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Assessing teachers' pedagogical practices and students' learning outcomes in science and mathematics across primary and secondary school level: A nationwide study (2018-21)

Sadia Muzaffar Bhutta

Aga Khan University, sadia.bhutta@aku.edu

Nusrat Fatima Rizvi

Aga Khan University, nusrat.fatimarizvi@aku.edu

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Assessing teachers' pedagogical practices and students' learning outcomes in science and mathematics across primary and secondary school level: A nationwide study (2018 – 21)

Aga Khan University, Institute for Educational Development, Pakistan

Researchers: Dr Sadia Muzaffar Bhutta | Dr Nusrat Fatima Rizvi

What was this study about?

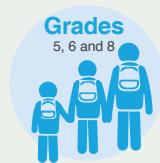
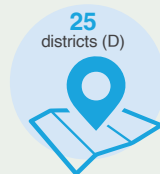
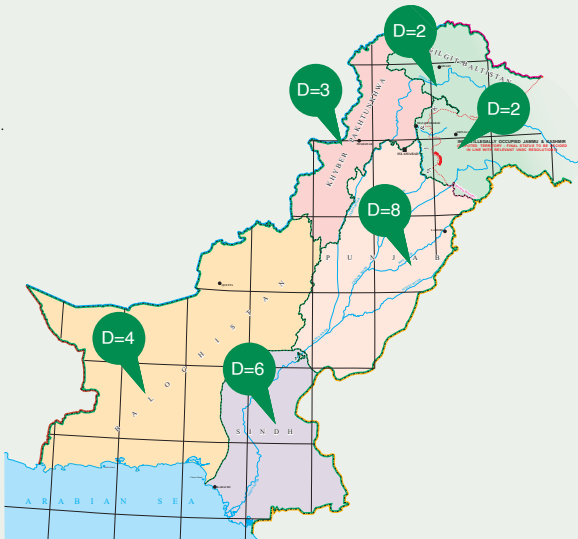
The study is about examining the relationship between ways of teaching and learning outcomes in science and mathematics in elementary grades. It also explored teachers' actions, dispositions and decisions underlying their teaching practices.

How was this study undertaken?



Who participated in this study?

Multi-stage sampling technique



How did we collect and analyse information?

3-point classroom observational scale (COS)



