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# Academic Resilience in Challenging Contexts: Evidence From Township and Rural Primary Schools in South Africa

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# ACADEMIC RESILIENCE IN CHALLENGING CONTEXTS: EVIDENCE FROM TOWNSHIP AND RURAL PRIMARY SCHOOLS IN SOUTH AFRICA

Gabrielle Wills and Heleen Hofmeyr<sup>1,2</sup>

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## Abstract:

Poverty is considered a risk factor that jeopardizes children's academic performance. However, even in high-poverty contexts there are students who manage to achieve consistently good academic results. This paper uses a resilience framework to identify and describe the characteristics of students from South African rural and township primary schools who perform above demographic expectations in reading comprehension. We use a rich longitudinal dataset of over 2600 Grade 6 students that contains information on institutional and individual protective factors, including students' socio-emotional skills (perseverance, aspirations, and attitudes toward school). The longitudinal dimension of the data provides a unique opportunity to not only identify consistently higher achievers, but also students whose literacy skills improved significantly more than their peers during a school year. After accounting for differences in socio-economic status and other home background factors such as English language exposure, we find that resilient students differ significantly from their lower-achieving peers along various dimensions. Students' socio-emotional skills emerge as particularly strong correlates of academic resilience. Although individual-level protective factors appear to be the strongest determinants of academic resilience, classroom factors such time-on-task and the availability of texts also play an important role. These findings add to our understanding of factors associated with academic success in challenging contexts.

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## I. Introduction

Educational outcomes and socio-economic status (SES) are strongly linked across countries and education systems (OECD 2011b). Despite this strong and persistent association, a growing body of literature documents the existence of students from disadvantaged socio-economic backgrounds who manage to achieve exceptional academic results (OECD 2011a; Agasisti & Longobardi 2017; Agasisti et al. 2018; Vera et al. 2015; Erberber et al. 2015; Cheung 2016). These students can be classified as resilient since they manage to overcome adversity to achieve academic success. The literature on academic resilience is primarily concerned with identifying individual and institutional protective factors that underlie this resilience. Such studies abound in developed countries (Erberber et al., 2015; OECD, 2011b; Agasisti et al., 2018; Agasisti and Longobardi, 2017), however the quantitative evidence-base for academic resilience in developing countries is considerably smaller (Vera et al. 2015).

Our study, located in the South African context, uses a unique dataset to contribute to our understanding of academic success in challenging contexts.<sup>4</sup> Our first research objective is to identify academic resilience in township and rural primary schools in three provinces. We consider how resilient students are distributed across schools of differing quality, and how they perform relative to international samples of students who wrote the same test. Our second research objective explores the ways in which resilient students differ systematically from their lower-achieving peers. Our analytical strategy aims to identify the mechanisms that allow students to obtain unusually high results relative to their peers even in the absence of crucial inputs such as an affluent socio-economic background. We find that one of the strongest predictors of academic resilience is socio-emotional skills. This facet of learning currently receives very little attention in South African education policy. Our findings suggest that future research stands much to gain from investigating socio-emotional skills as crucial inputs in education production.

The next section provides more background to the international literature on academic resilience and resilience in the local context. Section 3 describes the data and analytical strategy used to both define academic resilience in our study and identify its correlates. The results are presented in Section 4. The research and policy implications of the results are discussed in Section 5. Section 6 concludes.

## II. Background

Psychologists first used the term resilience to refer to *positive adaptation in the face of adversity* in the 1960's (Masten, 2012). This term was subsequently applied in education research to refer to students who manage to achieve good academic results despite considerable risks to their educational success. We situate our analysis in a social ecology view of human development (Bronfenbrenner, 1994), whereby resilience is thought to result from the dynamic interaction of risks and protective factors that exist at the level of the individual, the family, and the broader community. This theory of resilience informs the analysis presented in this paper.

There are two strands of literature that underpin our adoption of this theoretical position. One strand can broadly be termed literature on academic resilience and encompasses contributions mainly from educational psychology. Studies in this strand typically employ qualitative research methodologies. The second strand of literature comprises studies that use large-scale assessment

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<sup>4</sup> The data comes from the project "Understanding resilience and exceptionalism in high-functioning township and rural primary schools in South Africa", or briefly referred to as the "Leadership for literacy" project. This project is funded by the Economic and Social Research Council [grant ES/N01023X/1].

data such as the Programme for International Student Assessment (PISA), the Programme to Improve Reading Literacy (PIRLS) and Trends in Mathematics and Science Study (TIMSS). The latter body of work relies on quantitative analyses of academic resilience. Findings from both strands of this literature suggest protective factors at the level of the individual, home and broader community are important for fostering resilience, providing empirical support for the social ecology view of resilience.

### **The value of self-confidence, aspirations, and attitudes towards school**

The two strands of literature converge on the notion that socio-emotional skills are among the most important protective factors for fostering resilience. A number of studies in educational psychology find that students' belief in their self-efficacy and self-confidence are strong predictors of academic resilience (Cappella & Weinstein 2001; Shumow et al. 1999; Gizir & Aydin 2009; Borman & Overman 2004; Werner 1997). Furthermore, positive attitudes toward school are generally associated with academic resilience (Finn & Rock 1997; Moller 1995; Das 2018; Waxman et al. 1997; Brookover et al. 1978; Wright & Masten 2015; Borman & Overman 2004). Having high educational aspirations is also considered important for resilience (Benard 1997; Cappella & Weinstein 2001; Gizir & Aydin 2009).

Similarly, large-scale quantitative studies of resilience find that self-efficacy beliefs, self-confidence, educational aspirations, and attitudes toward school are the strongest and most consistent predictors of resilience among socio-economically disadvantaged students. This was first confirmed in the OECD study "Against the Odds: Disadvantaged students Who Succeed in School" (OECD, 2011) that used PISA data. The study showed that even when augmenting resilience models to include individual-level factors *and* school-level factors, student self-efficacy remains the most consistent predictor of resilience in almost all countries participating in PISA (OECD, 2011). Sandoval-Hernandez & Cortes (2012) conduct a similar analysis with PIRLS 2006 data and find that self-confidence was the strongest predictor of resilience in reading literacy across the participating countries. Having a positive attitude towards reading and higher educational aspirations also emerged as significant correlates of resilience in Sandoval-Hernandez & Cortes' study.

Using TIMSS 2011 data, Erberber et al. (2015) find that in the majority of participating countries, students' educational aspirations are the strongest and most consistent predictor of academic resilience of all protective factors considered in the study. Sandoval-Hernandez & Bialowoski (2016) also use TIMSS 2011 data and like Erberber et al., they find that educational aspirations are strongly correlated with resilience in the five countries they consider (Singapore, South Korea, Hong Kong, Chinese Taipei, and Japan).

Rather than using cross-country analyses, a number of studies have used the PISA and PIRLS data to investigate predictors of resilience among socio-economically disadvantaged students in country specific contexts (see for example Vera et al. (2015) for an analysis of resilient students in Chile and Cheung (2016) for resilience in mathematics in China, Singapore, Hong Kong, Taiwan and Korea). These studies also point to the importance of socio-emotional skills for resilience.

### **Resilience in South Africa**

South Africa presents a particularly interesting context for studying academic resilience because compared to other countries, it exhibits one of the strongest correlations between students' home background and academic performance (Taylor & Yu, 2009). Shepherd (2016) finds that differences in home background explain the majority of the learning gap (roughly 60%) between poorer and wealthier South African students. This strong correlation has its origins in the apartheid education system, which consisted of multiple racially defined departments of education. Apartheid policies

deliberately aimed to deliver inferior quality education to black students compared with white students, and low quality persists today across former black schools (Spaull, 2013; Van der Berg, 2008). Encouragingly, however, despite historical disadvantage, poverty and access to lower quality schools, a small number of students still beat the odds. PrePIRLS 2011 data reveals that about 5-6% of South African grade 4 children writing African language tests reach high benchmarks in reading (550 points or above). There are literally one or two of these higher achievers in over half of all classrooms or schools tested in African languages (Wills 2017).

There are five existing studies on academic resilience in South Africa which are mostly qualitative in their design. Dass-Brailsford (2005) studies first-year university students who come from township schools in Kwa-Zulu Natal, and finds that the individual characteristics of being goal-oriented, having initiative and motivation, and having an internal locus of control were common in all her participants. Participants also identified receiving emotional support and having positive role models as important in fostering resilience. Mampane & Bouwer (2006) find that resilient Grade 8 and 9 students in township schools demonstrated independence, responsibility, assertiveness, sense of control, self-efficacy, planning and resourcefulness. In later work, these authors posit that schools play a distinctive and determining role in fostering resilience by creating a supportive teaching and learning environment (Mampane & Bouwer, 2011). Importantly, resilient students were more likely than their non-resilient peers to utilise this support. Mampane (2014) studies resilience among 291 students in township high schools and finds these students attribute their resilience to self-confidence, an internal locus of control, commitment, being achievement-oriented, and having access to social support.

While providing valuable insight into some of the individual and contextual protective factors that were important in fostering resilience from students' own perspective, available studies are limited in scope and sample size. The present study is the first to consider the correlates of academic resilience among a larger sample of students in South Africa.

