and school resources.

Table 1 Results of a multiple regression analysis on the effects of home resource variables on mathematics performance

Regression Variable	Regression Coefficient	Regression Coefficient (*s.e.*)	Regression Coefficient (t-value)	Standardised Coefficient	Standardised Coefficient (*s.e.*)	Standardised Coefficient (t-value)	Statistical Significant (p-value)
(CONSTANT)	286.74	4.42	64.94	.	.	.	
PARENTQUAL_PM	20.51	3.26	6.29	0.11	0.02	6.54	p<.01
PARENTQUAL_MP	7.87	3.49	2.25	0.04	0.02	2.22	p<.05
BSBG03	41.85	3.51	11.93	0.22	0.02	12.9	p<.01
BSBG04	14.63	3.07	4.77	0.07	0.02	4.74	p<.01
HOMEASSET	10.42	0.69	15.1	0.30	0.02	15.44	p<.01
PARENTINVOLV	-11.92	1.63	-7.33	-0.13	0.02	-7.55	p<.01

Regression Analyses

The results of the regression analysis, which included home resource measures as predictors, are depicted in Table 1, and indicate that the selected home resource variables accounted for 30.0% of the variance in the mathematics scores (R^2 = .30, Adjusted R^2 = .30, p<.01). Similarly, the results of the regression analysis on school resource measures as predictors are presented in Table 2, and indicate that the selected school resource variables accounted for 21.0% of the variance in mathematics performance (R^2 = .21, Adjusted R^2 = .21, p<.01). The results of the final regression analysis, in which both home and school resource predictors were included, are presented in Table 3, which shows that 38.0% of the variance in mathematics performance was explained by these variables (R^2 = .38, Adjusted R^2 = .38, p<.01).

It is evident from the results reflected in Table1 that all independent home resource variables significantly contributed to the dependent variable. It is furthermore clear that (in order of having the highest to lowest effect on performance) the effect of: having more assets at home (HOMEASSET)(β = .30, p<.01), using the language most frequently spoken at home in the test (BSBG03)(β = .22, p<.01), and having a parent with higher qualifications than Grade 12 (matric) (PARENTQUAL_PM)(β = .11, p<.01) had a positive effect on learners mathematical results. The number of books at home also positively affected mathematics performance

(BSBG04)(β = .07, p<.01), while parental involvement in learners' homework from school negatively impacted on mathematics performance (PARENTINVOLV)(β = -.13, p<.01).

There was, on average, a 42 point difference (BSBG03)(β = 41.85, p<.01) between the results of learners who spoke the language of the test always, or almost always, at home, and the group of learners who spoke the test language sometimes or never at home. It was also found that learners performed, on average 10 points better for each additional asset at home (HOMEASSET)(β = 10.42, p<.01). Learners with parents who had qualifications higher than Grade 12 (post-matric qualifications) performed, on average, 21 points higher than learners whose parents' highest qualification was Grade 12 or lower (PARENTQUAL_PM)(β = 20.51, p<.01).

Table 2 presents the results of the regression analysis on the effects of school resources on mathematics performance.

The multiple regression analysis on school resources showed that the effects of instruction based on (or supplemented with) textbooks (BTBM20A_B, BTBM20A_S), workbooks or worksheets (BTBM20B_B, BTBM20B_S) and instruction supplemented by concrete objects (BTBM20C_S) were not statistically significant. The results also revealed (in order of having the highest to lowest effect) that the condition of the school building (BTBG08A)(β = .20, p<.01), the class size (BTBG12)(β = -.18, p<.01), and the capacity of the school to provide instruction (where this was affected by a shortage or inadequacy of resources) (BCBGMRS)(β = .17, p<.01) had the highest effect on learners' mathematics performance.

The condition of the school building (BTBG08A) contributed significantly and positively to learners' mathematics performance (β = .20, p<.01). The analysis revealed that learners who attended schools where the building needed minor or no repairs performed, on average, 35 points better than learners who attended schools with moderate to serious building problems (BTBG08A)(β = 35.06, p<.01).