Science and Mathematics Achievement Tests



Interviews



Multiple Linear Regression

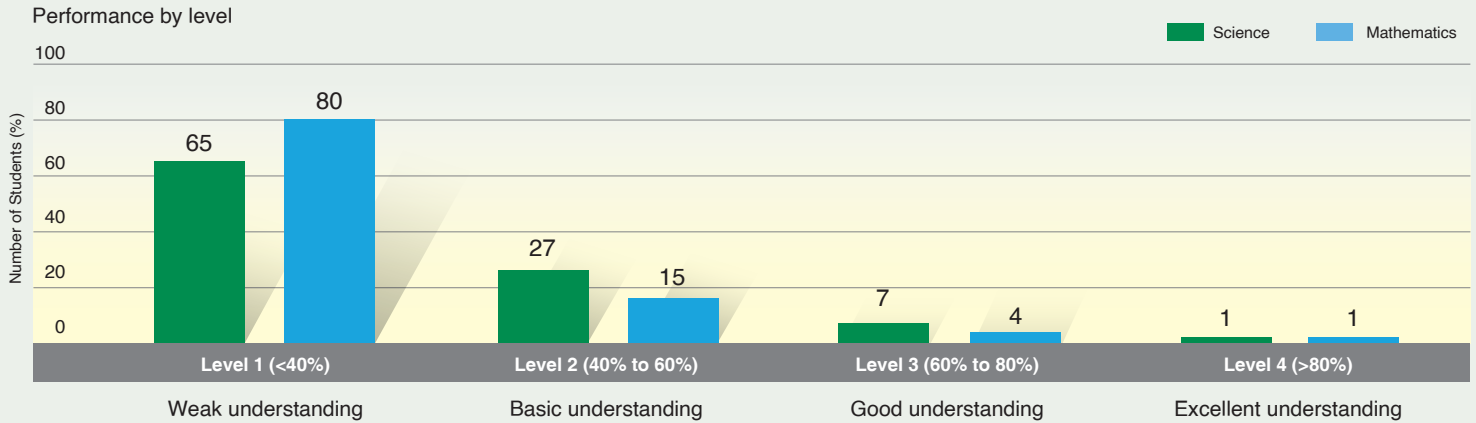


Thematic Analysis



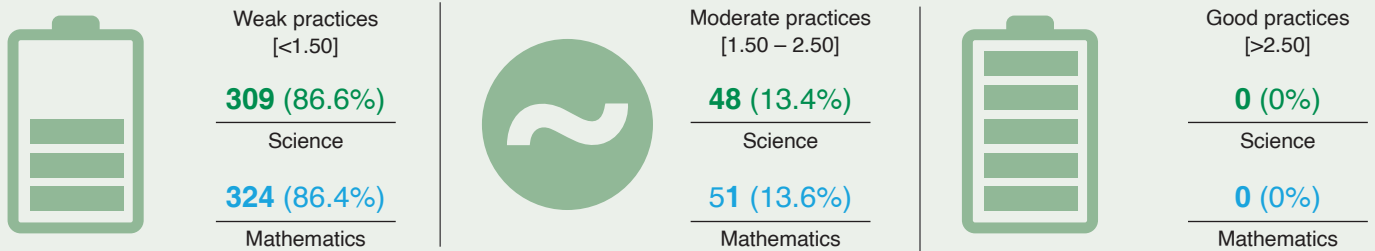
What did we find?

Students' performance in science and mathematics



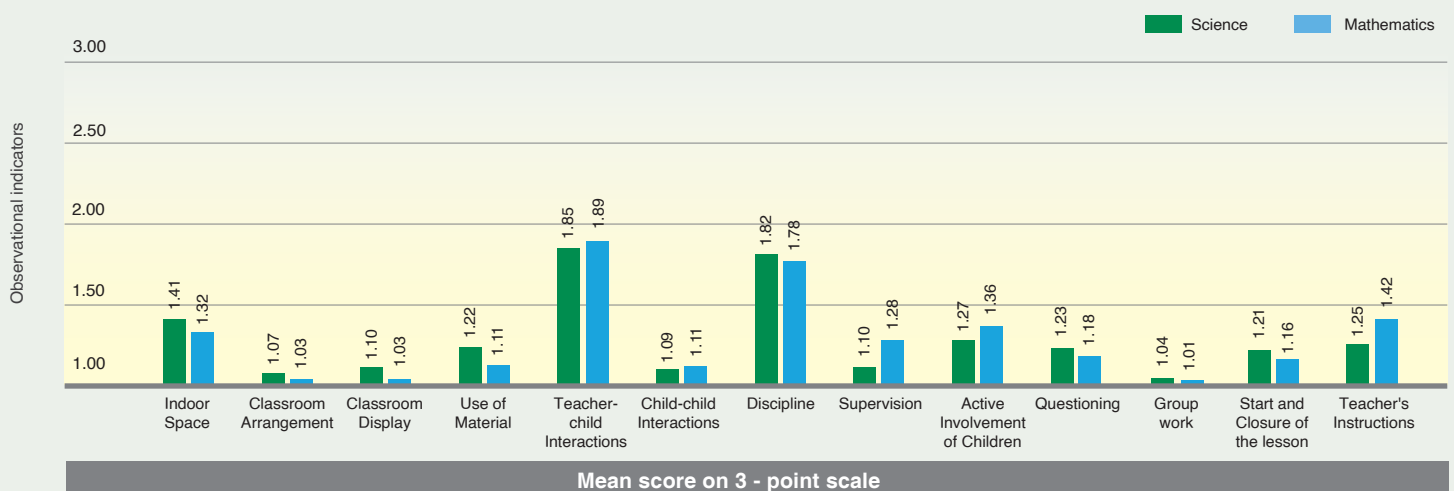
Generally, majority of the students fell in the category of level 1 and 2 demonstrating weak and basic understanding, respectively. Evidently, less than 10% of the sample students reached the good and/or excellent level in both target subjects regardless of grades.

Quality of teaching in science and mathematics



Regardless of subjects, a majority of lessons observed have a Classroom Observation Scale (COS) score of less than 1.5 (weak classroom practice). It is noteworthy that 13% of the observed lessons have moderate practices. None of the teachers demonstrated 'good' classroom practice in any subject.

Classroom practices of science and mathematics across Pakistan



The overall comparison of COS items across subjects revealed that only two aspects of classroom practices (i.e. teacher child interaction and discipline) fell in the category of moderate practices. A relatively higher score in teacher-child interaction indicated that teachers interacted with some of the children in supportive manner in some instances. Moreover, a majority of the teachers were observed to be maintaining enough control without using harsh discipline techniques.