### **III. Data and method**

#### **Data**

The data used was gathered for an ESRC/DFID-funded project entitled "Understanding resilience and exceptionalism in high-functioning township and rural primary schools in South Africa". In 2017, literacy tests scores were gathered from over 2600 Grade 6 students in 60 rural and township primary schools. Although the student sample is not nationally representative, it is instructive for our purposes. The schools where students were tested were purposively selected to ensure they were positioned in challenging contexts. Except for five schools charging fees of less than ZAR 2000 per year, the schools selected are no-fee schools<sup>5</sup>. The schools were also selected to reflect a range of variation in school quality across township and rural areas. They are also widely geographically located in three provinces (KwaZulu-Natal, Limpopo and Gauteng).

Most quantitative studies on academic resilience use test data from only one point in time, which may result in including students in a resilient sample who may have just had unusual success on a test day. A key advantage of our data is its longitudinal dimension, which offers a unique opportunity to identify consistently higher achievers. A silent reading comprehension test and vocabulary test were administered at the beginning of the 2017 school year and again towards the

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<sup>5</sup> No-fee schools constitute the poorest 60% of schools in South Africa, based on income, unemployment and illiteracy of the surrounding area.

end of the same school year to an entire class of grade 6 students in each school. Of the original pre-test sample of 2 656 students, 2 383 wrote the post-test, indicating a low attrition rate of 11%.

The two comprehension tests consisted of released items from previous rounds of the grade 4 PIRLS assessment. Permission was received from the IEA for their use. The reliability of these assessments is reflected in a high correlation between pre-test and post-test scores<sup>6</sup>. The use of an international assessment allows us to benchmark student proficiencies in our sample against international standards. These tests are in English and in this respect academic resilience in this study is largely defined in terms of exceptional performance in English. This may be criticised as a measure of overall academic resilience since students may perform badly in English reading but well in other subjects or languages. However, we maintain that English language proficiency is a necessary condition for academic success in South African schools. Schools are at liberty to choose one of the 11 official languages as their dominant medium of instruction in foundation phase grades (grades R-3), but are all required to teach in English or Afrikaans from grade 4 onwards. If children cannot read and write in English by the end of grade 3 it is very difficult for them to access the curriculum.

In addition to the comprehension tests, the research team also administered surveys to principals, teachers, and students. Information from these were used to derive the individual, home and school variables that we include in our analysis. The student survey included a grit scale, adapted from Duckworth and Quinn (2009). Grit, or “perseverance and passion for long-term goals” is a relatively new construct in positive psychology introduced by Duckworth et al. (2007). Grit is a higher-order construct which consists of two first-order constructs, namely consistency of interest and perseverance of effort. It is distinguishable from resilience in that grit is defined as a character trait (Duckworth & Quinn 2009), while resilience denotes a process of positive adaptation in the face of adversity. Grit is therefore one individual-level protective factor which may contribute to academic resilience along with other individual-, home-, and community-level protective factors.

Although the literature on the linkages between grit and academic achievement is still in its infancy, existing studies suggest it may be a strong determinant. In developed countries a positive association is usually identified between grit and academic performance (Duckworth et al., 2007; *Duckworth & Quinn, 2009; Duckworth et al., 2011; Mason, 2018; Reraki et al., 2015; Lee & Sohn, 2017; Akin et al., 2014; Rojas and Usher, 2012; and O’Neal, 2017, 2018*). To our knowledge only three studies explore this topic in developing countries (Datu et al. 2016; Oriol et al. 2017, Mason 2018). Mason (2018) administer the Grit Scale to a sample of first-year university students in South Africa and find that self-reported grit was positively associated with academic performance. Oriol et al (2017) do the same with primary and secondary school students in Peru and find that grit is positively associated with self-efficacy, which is an important determinant of academic achievement.

A finding emerging from two of these three studies is that the ‘consistency-of-interest’ subscale of grit might be less relevant for predicting academic outcomes than ‘perseverance-of-effort’ in developing country contexts.<sup>7</sup> For this reason, in addition to other considerations, we include only the perseverance-of-effort subscale in our analysis (Datu et al. 2016; Mason 2018). The scale was

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<sup>6</sup> The Pearson correlation statistic between the pre-test and post-test was almost 0.90.

<sup>7</sup> Datu et al (2016) find that only the perseverance-of-effort subscale of grit is correlated with academic achievement among high school and university students in the Philippines. In Mason’s study the consistency-of-interest subscale accounted for 3% of the variance in students’ academic achievement scores, while the perseverance-of-effort subscale accounted for 9% of the variance in academic achievement.

adjusted for the South African context and the age group of students in the sample. The questions can be found in the Appendix.

### **Method: Defining academic resilience**

Masten and Obradovic (2008) provide a useful typology for different approaches to defining academic resilience. Initially, they conceptualise resilience as reaching achievement levels above those expected for a particular at-risk group. This is a common definitional approach also used by other quantitative studies on academic resilience (Sandoval-Hernandez & Bialowoski 2016; Agasisti et al. 2018; Vera et al. 2015). Applied to our data, this at-risk group are socio-economically disadvantaged students from township and rural schools that *consistently* exceed sample expectations in a test administered at the beginning and end of the school year. In a second definition (Masten & Obradovic 2008), resilience is conceptualised in terms of recovery to normal achievement levels in the face of adversity. In this vein, conceptualising academic resilience in terms of learning improvements rather than just in terms of levels is appropriate. With two points of data, we can identify students who display unusual improvements in literacy over the course of a school year.

To identify resilient student we regress students' test scores on student SES, as per the following equation:

$$Y_{is} = \beta_0 + \beta_1 SES_{is} + \varepsilon_{is} \quad (1)$$

Here  $Y_{is}$  represents either the standardized pre-test or post-test scores of the  $i_{th}$  student in school  $s^8$ .  $SES_{is}$  is a vector of the students' background characteristics including a measure of wealth and its square<sup>9</sup>; the number of books in the student's home; whether or not they speak English at home and the rural or urban status of the school they attend. The residuals of the equation,  $\varepsilon_{is}$ , (the difference between the actual value of Y and the predicted value of Y) can be used to identify students who consistently perform above sample expectations after accounting for a select number of socio-economic background factors. Academically resilient students are defined as those whose residual performance lies two standard deviations above their predicted performance at both test points.

In conceptualising a comparison group against which to compare resilient students, it was appropriate to consider a typically performing group of students within the sample. The reason for this is that background data among average performers with some level of literacy is likely to be more reliable, and less likely to be subject to non-response bias, than for a very weak sample of students with low levels of literacy. In this regard, the comparison group is initially defined as performing within one standard deviation of the sample average of residual performance (that is, performance after accounting for the effect of SES). Two variations on definition 1 are also used in the analysis to consider the sensitivity of the results to the exclusion of weaker students and to address concerns that the choice of cut-off points for selecting resilient students may be arbitrary.

The second definition of academic resilience considers performance in terms of literacy gains within a school year (rather than levels) that exceed sample expectations. To obtain this indicator a similar equation is used except that pre-test scores are controlled for in this value-added model:

$$Posttest_{is} = \beta_1 + \beta_2 Pretest_{is} + \beta_3 SES_{is} + \varepsilon_{is} \quad (2)$$

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<sup>8</sup> Post-test scores are standardized in terms of the pre-test score mean and standard deviation.

<sup>9</sup> The wealth index is derived from questions on asset ownership in the student's home constructed using principal components analysis.

The advantage of this approach is that one can factor out historical accumulation of exposure to home background, teacher and school quality factors to determine which contemporaneous individual and institutional factors are associated with higher than expected learning. Academically resilient students, when defined in terms of test score gains, are those whose residual gains fall in the 90<sup>th</sup> percentile of the distribution of gain scores. These learners are compared to their peers who had improvements in their comprehension scores that lay between the 25<sup>th</sup> and the 75<sup>th</sup> percentile of the sample distribution, after controlling for SES.

A limitation of both approaches to defining resilience is that they rely on relative performance measures. In Section IV we consider how the performance of these resilient students compares in absolute terms to international samples of students.

### **Analytical strategy**

A logistic regression is used to determine which individual and institutional factors are linked to the probability of being academically resilient as opposed to typically performing or underperforming. We model the probability of being resilient as a function of individual, household and school factors that are theoretically linked to academic achievement. Tables A1 and A2 in the Appendix provide a description of all the variables included in the estimation and the questions informing the construction of indices. We provide descriptions of the explanatory variables included in the logit model in the next section.

## **IV. Results**

### **Identifying resilient students**

The results of the estimating equations 1 and 2 are shown in Table 1. In the models using test score levels rather than a value-added approach, the wealth index is shown to be positively and significantly related to English literacy scores. In addition, students in rural settings score lower on the test than their urban counterparts. More frequent use of English at home is also positively and significantly associated with reading test scores, but having more books at home provides little additional explanatory power to the models. In the value-added model, with estimation results shown in the last column of Table 1, the pre-test score, which absorbs wealth effects on English reading performance, explains most of the performance variation (80%) in post-test scores.

