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ABSTRACT

This paper challenges the current conventional policy view of time as a critical resource for learning. After reviewing literature on the subject, the paper analyzes the contribution of instructional time to learning using data from primary schools in Pakistan. The principal finding reported in this paper is that the amount of contact time between teachers and students in Pakistan appears to have no influence on student achievement as measured in mathematics and science tests. The discussion of this finding points to the need of having solid evidence looking at the particular context of each educational system. The risks implicit in recommending policies of universal validity on the basis of limited research evidence. The prevalent policy view on instructional time would seem to assume that time of contact between teachers and students is a process of constant quality and infinite elasticity. This paper suggests that quality of teacher-student interactions is probably more relevant than the total amount of time allocated to instruction. (DB)

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Time and Opportunity to Learn in Pakistan's Schools¹.

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Presented at the Northeast Universities Development
Consortium Conference
Harvard University, October 4 1991

Current policy views on education favor extending the duration of the school year and of the school day. Given the financial constraints facing education systems in most countries this policy perspective has critical implications: if an education system chose to implement policies to extend the amount of time allocated to education are the increases in work hours expected of teachers to be appropriately compensated? if so, where would the resources come from? if not, what would the implications be for living standards of teachers who in many countries already have to make ends meet by seeking additional remuneration working in the hours they are not teaching?

Given these critical implications of the subject it is worth looking for evidence that would document the type and magnitude of benefits that could be expected from expanding time allocated to instruction.

This paper challenges this conventional policy view of time as a critical resource for learning. After reviewing some of the literature on the subject, the paper analyzes the contribution of

¹ I appreciate the comments and suggestions of William Cummings, Noel McGinn, Abby R. Riddell and Donald Warwick to a draft of this paper. The responsibility for the views, errors or omissions in this paper is mine alone.

instructional time to learning using data from primary schools in Pakistan. The principal finding reported in this paper is that the amount of time of contact between teachers and students in Pakistan appears to have no influence on student achievement as measured in math and science tests. The discussion of this finding points to the need of having solid evidence looking at the particular context of each education system and to the risks implicit in recommending policies of universal validity on the basis of limited research evidence. The prevalent policy view on instructional time would seem to assume that time of contact between teachers and students is a process of constant quality and of infinite elasticity, this paper concludes suggesting that quality of teacher-student interactions is probably more relevant than the total amount of time allocated to instruction.

Common Policy Views on Instructional Time

Current views on educational policy advocate a longer school calendar and longer school days on the premise that these steps would increase the amount of time available for children to learn. In the United States, for instance, the influential report A Nation At Risk, after commenting on the comparatively lesser amount of time students spent in schools in the US relative to other industrialized nations, recommended "more effective use of the existing school day, a longer school day, or a lengthened

school year"².

A recent World Bank policy paper on Primary Education makes the following general recommendation to improve education in developing countries:

"Research from a number of countries has shown that the amount of time available for academic studies is consistently related to how much children learn in school. In general, the more time teachers spend actually teaching, the more students learn. While classroom instruction is valuable for all students, it is especially important for poor students, whose out-of-school time and opportunities for learning are limited.

Three factors determine the annual number of hours allotted to study any subject in school: the length of the official school year in hours, the proportion of these hours assigned to the subject, and the amount of time lost through school closings, teacher absences, student absences, and miscellaneous interruptions."³

This report goes on to recommend increasing official time (increasing the school calendar) and maintaining official time, ensuring: 1) that schools remain open during official hours, 2)

²Gardner, P. et al. 1983. A nation at risk: The imperative for educational reform. An open letter to the American People. A report to the National and the Secretary of Education. Washington, D.C. National Commission on Excellence in Education.

³ World Bank. 1990. Primary Education. A World Bank Policy Paper. Washington, D.C.

that children and teachers are in attendance, 3) that distractions are minimized, and 4) that instruction is feasible under inclement weather conditions.

A recent research report of UNESCO's International Institute for Educational Planning on the length of the primary education school year in developing countries is further testimony of current policy interest in this subject⁴.