Table 2 Results of a multiple regression analysis on the effects of school resource variables on mathematics performance

Regression Variable	Regression Coefficient	Regression Coefficient (*s.e.*)	Regression Coefficient (t-value)	Standardised Coefficient	Standardised. Coefficient (*s.e.*)	Standardised. Coefficient (t-value)	Statistical Significant (p-value)
(CONSTANT)	318.21	27.99	11.37	.	.	.	
BTBG12	-0.87	0.25	-3.44	-0.18	0.05	-3.56	p<.01
BCBG07	0.22	0.12	1.79	0.10	0.05	2.05	p<.05
BCBGMRS	9.07	2.59	3.5	0.17	0.05	3.34	p<.01
BTBG08A	35.06	7.82	4.48	0.20	0.04	4.59	p<.01
BTBM20A_B	-33.19	17.32	-1.92	-0.17	0.09	-1.88	n.s.
BTBM20A_S	-25.97	18.39	-1.41	-0.13	0.1	-1.39	n.s.
BTBM20B_B	1.03	9.96	0.1	0.01	0.06	0.10	n.s.
BTBM20B_S	0.89	9.29	0.1	0.01	0.05	0.10	n.s.
BTBM20C_B	-28.07	12.2	-2.3	-0.12	0.05	-2.20	p<.05
BTBM20C_S	-4.98	10.05	-0.5	-0.03	0.05	-0.49	n.s.
BTBM20D_B	50.49	11.75	4.3	0.13	0.03	3.72	p<.01
BTBM20D_S	31.06	9.19	3.38	0.14	0.04	3.69	p<.01

Note: n.s. = not statistically significant

Class size (BTBG12) also played a major role in the mathematics scores. It was found that, for each learner added to a class, the average score of the class dropped by one point (BTBG12)(β = -.87 p<.01). Of all the school resource variables, *class size* negatively contributed the second highest portion after the variable on the condition of the school buildings, which had a positive effect.

The effect on the learners' mathematics performance of the school's capacity to provide instruction (BCBGMRS) (where this was affected by a shortage or inadequacy of general school and mathematical resources) was significant, and positive (β = 9.07, p<.01). The results showed that for each unit increase on the index scale learners performed, on average, nine points better.

Having computers for the purposes of instruction of Grade 9 learners at the school (BCBG07) positively affected learner achievement in mathematics (β = .10, p<.05). A further contributing predictor of higher scores was teachers' utilisation of computer software as basis for or as supplement to mathematics instruction (BTBM20D_B)(β = .13 p<.01) and (BTBM20D_S) (β = .14, p<.01), respectively.

Final Model

The final model tested the effects of both home and school resources simultaneously in a regression analysis as presented in Table 3. The analysis shows that the number of home assets present in learners' homes had the highest positive effect on mathematics performance (HOMEASSET)(β = .24 p<.01). It was found that for each additional asset in a learner's home, the learner scored, on average, 8 points higher in mathematics (HOMEASSET)(β = 8.24 p<.01).

The second most important predictor of mathematics performance was the language most often spoken at home (BSBG03)(β = .17 p<.01). The data analysis suggests that learners who used the language most frequently spoken at home in the test, scored on average 32 points higher than learners who spoke the language of the test only sometimes or never at their homes (BSBG03)(β = 32.43 p<.01).

The third most important predictor of mathematics performance was the condition of the school building (BTBG08A)(β = .12 p<.01). Learners who attended schools with minor or no problems with the building performed, on average, 21 points higher than learners who attended schools with moderate to serious problems with their school buildings (BTBG08A)(β = 20.56 p<.01).

With regard to Table 3, the finding on the involvement of parents in learners' school homework at home was surprisingly negative (PARENTINVOLV)(β = -10.43 p<.01). This finding could be related to the highest level of qualification of either parent. Further investigation is needed. Additionally, as expected, larger class sizes had a negative effect on mathematics performance (BTBG12)(β = -.50 p<.05). Interestingly, by comparing the regression analyses – which included home resources only with the analysis on both home and school resources – it was found that the effect on mathematics performance of either parent having a qualification higher than Grade 12,was reduced in the combined model (PARENTQUAL_PM)(β = 20.51 p<.01) and (β = 15.76 p<.01), respectively. In the combined model, learners who had a parent with qualifications higher than Grade 12 performed on average 16 points higher than learners with parents with lower qualifications.