The residuals from estimations using pre-test and then post-test score levels are plotted in Figure 1 (page 9). Using our first approach to defining resilience, we identify 87 resilient students in our sample of 2 383. Graphically these 87 students are represented by the solid green scattered dots in Figure 1. Initially the group to which they are compared, the 1 563 students performing one standard deviation about the average, are represented by the orange scattered points in Figure 1. Variations on definition 1 are used in the analysis to consider the sensitivity of the results to the exclusion of weaker students and to address concerns that the choice of cut-off points for selecting resilient students may be arbitrary. Definition 1a expands the comparison group to include all weakly performing students (i.e. even those performing one standard deviation below the average in the pre-test and post-test). Definition 1b maintains the original comparator group but expands the group of resilient students from 87 to 158 by including those with residual performance levels between 1.5 and two standard deviations above average. These students are represented by the green outlined scatter points in Figure 1. Residuals from estimations of equation 2 are used to identify students with literacy gains in the 90<sup>th</sup> percentile. These students are considered resilient in terms of definition 2. The second panel of Figure 1 overlays points in blue, which represent students in the sample with residual gains in the 90<sup>th</sup> percentile. Academically resilient learners defined in

these terms have varying levels of initial pre-test scores, with a strong representation of learners with low initial pre-test scores.

**Table 1 Estimation of total marks (expressed in z-scores) for English comprehension test**

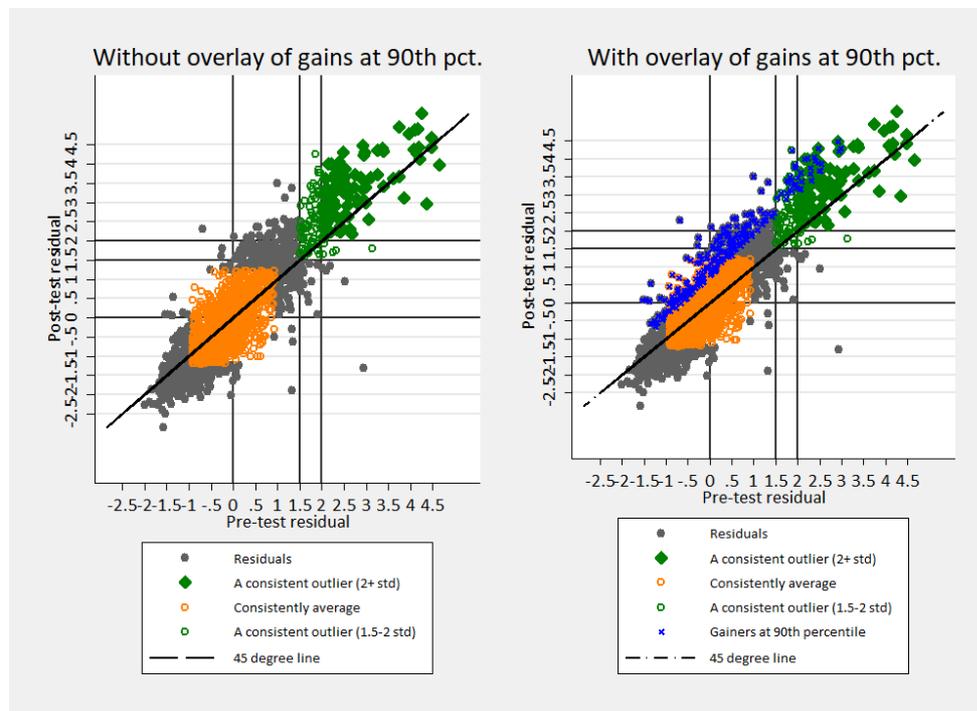
	Pre-test	Post-test	Value-added
Wealth index (asset ownership)	0.295*** (4.64)	0.320*** (4.26)	-0.0213 (-1.45)
Wealth index (asset ownership) squared	0.0971** (2.31)	0.0744 (1.53)	-0.0381** (-3.04)
<b>Books at home:</b>			
A few books (10)	-0.00456 (-0.10)	-0.0812 (-1.35)	-0.0759** (-2.16)
Enough to fill one shelf (20)	-0.0431 (-0.43)	-0.113 (-0.86)	-0.0632 (-1.15)
Enough to fill one bookcase (50)	-0.0514 (-0.42)	-0.113 (-0.58)	-0.0530 (-0.63)
Enough to fill two or more bookcases (100)	-0.0409 (-0.20)	-0.370 (-1.44)	-0.323** (-2.21)
<b>Location:</b>			
Rural (1=Rural, 0=Urban)	-0.241** (-2.11)	-0.309** (-2.06)	-0.0299 (-0.63)
<b>English spoken at home:</b>			
Sometimes	0.307*** (5.70)	0.483*** (5.83)	0.127*** (3.64)
Always-almost always	0.346** (2.55)	0.492** (2.57)	0.0914 (1.46)
<b>Pre-test score:</b>			1.158*** (50.25)
<b>Constant</b>	-0.191** (-2.07)	0.291** (2.23)	0.512*** (9.10)
<b>Observations</b>	2379	2379	2379
<b>Adjusted R-squared</b>	0.156	0.130	0.798

Source: Leadership for Literacy dataset. Notes: Reference categories include: no books at home, never speaks English at home, rural location. Standard errors are in parentheses and clustered at the school level. Statistically significant at the following levels: \* $p < 0.01$ , \*\* $p < 0.05$ , \*\*\* $p < 0.001$ .

Table 2 (page 9) describes average pre-test scores, post-test scores and gains (expressed in z-scores) as well as sample sizes for each group using the different definitions of resilience. The table also indicates the number of schools in which they are located. Considering how these academically resilient students are distributed across schools reveals important findings. The 87 students in the resilient group (definition 1) are scattered over more than half of the school sample - 36 of the 60 schools. When defined in terms of exceptional gains at or above the 90<sup>th</sup> percentile, resilient students are even more spread, identified in 51 of the 60 schools. However, these schools may vary notably in terms of quality. Figure 2 ranks the grade 6 classes across the 60 schools in our study in order of the test score of the middle learner in each class (i.e. median class performance). The figure also shows the highest and lowest mark in each class. On the second reversed axis, the yellow bars indicate the percentage of resilient learners identified in each school using definition 1. It is evident that resilient learners are more likely to be identified in schools that are better performing overall. For example, in the school class with the highest median mark, 30% of learners are identified as

resilient. But there are clear exceptions to this trend. Academically resilient learners are also located in school classes with very low median levels of performance.

**Figure 1 residual performance in the pre-test and post-test**



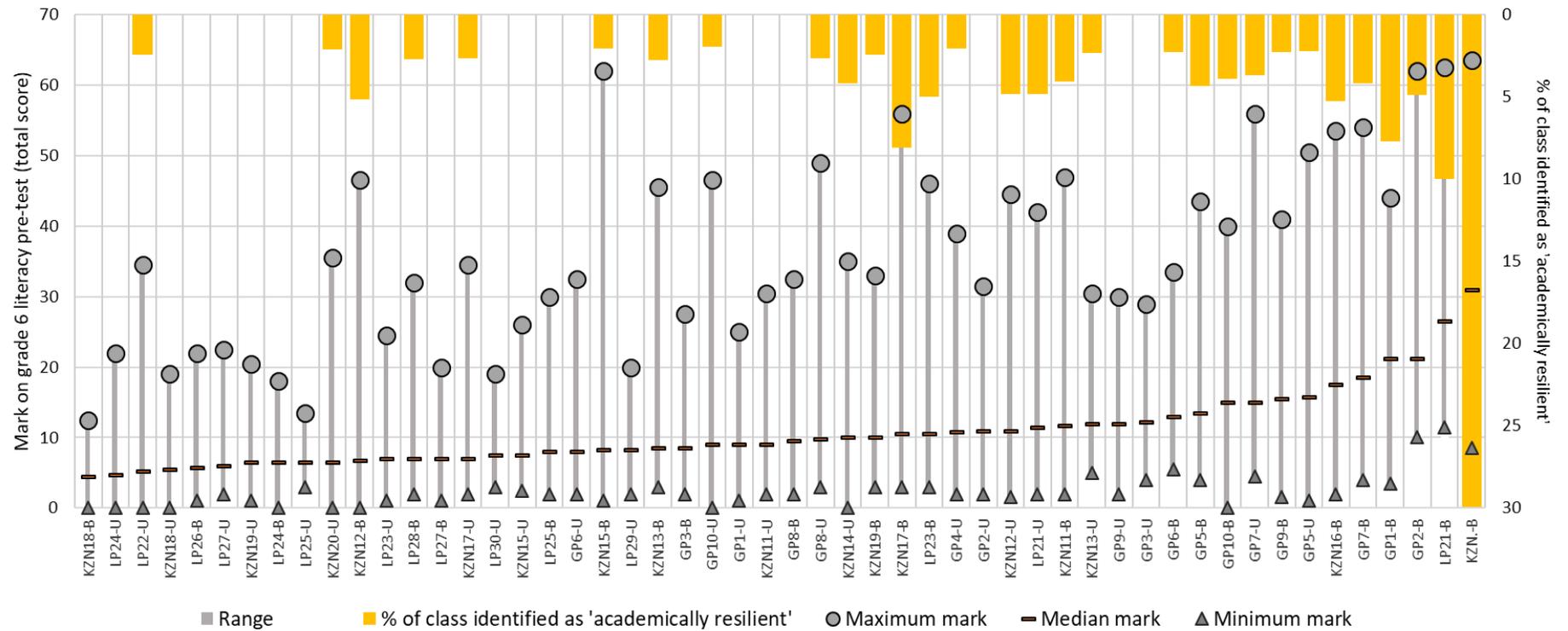
**Table 2 Academic resilience indicators: Sample sizes and average performance**