Implicit in these views is the assumption that time allocated for instruction defines the opportunity for children to learn. Opportunity to Learn is exactly how Carroll's model of school learning named the amount of time available to learn a given content⁵.

Research evidence on the contributions of time to learning.

Although the prevalent policy view about the importance of time has intuitive appeal, the research evidence on the subject is less than conclusive.

Studies in the United States on the impact of the length of the school year on student achievement yield contradictory results. One study found a significant positive impact of hours of schooling per year and student achievement in reading and

⁴ "An IIEP mini-survey on the length of the primary education school year" IIEP Newsletter. IX(3):11. September 1991.

⁵ Carroll, J.B. 1963. "A model of school learning" Teachers' College Record. 64:723-733.

math⁶, another study in schools in poor areas found that the length of the school year was unrelated to student achievement in basic subjects⁷.

Studies examining the contribution of time allocated to specific subjects to achievement in those subjects have also produced contradictory findings. Some studies found no impact of time allocated to reading instruction and reading ability⁸. Another study observed the same lack of effect of instructional time on social studies⁹. Other studies have found a positive effect of instructional time on student achievement in reading¹⁰. A review of the role of instructional time concludes that "most of the results tend to be non-significant"¹¹.

⁶ Harnischfeger, A. and D. Wiley. 1976. "The teaching-learning process in elementary schools" Curriculum Inquiry. 6:5-43.

⁷ Lee, D. et al. 1981. "Successful practices in high-poverty schools" Report No 16. The study of the sustaining effects of compensatory education on basic skills. System Development Corporation. Santa Monica.

⁸ Guthrie, J. et al. 1976. Impacts of instructional time in reading. International Reading Association. Newark. Delaware. and Felsenthal, H. and I. Kirsch. 1978. "Variations in teachers' management of and time spent on reading instruction: Effects on student learning" Presented at the Annual Meeting of the American Educational Research Association. Toronto.

⁹ Smith, N. 1976. The relationship between time allotted to social studies instruction and student achievement in fifth grade classes of the tri-county area of Southern Maryland. Doctoral Dissertation. University of Maryland 1976.

¹⁰ Kidder, S. et al. 1975. "Quantity and quality of instruction: empirical investigations" Presented at the American Educational Research Association. Washington, D.C.

¹¹ Rosenshine, B. and D. Berliner. 1978. "Academic time engaged" British Journal of Teacher Education. 4:3-26.

A cross-national study of the factors influencing achievement in mathematics, the first of the series of studies carried by the International Association for the Evaluation of Educational Achievement, found that the number of hours per week (instruction as well as homework) spent in mathematics instruction had only a weak association with student achievement in that subject¹². At a later date, a symposium at the Harvard Graduate School of Education to examine the policy relevance of the IEA studies concluded: "Time, that is, the years of study, the number of hours of instruction, and the time spent in homework per week, proved to be important."¹³.

The reports of the IEA studies found "opportunity to learn" a more promising construct than instructional time¹⁴. This variable was operationalized as the teacher's response to the percentage of children in the class who had had an opportunity to learn every item in the achievement test administered in the study. It introduced the notion that there were three levels of implementation of the curriculum: the curriculum as planned, the

¹² Postlethwaite, N. et al. 1975 "Methodology for the evaluation of education attainments: a project of the IBRD and IIEP" mimeog.

¹³ Postlethwaite, N. 1973. "A selection from the overall findings of the IEA study in Science, Reading Comprehension, Literature, French as a Foreign Language, English as a Foreign Language and Civic Education" Paper presented at the Harvard Graduate School of Education.

¹⁴ Notice that the IEA team reconceptualized 'opportunity to learn' to refer to the match between the subject tested and the content taught by the teacher, this is no longer the definition of J.B. Carroll for 'allocated time'.

curriculum as taught (opportunity to learn) and the curriculum as learned (student achievement).

A review of the IEA evidence prepared for the National Commission on Excellence in Education concludes that instructional time is positively related to student achievement¹⁵.