Predictors of students' performance

Predictors		Science	Mathematics
		Beta coefficient	Beta coefficient
	(Constant)	–	–
Pedagogical quality	Classroom practice score (3-point scale)	0.066***	0.038***
Teacher	Gender (Male = 1; Female = 2)	0.019	0.028
	Academic qualification (Bachelor = 1 & Masters = 2)	-0.012	0.040***
	Professional qualification (No = 0; Yes = 1)	-0.084***	-0.021
	Teaching experience (in years)	-0.069***	0.008
Class	Instructional time (in minutes)	0.015	0.069***
	Consistency in language (Inconsistent = 0; Consistent = 1)	0.177***	0.076***
	Grade 6 [^]	0.123***	-0.226***
	Grade 8 [^]	-0.179***	-0.388***
Parents	Father Education ^{^^} (High School)	0.009	0.006
	Father Education (Bachelor)	0.031**	0.043***
	Father Education (Master)	0.037**	0.044***
	Mother Education ^{^^} (High School)	-0.004	-0.004
	Mother Education (Bachelor)	0.070***	0.040***
	Mother Education (Master)	0.099***	0.065***
Student	Student Gender (Boy = 1; Girls = 2)	0.044**	0.014
	Student Age	-0.072***	-0.056***
School	School Type (Public = 1; Private = 2)	0.217***	0.158***
Region	Punjab ^{^^^}	0.266***	0.378***
	Sindh	0.002	0.059***
	Khyber Pakhtunkhwa	0.018	0.014
	Gilgit Baltistan	0.033**	0.018
	Azad Jammu & Kashmir	-0.026*	0.009
		(R²= 0.32) [F(23, 6708) = 134.34; p<0.001]	(R²= 0.33) [F(23, 7436) = 157.84; p<0.001]

Reference Category: [^]Grade 5; ^{^^}No or basic schooling; ^{^^^}Balochistan *p<0.05; **p<0.01; ***p<0.001

- Teaching quality contributes significantly to student performance, over and beyond other factors both in science and mathematics.
- Regardless of subject, younger students (grades 5/6), from Punjab, enrolled in private schools, and, having parents with at least a Bachelors degree tend to perform significantly better than their counterparts.
- Girls are more likely to perform better than boys in science while mathematics does not illustrate any gender differentiation.
- In both subjects, consistent use of the 'same language' across textbooks, instructions and assessment leads to better students' performance.
- Teachers' academic qualification has contributed positively in students' performance only in mathematics.
- The two models developed for science and mathematics explained 32% and 33% of the total variation in students' performance, respectively.

Qualitative findings: Teachers' actions, dispositions and decisions underlying their teaching practices

Science



Classroom arrangement is used as a tool for instilling teachers' power



Content delivery is the focus of teaching



Provision of teaching materials does not promote engaged learning



Lack of self-reflection among teachers



Activities are not used for active involvement of students

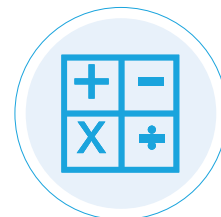


Factors for low performance (resources, absenteeism, parental involvement, medium of instruction)

Mathematics



Mathematics is not the forte of every child



Students' doing practice sums is a pre-dominant learning strategy



Teachers' exposition is a dominant teaching strategy



Teachers rely on intangible measures to assess students' learning



Factors for low performance (learning gap, teachers' qualification, content knowledge, parental involvement)

Recommendations for policy and practice

- Provide state-of-the-art opportunities for professional development of teacher educators.
- In-service teachers need rigorous and regular continuous professional development to enrich their pedagogical capabilities and to stay abreast with knowledge advancements.
- The gap between 'intended' and 'implemented' curriculum needs to be bridged by using a comprehensive approach of whole-school improvement (e.g., teachers' continuous professional development, community engagement, school leaders' professional development as instructional leaders).
- There should be synchronisation of language across textbooks, classroom instructions and assessment to reap

maximum benefits of recent reforms in the country. Especially, if the language of education is English, efforts need to be made to improve teachers' own competency of language being used as the medium of instruction.

- Findings of the study related to parents' education call for improving access and quality of higher education along with strengthening the provision of the lower levels of education so that the future generations benefit from informed involvement of highly educated parents in their academic endeavours.
- The study also calls for instantaneous yet targeted interventions to improve the quality of science and mathematics education in the country. In this regard, researchers need to plan, implement and evaluate the impact of such interventions to inform education policies and practices.

Final thought

"Teachers are the primary implementers of any innovation or reform. A teacher's role cannot be overstated in the context of school improvement. School improvement, and therefore student improvement, depends on what teachers do and think. It is as simple and as complex as that" (Fullan, 1991, p.117).