Residual z-score		Academically resilient			Comparison group			Total students (% of available sample)
		Mean	Standard Deviation	Number of students <sup>a</sup>	Mean	Standard Deviation	Number of students <sup>a</sup>	
Definition 1 (levels)	Pre-test	2.78	0.74	87	-0.16	0.42	1563	1650 (0.69)
	Post-test	3.40	0.77	(36)	-0.22	0.57	(60)	
	Gains	1.16	0.63		0.44	0.46		
Definition 1a (levels)	Pre-test	2.78	0.74	87	-0.33	0.53	1941	2028 (0.85)
	Post-test	3.40	0.77	(36)	-0.44	0.71	(60)	
	Gains	1.16	0.63		0.39	0.49		
Definition 1b (levels)	Pre-test	2.34	0.75	158	-0.16	0.42	1563	1721 (0.72)
	Post-test	2.96	0.87	(42)	-0.22	0.57	(60)	
	Gains	1.17	0.65		0.44	0.46		
Definition 2 (gains)	Pre-test	0.31	1.02	238	-0.17	0.82	1191	1429 (0.60)
	Post-test	1.48	1.23	(51)	-0.22	0.98	(60)	
	Gains	1.71	0.39		0.45	0.26		

Source: Residuals are estimated from either equation (1) or (2).

<sup>a</sup>Values in brackets show the number of schools in which the resilient students are located.

Figure 2 The presence of resilient learners in grade 6 school classrooms with different levels of median literacy test scores



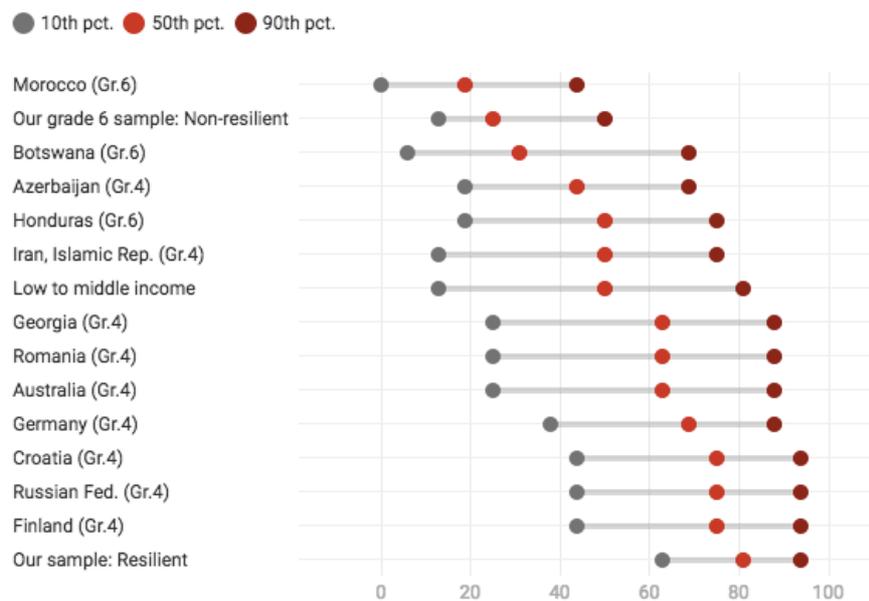
Source: Leadership for literacy dataset. Note: Marks are shown as total scores, not normalised values. Academically resilient learners are defined using definition 1.

## Descriptive evidence of competence: International comparison

Our resilient students have been defined in terms of exceeding sample performance expectations given their level of socio-economic status. But are these levels of performance educationally meaningful in any way? From a human capital perspective, how does the performance of these students compare to the competencies of students in other countries? Given the international nature of the PIRLS tests, we can benchmark our sample's performance against other countries. We compare the performance of our academically resilient and typically performing students (identified using definition 1) to students who wrote the same released PIRLS comprehension tests in other countries in PIRLS 2011. Figure 3 shows the percentage of items on a PIRLS passage correctly answered by students at the 10<sup>th</sup>, 50<sup>th</sup> and 90<sup>th</sup> percentile in lower to middle income countries and three wealthier countries. Most of the PIRLS countries administered the tests at the grade 4 level, thus our grade 6 resilient students' performance is compared with the performance of grade 4 students in other countries.

The median performance of our 87 resilient students is comparable to performance at the 90<sup>th</sup> percentile for other lower-to-upper middle-income countries in grade 4. Furthermore, our resilient students' performance at the 10<sup>th</sup> percentile is comparable to Australia's median performance, and comparable at all percentiles to Finland's performance. Even though Australia and Finland's students are almost two grades ahead of our resilient students, this result is encouraging nonetheless, given the highly challenging and under-resourced environments from which our resilient students come.

**Figure 3 International comparison of reading performance**



Source: Leadership for literacy dataset and PIRLS 2011 released items, own calculations. Results are sorted by the 50th percentile.

## Descriptive differences across resilient and typically-performing peers

The explanatory variables used in the logit estimations for the set of resilient and typically-performing students are shown in Table 3 (using the resilience indicator based on definition 1). The results in the table indicate that resilient students exhibit very different individual and home background characteristics compared to their typically-performing peers. They are wealthier, younger, more likely to be girls, and more likely to have attended grade R. The gender gap in the probability of being resilient in favour of girls is not surprising considering findings elsewhere in the

South African education literature that girls generally outperform boys by significant margins along a number of dimensions (such as dropout and repetition rates, matric results and success at university (Van Broekhuizen & Spaull, 2017)).

Table 3 also shows that at home, resilient students are more likely to be exposed to protective factors that support literacy development: They are more likely to have employed parents and to have their own story books to read. These students are also more likely to 'always' or 'almost always' speak English at home and to attend a school in an urban rather than rural area. They are less likely to report getting help with their homework from someone at home. Their scores on the grit index are notably higher, they have more aspirations for academic success, and report better attitudes towards school and their teacher.

The schools attended by resilient students in this sample are also systematically different from those attended by the comparison student group. The schools they attend have relatively wealthier students and are more likely to use English as the medium of instruction in the foundation phase. There is evidence of more time-on-task in the classrooms of resilient students, as seen by the differences in student-reported teacher absence between resilient and typically-performing students. The classrooms of resilient students contain significantly more texts that are relevant to teaching English and their schools are more likely to spend at least 33% of state allocated school budgets on books. Their language teachers are also more likely to have language specialisations.

Table 3 further shows that these observed differences between resilient and average-performing students defined according to test score levels also emerge when using a resilience indicator derived from test score gains. That is, these differences emerge even when we control for pre-test scores, which may be a proxy for an accumulated history of inputs underpinning students' academic preparedness. Importantly, this suggests that many of the individual, home and particularly classroom protective factors that are associated with better overall academic preparedness also function *during* the school year to promote literacy development.

**Table 3 Descriptive statistics: Resilient students vs. comparison group using definitions 1 and 2**

	Definition 1 (Levels)		Definition 2 (Gains)	
	Typical	Resilient	Typical	Resilient
<b>Individual factors:</b>				
Student SES index (z-score)	-0.26***	0.55	-0.11***	0.25
Age (in years)	12.1***	11.8	12.1***	11.8
Girl (%)	51.4**	62.1	48.8***	58.4
Attended Grade R (%)	89.1***	98.9	89.8	91.6
Grit index (z-score)	-0.08***	0.72	-0.1***	0.4
Grit index imputed (%)	2.7	1.1	4.1	3.4
Aspirations index (z-score)	-0.04***	0.38	-0.1***	0.2
Aspirations index imputed (%)	7.5	4.6	8.4	8.0
Attitude to school index (z-score)	-0.05***	0.25	-0.07***	0.30
Attitude to school imputed	8.6*	4.6	9.4	8.4
<b>Home factors:</b>				
Gets help at home with homework (%)	93.3***	81.6	93.4	90.3
Live with mother (Reference category: "No") (%)	77.0	81.6	79.8	79.4
Live with father (Reference category: "No") (%)	45.1	43.7	46.7	45.0
Parent employment: Neither parent has a job (%)	16.4***	6.9	16.7***	10.5
Parent employment: One parent has a job (%)	47.7**	36.8	46.5	42.9
Parent employment: Both parents have a job (%)	30.6***	55.2	31.9***	42.4
Parent employment: Not known (missing) (%)	5.4***	1.1	4.87	4.20
Student has own story books (%)	42.4*	51.7	43.1	47.9
English spoken at home: Never (%)	22.6***	6.9	20.7***	10.5
English spoken at home: Sometimes (%)	70.6	74.7	71.8***	80.3
English spoken at home: Always or almost always (%)	6.8***	18.4	7.6	9.2
Rural (Reference: Urban) (%)	62.6***	42.5	57.3***	37.8
<b>School factors:</b>				
School SES index - average SES of class (z-score)	-0.18***	0.43	-0.11***	0.17
Class size	45.9	47.5	46.3	47.2
School's language of instruction Gr1-3: English (%)	13.6***	44.8	14.6**	21.8
<b>Time on task:</b>				
Teacher missing from class: Never (%)	23.7*	33.3	25.7	28.6
Teacher missing from class: Sometimes (%)	50.2*	59.8	48.1	53.4
Teacher missing from class: Often (%)	18.9***	2.3	17.7***	10.9
Teacher missing from class: Missing (%)	7.17	4.6	8.5	7.1
Classes with present teacher (%)	83***	88	83.1***	86.3
Disruptions index	15.1	15.3	15.3**	15.9
<b>Availability and use of text:</b>				
% of teachers indicating pupils use library weekly/daily	27.3*	33.7	27.2***	33.9
% of schools allocating sufficient budget to books	15.1***	32.2	16.1***	25.2
Index of book presence in Gr. 6 classroom (z-score)	-0.11***	0.67	-0.1***	0.1
<b>Teacher quality:</b>				
Language teachers with language specialisations (%)	47.9***	52.6	48.0***	52.0
Gr.6 teacher vocabulary test score (z-score)	-0.08***	0.27	-0.02	-0.05
N (students)	1 563	87	1 191	238

