When do textbooks matter for achievement? Evidence from African primary schools

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HIGHLIGHTS

- We gauge the impact of textbook access on test scores with a within-student analysis.
- We focus on primary school students in 11 sub-Saharan African countries.
- Textbook access has no effect on average.
- Only one form of textbook access – sharing – has an impact at the margin.
- Textbook sharing positively affects the achievement of the richest students.

ARTICLE INFO

ABSTRACT

Using a within-student analysis, we find no average impact of textbook access (ownership or sharing) on primary school achievement. Instead, it is only for students with high socioeconomic status that one form of textbook access – sharing – has a positive impact.

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1. Introduction

Improving access to textbooks via ownership or sharing seems an obvious way to increase student achievement in African countries where resources are particularly limited. Retrospective studies of both Francophone and Anglophone African countries find significant positive correlations between access to textbooks and student test scores in both reading and mathematics.[1] However, such analyses are at risk from bias due to omitted variables that may influence both textbook access and educational outcomes. Alternatively, randomized experiments have allowed researchers to avoid such endogeneity biases and isolate the impact of schooling inputs on learning outcomes. Glewwe et al. (2009) analyze the only randomized experiment conducted in Africa that focuses on the impact of textbook access, specifically sharing, on pupils' achievement. They find that, due in part to overly ambitious curricula not suited for the average student, textbook sharing in Kenya improves test scores only for those students who were already high achievers prior to the intervention.[2]

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[2] This finding contrasts with the results by Jamison et al. (1981). Relying on a randomized experiment in Nicaragua, these authors show that allocating a textbook to each student improves mathematics test scores by one-third of a standard deviation on average. This diverging conclusion may be due to the fact that the curriculum is less ambitious in Nicaragua than in Kenya. Moreover, the average student in Nicaragua is better off than his/her Kenyan counterpart. Because he/she faces lower barriers to learning, textbook access may have a greater positive

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[1] For evidence that is both recent and comprehensive, see Fehrler et al. (2009).

Table 1
Summary statistics.

	Mean	Standard deviation	Observations		Mean	Standard deviation	Observations
Panel A: Dependent variable				Teacher has a wall chart	0.61	0.49	2,659
				Teacher has a cupboard	0.41	0.49	2,659
Student mathematics score	494.04	92.26	36,829	Teacher has bookshelves	0.27	0.44	2,659
Student reading score	498.36	96.58	37,062	Teacher has a class library	0.40	0.49	2,659
Panel B: Student and subject-specific characteristics				Teacher has a table	0.69	0.46	2,659
Student has access to a mathematics textbook	0.88	0.33	37,062	Teacher has a chair	0.70	0.46	2,659
Student has access to a reading textbook	0.89	0.31	37,062	Panel E: Reading teacher characteristics			
Student owns a mathematics textbook	0.78	0.41	21,049	Gender (female)	0.53	0.50	2,713
Student owns a reading textbook	0.79	0.40	19,631	Age	35.36	8.24	2,747
Student shares a mathematics textbook	0.78	0.42	20,589	Qualification (primary)	0.12	0.32	2,747
Student shares a reading textbook	0.81	0.39	21,458	Qualification (junior secondary)	0.20	0.40	2,747
Panel C: Student-specific characteristics				Qualification (senior secondary)	0.47	0.50	2,747
Student home possession	0.37	0.24	37,062	Qualification (A-level/tertiary secondary)	0.21	0.41	2,747
Panel D: Mathematics teacher characteristics				Test score	30.75	5.66	2,729
Gender (female)	0.46	0.50	2,644	Frequency of correcting homework	2.55	0.37	2,656
Age	35.38	8.13	2,679	Importance of encouraging students	2.76	0.48	2,747
Qualification (primary)	0.11	0.31	2,679	Frequency of assessing students	5.28	0.90	2,747
Qualification (junior secondary)	0.21	0.41	2,679	Teacher has a writing board	0.94	0.23	2,731
Qualification (senior secondary)	0.50	0.50	2,679	Teacher has chalk	0.94	0.24	2,731
Qualification (A-level/tertiary secondary)	0.19	0.39	2,679	Teacher has a wall chart	0.60	0.49	2,731
Test score	25.75	6.84	2,625	Teacher has a cupboard	0.40	0.49	2,731
Frequency of correcting homework	2.65	0.34	2,657	Teacher has bookshelves	0.27	0.44	2,731
Importance of encouraging students	2.77	0.47	2,646	Teacher has a class library	0.43	0.49	2,731
Frequency of assessing students	4.88	0.91	2,660	Teacher has a table	0.69	0.46	2,731
Teacher has a writing board	0.94	0.24	2,659	Teacher has a chair	0.70	0.46	2,731
Teacher has chalk	0.93	0.25	2,659				