Table 3 Results of a multiple regression analysis on the effects of home and school resource variables on mathematics performance

Regression Variable	Regression Coefficient	Regression Coefficient (*s.e.*)	Regression Coefficient (t-value)	Standardised Coefficient	Standardised Coefficient (*s.e.*)	Standardised Coefficient (t-value)	Statistical Significant (p-value)
(CONSTANT)	283.89	21.25	13.36	.	.	.	
PARENTQUAL_PM	15.76	3.36	4.69	0.09	0.02	4.78	p<.01
PARENTQUAL_MP	8.30	3.86	2.15	0.04	0.02	2.11	p<.05
PARENTINVOLV	-10.43	1.72	-6.05	-0.12	0.02	-6.09	p<.01
HOMEASSET	8.24	0.91	9.08	0.24	0.03	8.87	p<.01
BTBM20D_S	20.81	6.29	3.31	0.09	0.03	3.53	p<.01
BTBM20D_B	32.69	9.00	3.63	0.08	0.03	2.82	p<.05
BTBM20C_S	-8.02	7.05	-1.14	-0.04	0.04	-1.12	n.s.
BTBM20C_B	-20.41	9.49	-2.15	-0.08	0.04	-2.04	p<.05
BTBM20B_S	-5.62	7.04	-0.80	-0.03	0.04	-0.79	n.s.
BTBM20B_B	-7.41	7.43	-1.00	-0.04	0.04	-0.98	n.s.
BTBM20A_S	-10.76	14.19	-0.76	-0.05	0.07	-0.74	n.s.
BTBM20A_B	-21.69	14.1	-1.54	-0.11	0.07	-1.51	n.s.
BTBG12	-0.50	0.18	-2.71	-0.10	0.04	-2.74	p<.05
BTBG08A	20.56	6.37	3.23	0.12	0.04	3.22	p<.01
BSBG04	10.42	3.09	3.37	0.05	0.02	3.30	p<.01
BSBG03	32.43	3.67	8.83	0.17	0.02	8.87	p<.01
BCBGMRS	6.05	1.82	3.33	0.11	0.04	3.20	p<.01
BCBG07	0.15	0.06	2.29	0.06	0.02	2.78	p<.05

Note: n.s. = not statistically significant

Discussion and Implications

The aim of this paper was to investigate home and school environments of learners and the effects that these environments have on mathematics performance. By first isolating the home environment, it was found that learners from higher socio-economic backgrounds, who spoke the language of the test at home, and had one parent with at least a Grade 12 education qualification performed better in mathematics. When examining the effects of the school environment, it was noted that the condition of the school buildings and the availability of general school and mathematics resources had a positive effect and the sizes of classes had a negative effect. Taking the analysis one step further, the school and home environment measures were considered in unison, so as to determine the strongest effect on achievement. These findings showed that the socio-economic backgrounds of learners and the language that they spoke at home were the two most influential factors (home environment), followed by the condition of school infrastructure (school environment).

The predictors of TIMSS mathematics performance in South Africa have changed since 1999. Howie's (2003) study on the TIMSS 1999 data revealed that home language and class size had the most significant effects on mathematics performance. Furthermore, Van der Berg (2008) states that overcrowded and under-resourced classrooms had the strongest negative impact on learning outcomes, whereas this study – based on TIMSS 2011 data – revealed that no longer to be the case. These findings also contradict those found by Olatunde (2010), who found no relationship between socio-economic background and mathematics ability.

The findings of this paper have far-reaching implications, in particular for policy makers and teachers. Interventions that aim to increase mathematics performance cannot be solely aimed at the school level. The findings point to a need to consider the home environment from which the learner originates. This may point to the need for interventions that compensate for the lack of home resources at the school level. Here, mathematics teachers must be made aware of the effect of these factors on the achievement of their learners in order to compensate for any deficiencies. In addition, policies regarding language as a resource for learning demand rigorous research that will focus on using home language as an enriching tool rather than just one of the subjects to be taught at school.

Notes

i. Dinaledi schools are public schools selected by the national Department of Basic Education. These schools have exhibited the potential to perform well and therefore could increase Higher Grade Mathematics participation and performance. The schools received additional facilities, equipment and support for effective mathematics and science teaching and learning.