Source: Leadership for literacy. Notes: Significant using \*90% confidence interval, \*\*95% confidence interval, \*\*\*99% confidence interval.

## **Estimating resilience defined using test score levels**

Having observed systematic differences in the characteristics of resilient students and their typically-performing peers, the logistic regression results in Table 4 explore which of the factors remain significant in a multivariate context when resilience is operationalised according to definition 1. Coefficients are presented as odds ratios which reflect the odds of being resilient for each one-unit increase in the predictor variable. For example, the coefficient of 1.64 on being a girl in the first model (Table 4) indicates that girls are 1.64 times as likely as boys (that is, 64% more likely) to be resilient. Similarly, the coefficient of 0.25 on getting help with homework in the second model (Table 4) indicates that students who get help with homework are 75% less likely to be resilient than those who do not get homework help.

### **Individual and home-level protective factors**

At the individual level, gender remains a significant predictor of resilience even after controlling for other relevant factors. The influence of having attended grade R plays out very strongly, with an odds ratio indicating students are 7.5 to 112 times as likely to be classified as academically resilient if they had attended grade R. Although attending Grade R is included as an individual-level protective factor, this is also an indicator of home background; reflecting the decisions of parents to expose their children to early schooling.

The multivariate regression results are suggestive of the importance of socio-emotional skills in promoting academic resilience. The odds of being classified as academically resilient are about 3 times higher when a student scores one standard deviation above the mean on the grit index. The influence of aspirations is not as strong, but significant, with a student who scored one standard deviation above the mean on the aspirations index being 1.6 times more likely to be resilient than the rest of the sample.

Although student wealth initially appears to be a protective factor promoting resilience in models 1 to 3, this association is no longer statistically significant when accounting for school-level characteristics. Most of the home background factors are insignificant in the multivariate estimations. While this finding contrasts against international studies in which home background factors are strong determinants of resilience (Cheung 2016), it is consistent with the existing school effectiveness studies in South Africa (Van der Berg & Louw 2006), which suggest that SES works through the level of the school rather than at the individual level. That is, SES impacts on schooling outcomes primarily through determining which schools students attend (Taylor & Yu 2009).

Frequency of English use at home remains associated with academic resilience in this multivariate context. Compared to students who never speak English at home, students who often speak English at home are about 4 to 6 times more likely to be identified as resilient. The fact that the language of instruction of the school does not consistently predict resilience suggests the large coefficient on frequency of English use at home does not simply reflect English language exposure. It may capture other unobserved home background factors. Consistent with the descriptive differences in Table 4, students who get help with their homework from anyone at home are less likely to be identified as resilient. The negative association is puzzling, and could suggest students who struggle are more likely to get homework help, while high-ability students may be more able to complete their homework unassisted.

## **School factors**

Only some of the differences in school-level factors emerge as important for resilience in the multivariate estimation. School SES remains significant, with a one standard deviation increase in the school SES index associated with being 2 to 4 times more likely to be resilient. This is consistent with findings in the international literature. For example, Agasisti et al. (2018) find a consistent relationship between school SES and resilience across 50 countries participating in PISA. Teacher absenteeism as reported by the student also remains significant in the multivariate estimations, with resilient students' teachers less likely to be 'often' absent from the classroom. Being in a school environment with more literacy materials also appears to promote resilience, as does management prioritisation of budgets to support a text-rich environment. Resilient learners are also more likely to be located in schools with higher percentages of language teachers with language specialisations.

## **Estimating resilience using test score gains**

The first set of estimation results (Table 4) consider resilience from the perspective of achieving higher-than-expected test score *levels*. Results are now shown for estimates of resilience defined in terms of achieving higher-than-expected test score *gains* (i.e. literacy improvements during a school year). Table 5 shows that it is largely individual factors that explain higher-than-expected gains. Classroom and school characteristics do not emerge as particularly important in these estimations, although the percentage of teachers in the school with a language specialisation is positive and significant. It must be kept in mind that 51 out of the 60 schools in the sample had at least one resilient student when resilience was defined in terms of test score gains (Table 5). The nine schools that did not have any resilient students according to this definition likely constitute a sample too small for the logit regression to pick up significant effects for school-level variables.

At the individual level, grit emerges again as positively associated with resilience: the odds of being resilient are one-and-a-half times higher if a student's grit index is one standard deviation above the mean. Attitudes toward school rather than aspirations are now significant, and getting help with homework remains significantly negatively associated with resilience. Student wealth is slightly positively associated with the probability of resilience. Age now emerges as significant and negatively associated with resilience, suggesting that repeating students are less likely to experience unusual improvements in literacy.

**Table 4 Logistic regressions of academic resilience (Levels)**

Logistic regression	Model1	Model2	Model3	Model 4	Model 5	Model 6	Model 7
<b>Individual factors</b>							
Student SES index	3.20*** (0.74)	2.69*** (0.60)	2.15*** (0.49)	1.17 (0.26)	1.18 (0.25)	1.17 (0.25)	1.14 (0.23)
Age	0.82 (0.12)	0.81 (0.13)	0.85 (0.13)	0.78 (0.13)	0.77 (0.14)	0.77 (0.14)	0.74 (0.15)
Girl	1.64** (0.36)	1.54* (0.36)	1.38 (0.31)	1.61** (0.34)	1.68** (0.35)	1.72** (0.37)	1.70** (0.39)
Attended Grade R	7.98** (8.25)	7.51* (7.75)	7.69** (7.75)	9.27** (10.13)	9.89** (10.86)	10.40** (11.67)	11.72** (13.45)
<b>Home background factors</b>							
Help with homework		0.249*** (0.08)	0.214*** (0.07)	0.196*** (0.06)	0.198*** (0.07)	0.199*** (0.07)	0.204*** (0.08)
Live with mother		1.29 (0.37)	1.27 (0.39)	1.25 (0.40)	1.33 (0.45)	1.30 (0.45)	1.26 (0.45)
Live with father		0.72 (0.21)	0.76 (0.23)	0.77 (0.23)	0.76 (0.23)	0.76 (0.23)	0.74 (0.23)
Either mother or father have a job		1.55 (0.73)	1.53 (0.74)	1.45 (0.70)	1.31 (0.64)	1.14 (0.56)	1.20 (0.61)
Both mother & father have a job		2.312* (1.05)	2.260* (1.04)	2.193* (0.99)	2.00 (0.95)	1.74 (0.83)	1.78 (0.87)
Job not known		0.36 (0.40)	0.30 (0.32)	0.17 (0.20)	0.15 (0.18)	0.119* (0.14)	0.124* (0.14)
Learner has own story book		0.82 (0.19)	0.76 (0.21)	0.72 (0.20)	0.76 (0.23)	0.77 (0.24)	0.79 (0.25)
English spoken at home: sometimes		2.385** (0.92)	1.884* (0.70)	1.57 (0.63)	1.64 (0.66)	1.59 (0.64)	1.56 (0.62)
English spoken at home: always or almost always		6.368*** (3.30)	5.070** (2.71)	4.291** (2.29)	4.667** (2.57)	4.616** (2.56)	4.627** (2.49)
<b>Perseverance, aspirations, attitudes</b>							
Grit index (perseverance)			3.262*** (0.95)	3.283*** (0.96)	3.185*** (0.93)	3.350*** (0.95)	3.492*** (1.01)
Aspirations index			1.525** (0.24)	1.676** (0.30)	1.656** (0.30)	1.674** (0.32)	1.670** (0.32)
Attitude to school index			1.11 (0.26)	1.12 (0.25)	1.14 (0.26)	1.19 (0.26)	1.19 (0.26)
<b>School factors</b>							
Rural (Urban ref)				1.19 (0.64)	1.02 (0.58)	0.71 (0.42)	1.02 (0.62)
School SES Index				3.928** (1.88)	3.562** (1.81)	2.388* (1.26)	1.98 (0.97)
Class size				1.00 (0.01)	0.99 (0.02)	0.99 (0.02)	1.01 (0.02)
Language of instruction - English				1.14 (0.41)	1.07 (0.39)	0.99 (0.32)	0.73 (0.23)
Teacher missing from class: sometimes					0.92 (0.29)	0.95 (0.30)	0.94 (0.28)
Teacher missing from class: often					0.133** (0.11)	0.120** (0.09)	0.118** (0.09)
Teacher missing from class: non-response					0.99 (0.64)	0.98 (0.64)	1.05 (0.68)
% of classes with present teacher					0.84 (0.90)	1.56 (1.47)	0.65 (0.68)
Disruptions index					0.96 (0.03)	0.97 (0.03)	1.00 (0.04)
% educators with language specialisations						1.024** (0.01)	1.030** (0.01)
Standardized values of Gr.6 teacher test score						1.242* (0.16)	0.99 (0.14)
% of teachers indicating pupils use library							1.01 (0.00)
Strategic allocation of budget to books							2.322** (0.88)
Index of book presence in grade 6 classroom							1.465** (0.27)
Observations	1650	1650	1650	1650	1650	1650	1650
Wald $\chi^2$ (p-value)	37 (0.000)	93 (0.000)	206 (0.000)	382 (0.000)	500 (0.000)	663 (0.000)	928 (0.000)
<b>Source:</b> Leadership for literacy. <b>Notes:</b> Coefficients expressed in odds ratios. Standard errors are in parentheses and clustered at the school level. Estimations control for provincial indicators as well as three dummy variables to indicate if perseverance, attitudinal and aspiration indices are missing for the student but these are not shown. Significant at *p < 0.1; ** p<0.05; ***p < 0.001.							