An extensive document which reviews the research literature prepared as background for the World Bank Policy Paper on Primary Education reviewed studies on Iran, India, Thailand, Nigeria and Indonesia for the section on instructional time. All of these studies supported the view that instructional time was positively related to student achievement¹⁶. Another review of the education research literature in developing countries identified 14 studies covering the role of instructional time, 12 of which showed a positive effect on achievement¹⁷. The measures of time included length of the school day, hours of school offered per year, number of class periods in academic courses and number of hours of instruction per subject per year.

More recent studies have refined the definition of instructional time to "academically engaged time" or "academic

¹⁵ Holsinger, D. 1982. "Time, content and expectations as predictors of school achievement in the USA and other developed countries: A review of IEA evidence". Prepared for the National Commission on Excellence in Education. Washington, D.C.

¹⁶ Lockheed, M. and A. Verspoor. 1989. Improving Primary Education in Developing Countries: A Review of Policy Options. Washington, D.C. World Bank. Manuscript. p. 63.

¹⁷ Fuller, B. 1987. "What school factors raise achievement in the Third World?" Review of Educational Research 57(3):255-292.

learning time". The Beginning Teacher Evaluation Study¹⁸, a 6 year longitudinal study, expanded academic learning time to include not only the amount of time devoted to teaching, but the amount of time the student is engaged in academic tasks and the consequences of the student performance. This study showed that achievement in mathematics and reading is only partially explained by allocated and engaged time, after controlling for entry-level ability. This research on Academic Learning Time shows the most promise among the various approaches to study the role of time discussed here. The definition of academic learning time is as much concerned with how time is utilized in the classroom as it is with the amount of time available. Academic learning time is defined as "the amount of time a student spends engaged in an academic task that s/he can perform with high success" ¹⁹. The prevalent policy views discussed earlier, on the contrary, emphasize the amount of time available or allocated time.

A review of the literature on time prepared for the National Commission on Excellence on Education (which produced A Nation at Risk) shows that the relationship between allocated time and the time students are actually engaged in learning is weak:

"Variability in the use of allocated time in classrooms and

¹⁸ Fisher, C. et al. 1980. "Teacher behaviors, academic learning time, and student achievement" in Denham, C. and A. Lieberman (eds) 1980 Time to learn. National Institute of Education. Washington, D.C. pp 7.32.

¹⁹ Ibid p. 8.

schools implies that studies of the effect of allocated time are of limited value for understanding the likely effect of increasing the school term or day. Allocated time measures are too far removed from the variable of interest -time engaged with instruction- to unambiguously tell us about their impact"²⁰

A recent review of literature on instructional time also concludes that allocated time, in itself, has little influence on student achievement²¹.

In sum, the available research evidence is less than conclusive about documenting a positive impact of instructional time on learning. A fundamental issue at the core of the discrepancies is probably the many different ways in which time has been measured: length of school days, number of school days, hours of instruction, and also (but probably less important) the different areas in which student achievement has been measured. Regrettably most the systematic reviews of the literature obviate discussions on the role of how instructional time has been operationalized or of effect sizes.

²⁰Karweit, N. 1985. "Should we lengthen the school term?"Educational Researcher. June-July. 14(6):9-15.

²¹ Nelson, S. 1990. "Instructional Time as a factor in increasing student achievement". Northwest Regional Educational lab. Portland. Oregon.

Additional evidence.

This paper examines the contribution of time to student achievement using data from a national sample survey of schools in Pakistan. The data collected included a multiple option test in math and science for students in grades 4 and 5, and interviews with teachers and the headteachers in the school. A brief questionnaire was also administered to the students taking the test.

The analysis discussed in this paper is based on various answers in the teacher interview related to time and in their effect on the average achievement of the students in the class taught by that teacher. The validity of these findings rests on the assumption that variations in student achievement across classes at one point in time are equivalent to changes in the achievement of classes between two points in time, so that causality from teacher responses and student achievement can be inferred from ex-post facto differences across teachers. Another assumption on which the validity of these findings rests is that teacher reports accurately portray their behavior.