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Appendix

The sets of variables selected for inclusion in the regression analyses for this study are provided below.

Measurement of Home Resources

The selected home resource variables were all taken from the learner questionnaire and included the following (cf. TablesA1 and A2): BSBG03 (how often the language of the test has been spoken at the learner's home); BSBG04 (the number of books at home); HOMEASSET (the number of home assets such as a fridge, television, own room, computer, internet connection, etc.); PARENTQUAL_MP (this variable indicates if the highest qualification of either parent was equal to Grade 12 (Matric) or higher: MP = Matric Plus) and PARENTQUAL_PM (if the highest qualification of either parent was higher than Grade 12 (Matric): PM = Post-Matric); and PARENTINVOLV (a measure of parental involvement in school homework at home).

The variable HOMEASSET was generated from learners' responses to 18 listed assets in the learner questionnaire. Learners were asked to indicate whether each of the listed assets was present at their homes (dichotomous variables -yes/no response). Frequency analysis was done on the responses to each listed asset. Missing values ranged from 2.3% to 7.1% across all assets. The variable HOMEASSET was generated by adding the responses of all assets where the number of positive responses was less than 75%. Put differently, if a specific asset was present in 75% or more of the learners' homes it was excluded from the newly generated variable. Ten of the eighteen assets were included in the newly developed variable.

The variable PARENTINVOLV contains the factor scores from a Principal Component Analysis (PCA) of learner responses to four questions in the learner questionnaire (cf. Table A3). Missing values on these four questions ranged from 5.9% to 6.9%. The questions are listed below. The learners had to respond by selecting options (every day or almost every day = 3, once or twice a week = 2, once or twice a month = 1, never or almost never = 0):

- My parents ask me what I am learning in school;
- I talk about my schoolwork with my parents;
- My parents make sure that I set aside time for my homework;
- My parents check if I do my homework.

The PCA extracted a unidimensional (one-dimensional) component named as PARENTINVOLV, with reliable internal consistency (four items; Cronbach's Alpha: $\alpha=0.76$) and which explains 58% of the variance in the sample (cf. Table A3).

Measurement of School Resources

A set of variables from the mathematics teacher questionnaire and the school questionnaire was used for school resource variables (cf. Tables A4 and A5). The variables included: BTBG12 (the number of learners per class), BCBG07 (the number of computers available for mathematics instruction), BTBG08A (school building needs significant repair), BTBM20A (use of textbooks), BTBM20B (use of workbooks), BTBM20C (use of concrete objects or materials), and BTBM20D (the availability of computer software for mathematics instruction). The four latter variables were further disaggregated into resources used as basis of instruction (with a postfix of _B) and resources used as a supplement (with a postfix of _S).

Another variable included in the regression model was an index called BCBGMRS *(Index on instruction affected by resource shortages)* which was developed by the IEA from principals' responses to twelve questions in the school questionnaire. The questions investigated how the capacity of the school to provide instruction was affected by shortages of six general school resources and six mathematics-specific resources. High values of above 11.1 on the index indicate that the instruction at the school has not been affected while values of below 7.3 on the index indicate that instruction at the school has been severely affected by resource shortages.

Tables A4 and A5 provide lists and descriptive statistics of all independent variables on school resources selected and used in a regression model with mathematics performance as the dependent variable.

Table A1 Statistics on the selected continuous variables related to HOME resources

School resource variables	Variable name	N valid	N missing	Mean (Standard error)	Standard deviation (SD)	Variance	Minimum	Maximum
Parental involvement in learner's school work at home (Factor score)	PARENTINVOLV	10,866	1,103	46.85(.0095)	1	1	-3.24	0.94