**Table 5 Logistic regressions of academic resilience (Gains)**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
<b>Individual factors</b>							
Student SES index	1.342** (0.17)	1.230* (0.15)	1.17 (0.14)	1.17 (0.12)	1.179* (0.12)	1.17 (0.12)	1.17 (0.12)
Age	0.67*** (0.07)	0.67*** (0.07)	0.72** (0.07)	0.71*** (0.07)	0.71*** (0.07)	0.72*** (0.07)	0.72*** (0.07)
Girl	1.30 (0.27)	1.25 (0.26)	1.10 (0.23)	1.10 (0.23)	1.10 (0.24)	1.12 (0.24)	1.13 (0.23)
Attended Grade R	1.00 (0.34)	0.96 (0.33)	0.91 (0.31)	0.92 (0.31)	0.94 (0.32)	0.92 (0.31)	0.92 (0.31)
<b>Home background factors</b>							
Help with homework		0.566** (0.14)	0.589** (0.15)	0.589** (0.15)	0.578** (0.15)	0.582** (0.15)	0.591** (0.15)
Live with mother		0.86 (0.16)	0.87 (0.16)	0.86 (0.16)	0.86 (0.16)	0.85 (0.15)	0.86 (0.15)
Live with father		0.94 (0.13)	0.97 (0.13)	0.95 (0.12)	0.94 (0.13)	0.96 (0.12)	0.95 (0.12)
Either mother or father have a job		1.22 (0.27)	1.19 (0.27)	1.18 (0.27)	1.17 (0.26)	1.19 (0.27)	1.21 (0.26)
Both mother & father have job		1.570* (0.37)	1.483* (0.35)	1.477* (0.34)	1.465* (0.34)	1.47 (0.35)	1.46 (0.35)
Job not known		1.12 (0.45)	1.24 (0.54)	1.22 (0.52)	1.19 (0.51)	1.24 (0.54)	1.25 (0.54)
Learner has own story book		0.95 (0.14)	0.90 (0.13)	0.92 (0.13)	0.93 (0.13)	0.90 (0.13)	0.90 (0.13)
English spoken at home: sometimes		1.711** (0.41)	1.508* (0.36)	1.480* (0.34)	1.42 (0.32)	1.41 (0.33)	1.43 (0.33)
English spoken at home: always or almost always		2.378** (0.77)	2.092** (0.66)	2.061** (0.66)	1.944** (0.62)	1.894** (0.62)	1.953** (0.64)
<b>Perseverance, aspirations, and attitudes</b>							
Grit index (perseverance)			1.545*** (0.16)	1.548*** (0.17)	1.533*** (0.17)	1.550*** (0.18)	1.538*** (0.18)
Aspirations index			1.16 (0.13)	1.15 (0.12)	1.14 (0.12)	1.16 (0.12)	1.16 (0.12)
Attitude to school index			1.215* (0.13)	1.211* (0.13)	1.232** (0.13)	1.233** (0.13)	1.236** (0.12)
<b>School factors</b>							
Rural (Urban ref)				0.75 (0.32)	0.80 (0.38)	0.66 (0.31)	0.72 (0.32)
School SES Index				0.88 (0.25)	0.83 (0.23)	0.78 (0.22)	0.75 (0.22)
Class size				1.00 (0.01)	1.00 (0.01)	1.00 (0.01)	1.00 (0.01)
Language of instruction - English				1.08 (0.39)	1.08 (0.37)	0.91 (0.27)	0.87 (0.25)
Teacher missing from class: sometimes					1.09 (0.22)	1.14 (0.21)	1.11 (0.22)
Teacher missing from class: often					0.71 (0.21)	0.72 (0.21)	0.70 (0.22)
Teacher missing from class: non-response					0.85 (0.39)	0.87 (0.41)	0.90 (0.43)
% of classes with present teacher					2.49 (2.38)	2.89 (2.54)	1.95 (1.78)
Disruptions index					1.02 (0.05)	1.02 (0.05)	1.02 (0.05)
% educators with language specialisations						1.027** (0.01)	1.027** (0.01)
Standardized values of Gr.6 teacher test score						0.90 (0.11)	0.84 (0.10)
% of teachers indicating pupils use library							1.00 (0.00)
Strategic allocation of budget to books							1.46 (0.63)
Index of book presence in grade 6 classroom							1.08 (0.13)
Observations	1 429	1 429	1 429	1 429	1 429	1 429	1 429
Wald $\chi^2$	62	93	232	273	290	375	415
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

**Source:** Leadership for literacy. **Notes:** Coefficients expressed in odds ratios. Standard errors are in parentheses and clustered at the school level. Estimations control for provincial indicators as well as three dummy variables to indicate if perseverance, attitudinal and aspiration indices are missing for the student but these are not shown. Significant at \*p < 0.1; \*\* p<0.05; \*\*\*p < 0.001.

### Sources of confoundedness: Unobserved innate ability

One major limitation of the analysis presented here is that we do not control for innate ability. It may be that high-ability students also have well-developed socio-emotional skills where a two-way causal relationship exists between the two. For example, if persevering in academic pursuits is a more productive activity for high-ability students than for low-ability students, persevering in school would be more rewarding for high-ability students, causing them to be more perseverant. If there is such a correlation between these two traits, our models may simply be picking up the effect of high ability and not socio-emotional skills. Teachers and parents may also reinforce higher attitudes and aspirations for those students who display high-ability resulting in a two-way casual relationship between academic achievement and these individual traits.

A related concern is that self-reported questions require not only socio-emotional skills to reflect and answer the questions but also literacy skills. As Duckworth & Yeager (2015: 240) argue, “Beyond vocabulary, it cannot be assumed that students always understand the pragmatic meaning—the intended idea—of questionnaire items”. In this respect disentangling socio-emotional skills from academic ability can be difficult. The positive relationship between grit and test scores may be simply be detecting higher literacy or ability.

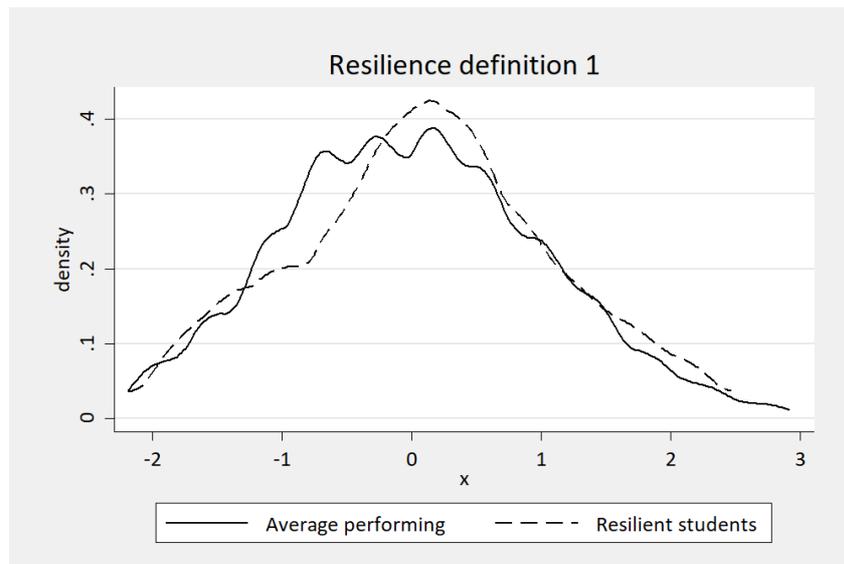
Although we cannot test for ability with the available data, the results from our second set of regressions, that is, the models where academic resilience is defined in terms of gains rather than levels, suggest we are not simply picking up innate ability. These results (Table 5) show that even for a sample characterised by very low pre-test scores, socio-emotional skills matter for learning improvements over time. In other words, the results suggest it is possible for a lower-ability student’s learning outcomes to improve between the pre- and post-test, and that socio-emotional skills explain a large part of this improvement over time. Students with low scores are also less likely to receive affirmation for their performance than higher performing students ruling out that a reverse causal relationship entirely drives the results we identify.