Both of these assumptions could be challenged, in response to those challenges is the statistical power derived from a sample of about 1000 teachers and over 11,000 students. The standard error for the population is very small in all indices computed from the sample. For example, for the achievement scores the following averages were obtained:

	=====SAMPLE=====			POPULATION
	Mean	Standard Dev.	n	Population Error
Math 4	11.80	6.28	427	0.30
Math 5	12.52	5.57	410	0.27
Science 4	13.88	5.44	426	0.26
Science 5	16.51	6.39	431	0.31

The following sections will examine the effect on student achievement of teacher and student absences, time of contact with teachers, time allocated to teach the subject (math and science) and the relationship between time allocated and coverage of the curriculum.

Teacher Absences.

The conventional policy view suggests that instruction is fostered by the presence of a teacher. The survey had two measures of teacher absenteeism. One was an observation of which teachers were absent on the day the research teams visited the schools. The second was a series of questions to the teachers asking them to report the number of days they had been absent for a number of reasons (health, administrative, etc.)

If we assume that the teachers who were absent on the day of the interview are more likely to be absent than the other teachers, we should expect that their students scored, on average, lower in all subjects than students whose teachers were present on the day of the interview.

In the schools visited 10% of the teachers of grades 4 and 5 were absent on the day of the interview. However, the achievement of their students was not significantly different from the

achievement of their counterparts who were present.

	Teacher Present		Teacher Absent	
	Mean	St. Dev	Mean	St. Dev
Math 4	11.8	6.3	11.9	6.7
Math 5	12.5	5.6	11.7	5.8
Science 4	13.9	5.4	13.3	4.5
Science 5	16.5	6.3	15.5	5.6

Similarly, the number of days teachers said they were absent (15 days on average, with a standard deviation of 17) is not related to the achievement of their students.

Total absences

Value Label	Frequency	Percent	Valid Percent	Cum Percent
0-7	206	22.0	32.4	32.4
8-14	187	20.0	29.4	61.7
15-21	139	14.9	21.8	83.6
21-up	105	11.2	16.4	100.0
	299	32.0	Missing	
Total	936	100.0	100.0	

Valid cases 637 Missing cases 299

Student Absenteeism.

About 20% of the students in each of the classes studied was absent on the day of the interview. This figure was not related to the achievement of the students who were tested. Of course, we have no way of knowing whether the achievement of the students who were absent was different from the achievement of those who were present, nor can we ascertain whether the absent students are students who are typically absent or who were just absent that day.

The student questionnaire contained several questions related to time. One question asked the students how many days they had been absent from school the week prior to the visit by the researchers. Their answers to this question averaged half a day (with a standard deviation of one day) but had a very small relationship to student achievement²².

Another question to the students asked if the school was located in the same village in which they lived, 22% of the students in each grade replied no to this question, however, there were no significant differences in the achievement scores of students who went to school in their own villages and those who came from other villages.

Another question asked the students to indicate whether the school was close by, far away or very far away from their home. There were no differences in the achievement of those who answered either of the two first choices, but the achievement of those who answered 'very far away' was consistently lower for math in both grades and for science in grade 4. As the following table shows, however, the differences are marginal (a little over a tenth of a standard deviation).

²² The Pearson R was 0.03 for math in grade 4 and 0.04 for math in grade 5.

Math 4	Mean	St.Dev.	n
Close by	12.37	8.07	3192
Far Away	13.04	7.80	2228
Very Far Away	11.55	7.70	452

Science 4	Mean	St.Dev.	n
Close by	14.38	7.47	3196
Far Away	14.96	7.21	2239
Very Far Away	13.81	7.07	450

Math 5	Mean	St.Dev.	n
Close by	13.36	7.42	2660
Far Away	13.60	6.89	2072
Very Far Away	12.47	6.95	488

Teacher contact time.