Table A2 Statistics on the selected nominal variables related to HOME resources

Home resource variables and attributes	Variable name	Frequency	Percent	Valid Percent
How often the language of testing is spoken at home	BSBG03			
Sometimes or never (=0)		7,836	65.5	66.3
Always or almost always (=1)		3,986	33.3	33.7
N missing		147	1.2	
Number of books at home	BSBG04			
0-25 books (=0)		8,706	72.7	74.4
More than 25 books (=1)		3,000	25.1	25.6
N missing		263	2.2	
Home assets	HOMEASSET			
None of the selected assets		343	2.9	2.9
1 of the selected assets		691	5.8	5.8
2 of the selected assets		1,045	8.7	8.8
3 of the selected assets		1,472	12.3	12.4
4 of the selected assets		1,805	15.1	15.2
5 of the selected assets		1,627	13.6	13.7
6 of the selected assets		1,438	12.0	12.1
7 of the selected assets		1,133	9.5	9.6
8 of the selected assets		874	7.3	7.4
9 of the selected assets		724	6.0	6.1
All 10 of the selected assets		706	5.9	6.0
N missing		111	0.9	
Either parent with Grade 12 or higher qualification	PARENTQUAL_MP			
Below matric (=0)	(MP = Matric Plus)	2,261	18.9	25.8
Grade 12 (Matric) or above (=1)		6,516	54.4	74.2
N missing		3,192	26.7*	
Either parent with qualification higher than Grade 12	PARENTQUAL_PM			
Grade 12 (Matric) or below (=0)	(PM = Post-matric)	5,193	43.4	59.2
Above matric (=1)		3,584	29.9	40.8
N missing		3,192	26.7*	

Note:* 13.0% of the 26.7% is accounted for by learners who selected the option 'I don't know' for the qualification level of both parents. The rest (13.7%) represents missing values, which could also indicate a lack of knowledge of parents' qualification levels.

Table A3 Results of PCA - Total Variance Explained for PARENTINVOLV

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.337	58.414	58.414	2.337	58.414	58.414
2	.639	15.974	74.388			
3	.575	14.381	88.768			
4	.449	11.232	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]	Component
	1
My parents check if I do my homework.	.807
My parents make sure that I set aside time for my homework.	.776
My parents ask me what I am learning in school.	.744
I talk about my schoolwork with my parents.	.728

Extraction Method: Principal Component Analysis.
a. 1 component extracted.

Table A4 Statistics on the selected continuous variables related to SCHOOL resources

School resource variables	Variable name	N valid	N missing	Mean (Standard error)	Standard deviation (SD)	Variance	Minimum	Maximum
Number of learners per class	BTBG12	11,969	0	46.85 (0.164)	17.97	323.05	10	118
Number of computers available for instructional purposes	BCBG07	10,783	1.186	24.54 (0.353)	36.63	1341.35	0	288
Index on instruction affected by resource shortages	BCBGMRS	11,496	473	9.292 (0.015)	1.59	2.52	4.851	15.23

Table A5 Statistics on the selected nominal variables related to SCHOOL resources

School resource variables	Variable name	Frequency	Percent	Valid Percent
School building needs significant repair	BTBG08A			
Moderate to serious problem (=0)		5,579	46.6	51.3
Minor to no problem (=1)		5,293	44.2	48.7
N missing		1,097	9.2	
Textbooks used as basis for instruction	BTBM20A_B			
No (=0)		3,411	28.5	31.0
Yes (=1)		7,580	63.3	69.0
N missing		978	8.2	
Textbooks used as supplement	BTBM20A_S			
No (=0)		7,798	65.2	70.9
Yes (=1)		3,193	26.7	29.1
N missing		978	8.2	
Workbooks or worksheets used as basis for instruction	BTBM20B_B			
No (=0)		6,266	52.4	57.0
Yes (=1)		4,725	39.5	43.0
N missing		978	8.2	
Workbooks or worksheets used as supplement	BTBM20B_S			
No (=0)		5,411	45.2	49.2
Yes (=1)		5,580	46.6	50.8
N missing		978	8.2	
Concrete objects or materials used as basis for instruction	BTBM20C_B			
No (=0)		9,261	77.4	84.3
Yes (=1)		1,730	14.5	15.7
N missing		978	8.2	
Concrete objects or materials used as supplement	BTBM20C_S			
No (=0)		2,902	24.2	26.4
Yes (=1)		8,089	67.6	73.6
N missing		978	8.2	
Computer software for mathematics used as basis for instruction	BTBM20D_B			
No (=0)		10,233	85.5	94.1
Yes (=1)		644	5.4	5.9
N missing		1,092	9.1	
Computer software for mathematics used as supplement	BTBM20D_S			
No (=0)		8,789	73.4	80.8
Yes (=1)		2,088	17.4	19.2
N missing		1,092	9.1	