One way to test whether higher grit scores are simply reflective of higher literacy is to compare the distribution of negatively-worded grit scores for the resilient students and rest of the sample, respectively. These negatively-worded questions (largely reflecting the consistency-of-interest scale) are more challenging to answer. We argue that students with more literacy skills will be *more* prone to the biases associated with self-reported questionnaires, since they understand the content of the questions better than their less literate counterparts. Thus, we might expect more bias among more literate students. In this sense, being more prone to acquiescence (being agreeable to the statements regardless of their content (Diers 1964)) and social desirability bias may potentially proxy for higher literacy in the sample.

We can use this to test for the possibility that higher grit merely reflects higher ability. If more literate students are more prone to cognitive biases, then the distribution of grit scores (derived from negatively worded questions) for more literate students should lie to the left of typically-performing students’ distribution, since lower scores are attached to the right side of the scale for negatively worded questions. Figure 3 below shows there is no systematic distributional difference, suggesting higher scores on the grit scale among resilient students do not simply reflect better literacy among these students.

While we cannot rule out that innate ability might be driving some of the effects we see, these findings provides some evidence that innate ability is not all we are picking up, and that socio-emotional skills play a distinctive role in explaining academic resilience.

**Figure 3: Distribution of negatively worded items in grit index**



## V. Discussion

Applying a resilience framework to exceptional academic performance among students in South African township and rural schools adds to our understanding of the factors that likely protect students from the multitude of risks to their academic success. However, an important limitation of this research is that the relationships we find between the probability of resilience and the protective factors considered are correlational rather than causal. We cannot infer casual relationships, or the direction of causality, between a student's probability of being academically resilient and associated protective factors. In this sense, the results presented here should be considered exploratory in nature, with a call to future research to focus on gaining an understanding of the aetiology of resilience. Qualitative research is likely to aid in developing such an understanding (Wright & Masten, 2015). However, we make a case that the associations observed are not merely driven by differences in students' unobserved ability.

Despite these limitations, our results constitute an important first step in understanding the correlates of academic resilience in challenging school contexts in South Africa. We show that socio-emotional skills such as perseverance and aspirations are strong predictors of being academically resilient. These results are supported by an established literature on the importance of "non-cognitive" skills in determining academic success (see Kautz et al. (2014) for a comprehensive summary of this literature). Moreover, our results suggest socio-emotional skills are important in challenging school contexts, where students face a multitude of risks to their academic success. This notion is supported by other studies in the broader resilience literature, where socio-emotional skills are found to be particularly important for enabling children to successfully navigate challenging circumstances (Varela et al. 2013). From a research perspective, our results point to the importance of including measures of socio-emotional skills in future analyses of academic performance, since these skills may explain part of the performance differentials between students.

It is important to stress that our results do not imply resilience is located within the individual. A large body of resilience literature converges on the view that resilience is not a trait; rather, it results from "ongoing interactions among complex systems within the person and between person and environment" (Masten, 2012: 211). Our results can be explained within this framework: The two "individual-level" variables that have the strongest associations with the probability of being resilient

(perseverance and aspirations) are shaped by the social contexts (including families, schools, and broader communities) within which children are raised.

Policy implications emerge from these results, for as Kautz et al. (2014: 2) explain, “Skills are not traits set in stone at birth and solely determined by genes. They can be fostered.” This conclusion, based on decades of research on socio-emotional skills, in conjunction with the results we present here, may hold promise for education policy not just in South Africa, but for all education systems where students face challenging and under-resourced environments. Our results suggest that policies aimed at fostering socio-emotional skills among students in such contexts may have a lot of leverage in changing the learning trajectories of these students. Our results also imply that schools and teachers have a role to play in promoting exceptional achievement through managing time-on-task, allocating school budgets to books and hiring subject specialists.

A further important result emerges from the analysis presented here, namely the existence of very different levels of learning within the same classroom.<sup>12</sup> Such differential learning levels within the same classroom have been the subject of growing research interest in recent years, especially in developing country contexts, including sub-Saharan Africa (see for example Duflo et al. (2011)). Policy interventions must take account of this variation in preparedness, and look to studies of the effectiveness of programmes aimed specifically at dealing with this heterogeneity.

## **VI. Conclusion**

In this paper, we identified resilient students in a sample of township and rural primary schools in South Africa. Three key findings emerged. First, although academically resilient students are more likely to be identified in better performing schools, they are also present in very low-quality schools. Second, academically resilient students differ systematically from their non-resilient peers along a number of dimensions. Third, socio-emotional skills such as perseverance and aspirations may be particularly important for fostering academic resilience in the South African context. Understanding how some students manage to overcome the risks to their academic success that result not only from their socio-economically disadvantaged home backgrounds, but also the poor quality schools they attend, may aid in developing knowledge of how to support more students to do the same.

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<sup>12</sup> Our results echo those of Van der Berg and Louw (2006), which suggest a similar situation exists in South African classrooms.

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## Appendix

**Table A1: Description of variables and their formation: Individual factors**

<b>Individual factors:</b>	
Student SES index (z-score)	Index of 13 home-ownership assets combined using principal components analysis. Average taken across February and October. Home-ownership questions were pictorial in nature, reducing the need for strong literacy skills to answer these questions.
Age	Age in years
Girl	Indicator variable for whether student is female.
Attended Grade R	Indicator variable for whether child attended grade R.
Student has own story books	Indicator variable for whether the child identifies having any of his/her own story books at home.
Grit index (z-score)	Principal components index derived from the perseverance subscale of the grit index. Students were asked to respond to the following statements using a response scale: [That's not at all like me", "That's not really like me", "That's sometimes like me", "That's a lot like me"] 1) "Problems and challenges don't discourage me. When I make a mistake I get back up and try again." 2) "I work hard to do things well." 3) "I finish whatever I start." 4) "I can sit still for longer than other children in the class." 5) I do my schoolwork carefully." Cronbach's alpha value is low at 0.51, with an average inter-item covariance of 0.18.
Grit index imputed	Indicator for whether the grit index was imputed for the student. Using definition 1 of resilience, 86 (5%) non-resilient students' scores imputed, and 98 (2 %) resilient students' scores were imputed.
Aspirations index (z-score)	Principal components index derived from 3 questions asked of students: i) How important is it to get good marks in school? [Not important, a little important, very important.] ii) Do you think you'll pass matric? [No, Maybe, Yes] iii) Do you think you'll go to university after school? [No, Maybe, Yes] Cronbach's alpha value is 0.59, with an average inter-item covariance of 0.27
Aspirations index imputed (%)	Indicator for whether the aspirations index was imputed for the student. Using definition 1, 83 (5%) non-resilient students' scores imputed, and 4 (3%) resilient students' scores were imputed.
Attitude to school index (z-score)	A principal components index derived from 4 questions asked of students: i) How much do you learn in school every day? [Not very much, A little, A lot!] ii) How excited are you to go to school each day? [Not excited at all, A little excited, Very excited!] iii) How much do you think your teacher cares about you? [Not at all, A little, A lot!] iv) Do you feel like your teacher believes in you? [No, Yes, I don't know]. Cronbach's alpha value is 0.46, with an average inter-item covariance of 0.22
Attitude to school imputed	Indicator for whether the attitudes index was imputed for the student. Using definition 1, 83 (5 %) non-resilient students' scores imputed, and 4 (3%) resilient student scores were imputed. Cronbach's alpha value is 0.59, with an average interitem covariance of 0.27