Another way to assess the contribution of teacher time is to look at the number of hours students spend with student monitors. In Pakistan many teachers use monitors (older students) to watch over their classes, mostly as disciplinary guardians. On average teachers use student monitors 4 hours a week. The number of hours a given class spends with a student monitor is not related to their achievement in math, but is related to their achievement in science²³.

²³ the R square, however, is very small, only 1% of the variance of achievement is explained by the number of hours spent with the monitors, the slope is-.14 and -.18 in 4th and 5th grade, respectively.

Number of hours spent with the monitor.

Value Label	Frequency	Percent	Valid Percent	Cum Percent
0-2	495	52.9	57.1	57.1
3-7	275	29.3	31.7	88.9
7-up	96	10.3	11.1	100.0
	70	7.5	Missing	
	-----	-----	-----	
Total	936	100.0	100.0	
Valid cases	866	Missing cases	70	

It could also be argued that teacher contact time is reduced by the size of the class. To test this hypothesis I examined the effect of class size²⁴ and the average achievement of the class. The results contradict the hypothesized relationship. There were significant positive relationships between class size and class achievement²⁵. It is possible that classes with more students are more likely to be related to more resources, or to a better organization of instructional resources. For instance, the number of students in the class is related to whether the teacher teaches only one class or several classes -- smaller classes are more likely to have teachers that teach several classes. This variable in turn is also related to student achievement. Teachers who teach only one class have classes of significantly higher achievement than their counterparts teaching several classes. However, it is unlikely that this relationship is mediated by 'time' as explored in this paper. In fact in a multiple

²⁴ Measured as the number of students who took the test.

²⁵ The number of students in a class ranged from 1 to 50, averaging 11 with a Standard Deviation of 6.

regression which included a term for whether the teacher taught one or more classes and the size of the class tested, the coefficient for the latter retained a statistically significant effect²⁶.

Time teaching the subject.

We also asked the teachers in the sample how many minutes a week they spent teaching math and science. Though their answers showed a wide range of variation²⁷, the figures reported are unrelated to the achievement of their students. The following table summarizes the variation in the number of minutes each subject was taught each week:

²⁶ Also multiple regressions including both time --number of minutes each subject is taught-- and whether the teacher taught one or more classes show that time has no effect either.

²⁷ For math 300 minutes on average and a standard deviation of 166 minutes. For science 213 minutes on average and a standard deviation of 111 minutes.

Minutes per week Math?

Value Label	Frequency	Percent	Valid Percent	Cum Percent
0-180	215	23.0	27.2	27.2
181-240	175	18.7	22.1	49.3
241-360	250	26.7	31.6	80.9
360up	151	16.1	19.1	100.0
	145	15.5	Missing	
	-----	-----	-----	
Total		936	100.0	100.0

Valid cases 791 Missing cases 145

Minutes per week Science?

Value Label	Frequency	Percent	Valid Percent	Cum Percent
0-180	416	44.4	52.8	52.8
181-240	210	22.5	26.7	79.5
240up	162	17.3	20.5	100.0
	148	15.8	Missing	
	-----	-----	-----	
Total		936	100.0	100.0

Valid cases 788 Missing cases 148

It could be argued that the effect of the amount of time the teacher teaches the subject interacts with the number of classes the teacher teaches or with the level of education of the teacher. I modelled regressions which included level of education and whether the teacher taught more than one class, plus the interaction terms between these variables and the number of minutes the teacher taught each subject. While both education of the teacher and the number of classes taught were significant predictors of achievement, the interaction terms were not, nor were the number of minutes when included in these multiple

regressions.

These findings suggest that instructional time, at least as measured in this study, is a poor predictor of student achievement. Teachers who spend more time on instruction can have classes with as low achievement as their counterparts who spend less time, as illustrated in the following example. I split the number of minutes of instruction in science in grade 4 in the three segments indicated above: those teachers teaching less than 3 hours a week, between 3 and 4 hours, more than 4 hours. The distributions of achievement of the classes in these three groups have so much overlap that it is unlikely that they come from different population distributions. I have estimated the 95% confidence intervals for the population of achievement scores for each of the groups below:

Upper and Lower Limits of 95% confidence interval for achievement in Science in grade 4.