Notes: Our data include 37,062 students, 2,679 mathematics teachers and 2,747 reading teachers. In Panel B, the mean number of students with access to a textbook is the number of students with textbook access divided by the total number of students in the dataset (37,062). For mathematics and reading, 88% and 89% of students have textbook access, respectively. By subject (not reported here), 43% share a mathematics textbook while 45% own one, and 47% share a reading textbook while 42% own one. Also in Panel B, the mean number of students owning a textbook is the number of students owning a textbook divided by the number of students who either own a textbook or do not have textbook access. Similarly, the mean of students sharing a textbook is the number of students sharing a textbook divided by the number of students who either share a textbook or do not have textbook access.

Our paper aims to improve upon this result in two ways. First, we do not restrict our attention to the impact of textbook sharing alone. Instead, we expand our analysis to include textbook ownership, as these two forms of textbook access are expected to create differential effects. For instance, Frölich and Michaelowa (2011) demonstrate, based on African data, that textbook sharing is associated with positive externalities (notably through knowledge sharing) which simple textbook ownership does not allow. Second, instead of relying on only one African country, we cover 11 sub-Saharan African countries from the second round of the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ) survey from 2005.[3] Our identification strategy treats endogeneity through a within-student analysis (across subject rather than across time). Doing so ensures that there are no unobserved student characteristics which are correlated with both textbook access and achievement, at least when these unobservables remain constant across subjects.[4] Moreover, with a

rich set of controls at the teacher level, we mitigate the possibility of unobserved teacher characteristics being correlated with both textbook access and test scores.

2. Data

The SACMEQ II survey administers questionnaires and standardized reading and mathematics examinations to both students and teachers to compare cross-country achievement in the final year of primary school. We measure achievement with the scores obtained by students on standardized tests in reading and mathematics. For textbook access we use an indicator variable which is equal to 1 if a student has access to a textbook in mathematics or reading (whether via ownership or sharing) and 0 if a student has no access to a textbook. We then disaggregate this variable into two dummies: one that is equal to 1 if a student owns a textbook (and 0 if a student has no access to a textbook) and another that is equal to 1 if a student shares a textbook (and 0 if a student has no access to a textbook). We do so in order to examine the potentially different effects of textbook ownership versus sharing.

Glewwe et al. (2009) find that textbook access in Kenya improves test scores only for those students who were already high achievers before receiving textbook access. However, socioeconomic status (SES) is known to be an excellent predictor of academic ability. In sub-Saharan Africa, for instance, Lee et al. (2005) find that a pupil with a high SES strongly outperforms his/her low SES counterparts. We therefore test, later in the analysis, whether textbook access may make a significant difference only for students from the most privileged backgrounds. We do so by interacting our indicators for textbook access with student socioeconomic status, a proxy derived from an average of 14 home possessions (a newspaper, magazine, radio, television, VCR, cassette, telephone, refrigerator, car, motorcycle, bicycle, water, electricity, and table) present in each student's household.

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impact on his/her achievement. The same reasoning applies to Hungi (2008), who shows that textbook ownership positively impacts test scores in mathematics and reading in Vietnam, as well as to Tan et al. (1999), who demonstrate that providing teachers with learning materials leads to a significant decline in dropout rates in the Philippines.

[3] These include Botswana, Lesotho, Kenya, Malawi, Mozambique, Namibia, Seychelles, Swaziland, Tanzania, Uganda, and Zambia. We are forced to exclude Mauritius and South Africa as they report no test scores for teachers, a crucial control variable.

[4] To be sure, a student fixed effect approach does not allow us to control for students' subject-specific propensities for achievement. However, this potential endogeneity problem is expected to be weak, given that our data reveal a very strong correlation (equal to 76%) between students' achievements across subjects. This correlation suggests that students' unobserved propensities for achievement are constant across subjects rather than subject specific.