**Table A2 Description of variables and their formation (Home and school factors)**

<b>Home factors:</b>	
Gets help at home with homework	Indicator variable for whether anyone in the child's household helps them with their homework.
Lives with mother	Indicator variable for whether the child lives with their mother.
Lives with father	Indicator variable for whether the child lives with their father.
<u>Parent employment:</u> Neither parent has a job (Reference category) One parent has a job Both parents have a job Not known (missing)	Indicator variables for the employment status of the student's parents.
<u>English spoken at home:</u> Never (Ref. category) Sometimes Always / almost always	Indicators for how often the child reports speaking English at home.
Rural (Reference category: Urban)	Indicator variable for rural vs. urban status of the school's location obtained from EMIS/Census data.
<b>School factors:</b>	
School SES index (z-score)	Class average of the Student SES index
Class size	Number of students who wrote the pre-test in each class.
School's language of instruction Gr1-3: English (%)	The schools' language of instruction in Grades 1-3 before a compulsory switch to English in Grade 4.
<u>Teacher missing from class:</u> Never (Ref. category) Sometimes Often Missing	These indicator variables vary at the student level and were derived from a questionnaire asking each student to identify "How often is your teaching missing from class?".
Proportion of utilised classrooms in the school with a present teacher (teaching or class engaged).	Fieldworkers walked around each school identifying the number of classrooms with i) a present teacher who was teaching, ii) a present teacher who was not teaching but students in his/her class were engaged in a learning activity, iii) a present teacher but students were not engaged in any learning activity, iv) absent teachers but students in the class and v) classrooms that were not utilised at all.
Disruptions index	The deputy principal, principal and grade 6 teacher were asked to identify on a scale of 1 - 5 ("Not at all" = 1 to "A huge amount" = 5), how much the school has been affected in the past year by any of the following: a) Damages to school infrastructure; b) Negative changes to school management; c) Water supply disruptions; d) Community protests; e) Strike action by teachers; f) Disruptions to work due to rules/go-slow/down tools by teachers; g) Conflict among staff; h) Violence amongst students; i) Break-ins, robberies or other criminal activity. The average response across the three teachers to each of the sub-questions is summed to obtain the disruptions index.
Proportion of language teachers with language specialisations	Proportion of teachers in a school identifying that they have "completed an ACE or short course in teaching language or reading" or that "English or African language was one of my subject majors"
Gr.6 teacher vocabulary test score (z-score)	Standardized scores of teacher's responses to a vocabulary test. The test consisted of 72 questions ranging from most to less frequently used words in English. This was the same vocabulary test provided to students along with the reading comprehension test. The lowest score was 16.5 and highest score 66.5 (maximum possible score 72).
Proportion of teachers indicating pupils use library weekly/daily	Proportion of teachers in a school responding "weekly" or "daily" to the question "How often do students in your class visit the school library?"
Percentage of schools allocating sufficient budget to books (%)	An indicator for whether 33% or more of 2016 or 2017 financial year provincial allocation to the school was spent on books.
Index of book presence in grade 6 classroom (z-score)	A principal components index derived from 6 questions asked of the grade 6 English language teacher on access to books/resources as well as an observational question on the number of different types of books observed in the grade 6 classroom by the fieldwork [i) English textbooks; ii) DBE workbooks; iii) Graded reader for grade 6; iv) Dictionaries; v) Novels; vi) Books of short stories; vii) Poetry books; viii) Dramas/plays; ix) Newspapers or magazines].

**Table A3: Sensitivity analysis – excluding English LOLT samples and using different cut-off points in defining resilience. Logistic regression of academic resilience (Odds Ratios)**

	Definition 1	Exclude English schools	Definition 1a	Definition 1b				
	Model 6	Model 7	Model 6	Model 7	Model 6	Model 7	Model 6	Model 7
<b>Individual factors:</b>								
Student SES index	1.166 (0.73)	1.142 (0.66)	1.016 (0.06)	0.978 (0.09)	1.041 (0.19)	1.024 (0.12)	0.837 (1.21)	0.822 (1.39)
Age	0.769 (1.43)	0.737 (1.47)	0.676** (2.05)	0.662** (2.07)	0.705* (1.93)	0.682* (1.84)	0.713** (2.52)	0.700** (2.66)
Girl	1.715** (2.48)	1.702** (2.31)	2.389** (2.25)	2.365** (2.17)	1.707** (2.47)	1.693** (2.25)	1.802** (3.05)	1.812** (3.03)
Attended Grade R	10.40** (2.09)	11.72** (2.14)	3.162 (1.07)	3.355 (1.11)	10.75** (2.13)	11.83** (2.17)	4.116** (2.26)	4.370** (2.32)
<b>Perseverance, aspirations, and attitudes:</b>								
Grit index (perseverance)	3.350*** (4.26)	3.492*** (4.33)	4.956*** (3.78)	5.165*** (3.73)	3.774*** (4.61)	3.821*** (4.55)	3.270*** (5.80)	3.361*** (5.98)
Aspirations index	1.674** (2.74)	1.670** (2.67)	2.004** (2.42)	1.954** (2.35)	1.702** (2.77)	1.679** (2.56)	1.598*** (3.70)	1.605*** (3.71)
Attitude to school & teacher index	1.185 (0.78)	1.189 (0.80)	1.800 (1.34)	1.798 (1.33)	1.226 (0.94)	1.231 (0.99)	1.400* (1.85)	1.410* (1.95)
<b>Home factors:</b>								
Help with homework	0.199*** (4.47)	0.204*** (4.28)	0.221** (2.88)	0.203** (2.94)	0.206*** (4.78)	0.217*** (4.47)	0.261*** (3.97)	0.263*** (3.87)
Live with mother	1.296 (0.75)	1.257 (0.64)	1.284 (0.62)	1.182 (0.42)	1.177 (0.50)	1.149 (0.40)	0.903 (0.42)	0.866 (0.58)
Live with father	0.760 (0.89)	0.743 (0.95)	0.471 (1.58)	0.486 (1.50)	0.842 (0.53)	0.790 (0.73)	0.817 (0.87)	0.811 (0.89)
Either mother or father have a job	1.137 (0.26)	1.201 (0.36)	0.835 (0.35)	0.844 (0.32)	1.139 (0.27)	1.223 (0.42)	0.965 (0.09)	0.961 (0.10)
Both mother & father have job	1.743 (1.17)	1.775 (1.17)	1.842 (1.11)	1.759 (1.00)	1.745 (1.19)	1.776 (1.20)	1.717 (1.48)	1.678 (1.41)
Job not known	0.119* (1.88)	0.124* (1.85)	0.371 (1.02)	0.317 (1.19)	0.114* (1.95)	0.119* (1.90)	0.136** (2.60)	0.134** (2.57)
Learner has own story book	0.770 (0.86)	0.785 (0.77)	0.578 (1.45)	0.634 (1.19)	0.772 (0.84)	0.780 (0.79)	0.930 (0.35)	0.958 (0.21)
English spoken at home: Sometimes	1.585 (1.14)	1.558 (1.11)	1.427 (0.79)	1.333 (0.63)	1.364 (0.75)	1.337 (0.71)	1.266 (0.73)	1.220 (0.62)
English spoken at home: Always/ almost always	4.616** (2.76)	4.627** (2.85)	2.621* (1.74)	2.877* (1.90)	4.215** (2.54)	4.356** (2.70)	3.035** (2.58)	2.983** (2.62)
<b>School factors:</b>								
Rural (Urban ref)	0.713 (0.58)	1.020 (0.03)	1.969 (0.86)	2.768 (1.22)	0.843 (0.28)	1.092 (0.15)	0.486 (1.44)	0.597 (1.07)
School SES Index	2.388* (1.65)	1.983 (1.40)	2.793 (1.57)	2.977** (2.20)	2.854* (1.91)	2.152 (1.55)	2.825** (2.49)	2.649** (2.74)
Class size	0.993 (0.42)	1.006 (0.29)	1.005 (0.27)	1.014 (0.67)	0.992 (0.48)	1.008 (0.39)	0.993 (0.56)	0.999 (0.07)
Language of instruction - English	0.992 (0.03)	0.729 (0.99)	N.A.	N.A.	0.946 (0.16)	0.728 (1.05)	0.767 (0.84)	0.623 (1.49)
Teacher missing from class: Sometimes	0.948 (0.17)	0.944 (0.19)	0.802 (0.55)	0.785 (0.60)	0.969 (0.10)	0.968 (0.11)	0.761 (1.23)	0.750 (1.37)
Teacher missing from class: Often	0.120** (2.72)	0.118** (2.81)	0.0587** (2.62)	0.0611** (2.55)	0.107** (2.78)	0.106** (2.85)	0.0802*** (3.87)	0.0797*** (3.93)
Teacher missing from class: Non-response	0.980 (0.03)	1.053 (0.08)	0.383 (1.13)	0.396 (1.15)	0.725 (0.54)	0.790 (0.41)	0.528 (0.82)	0.553 (0.78)
% of classes with present teacher	1.559 (0.47)	0.648 (0.41)	0.384 (0.76)	0.203 (1.19)	1.802 (0.61)	0.617 (0.45)	1.733 (0.67)	0.820 (0.22)
Disruptions index	0.965 (1.00)	1.002 (0.05)	1.034 (0.75)	1.080 (1.39)	0.967 (0.91)	0.997 (0.09)	0.990 (0.27)	1.017 (0.45)
% educators with language specialisations	1.024** (2.06)	1.030** (2.42)	1.034** (2.66)	1.034** (2.53)	1.025** (2.19)	1.031** (2.57)	1.023** (2.72)	1.026** (2.89)
Standardized values of Gr.6 teacher test score	1.242* (1.67)	0.993 (0.05)	0.670* (1.95)	0.652** (2.09)	1.205 (1.41)	0.958 (0.33)	1.155 (1.16)	0.993 (0.05)
% of teachers indicating pupils use library		1.007 (1.55)		1.012* (1.89)		1.009* (1.79)		1.008* (1.82)
Strategic allocation of budget to books		2.322** (2.23)		1.314 (0.58)		2.605** (2.50)		1.630 (1.43)
Index of book presence in grade 6 classroom		1.465** (2.10)		1.395 (1.53)		1.495** (2.26)		1.329** (1.97)
Observations	1650	1650	1398	1398	2028	2028	1721	1721
Wald $\chi^2$ (p-value)	663 (0.000)	928 (0.000)	694 (0.000)	932 (0.000)	698 (0.000)	981 (0.000)	998 (0.000)	1007 (0.000)