	Mean	Std Dev	Cases	Se	Lower Limit	Higher Limit
For Entire Population	13.98	5.55	394			
0-180	13.87	5.41	195	0.39	13.10	14.64
181-240	13.89	5.80	116	0.54	12.81	14.97
240up	14.38	5.53	83	0.60	13.17	15.61

As we can see some of the teachers spending 4 hours or more in science have classes with scores as low (13.17) as the lowest scores of the classes whose teachers teach science for less than 3 hours. Similarly, among the teachers teaching fewer hours of

science there are scores as high as those of teachers teaching more science.

Amount of time and time use.

These findings suggest that instructional time by itself is a poor predictor of student achievement. Therefore policy intervention needs to go beyond 'setting and maintaining standards for instructional time'. Although we do not advocate teacher absenteeism, it is possible that effective teachers can 'compensate' for the time they lose when they miss classes. Improving teacher effectiveness then would call more for strategies to help teachers make productive use of the time they have available, rather than for expansion of that time. The evidence examined in this paper suggests that teachers can spend long hours with their students without significant gains in achievement, while teachers spending less time with their students can have higher levels of learning in their classes.

This is equivalent to saying that academic engaged time is not the same as instructional time or time of contact between teacher and students. But to the extent that engaged time is defined by reference to gains in learning this is a circular definition, therefore without reference to learning gains we would have to admit that time, or instructional time, is a poor predictor of student learning. The fact that time can be used in a variety of manners by teachers is suggested by the loose connection between the number of minutes teachers spend on each

subject every week and the point they have reached in the math and science textbooks²⁸.

Discussion and Conclusions

The evidence from Pakistan does not support the conventional policy view that teacher absences and the number of hours a subject is taught are significant influences on student achievement. This suggests that an understanding of opportunity to learn in Pakistan needs to move beyond instructional time to understand why is there such a loose link between the coverage of the curriculum²⁹ and instructional time or why some teachers make better use of the time they have available than others. That type of information is more likely to allow the formulation of policy options to improve the quality of education than the simple expansion of instructional time.

Furthermore, since Pakistan's education system, as the education systems of many other developing countries, suffers severe resource constraints, options to increase the instructional quality of the time teachers have available are likely to have lesser cost implications than increases in the number of days teachers work, which would probably translate in increased demands for salaries.

²⁸ There is no significant relationship between number of exercises covered in math and amount of time spent in math per week. In Science the relationship is statistically significant, but low (Pearson 0.125).

²⁹ Which, using IEA terms would be the real opportunity to learn.

A number of hypotheses can be proposed to explain these findings, it is possible that given current conditions in schools in Pakistan, current levels of education of their teachers and the practices currently used in classrooms, no gains could be expected from extending the amount of contact between students and teachers. This is the same as saying that when the quality of an education system is very low 'more of the same' will not produce large learning gains for students. This emphasizes the importance of restricting these findings to the range of variability of the variables examined in Pakistan's education system today.

It is possible that if teachers' levels of education improved, if teachers learned how to engage students more effectively, expanding the opportunities for children and students to interact would have beneficial effects on learning.

The general point this underlines is the need to have policy recommendations that are context-specific, and the risks implicit in proposing universal policy avenues on the basis of a limited set of studies. A related problem, mentioned earlier, are reviews of the literature which neglect discussions of how the independent and dependent variables were operationalized and of the effect sizes that were found. Apparently they could well lead to policy recommendations that are opposite of what the research evidence supports. For instance, if the only variable that had a significant impact on learning was engaged time, and all other studies of allocated time showed no significant effects, a review

obviating this type of information could well mislead policy makers into recommending increasing allocated time. Similarly, reviews neglecting effect sizes could lead to policy recommendations that would be impractical if the number of days needed to yield significant increases in learning was too long.

Making policy recommendations abstracting from context may lead to proposing expensive changes for education systems which will fall short of yielding the expected benefits. A bold prospect in the current context of financial austerity facing education systems!