

The criticality of Pupil Teacher Ratio:

Empirical evidence from 766 lower primary schools of North East Karnataka

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Contents

	Page
Abstract	3
<u>Section A</u>	5
Snap shot of school performance – Learning Guarantee Programme 2005	
<u>Section B</u>	7
Pupil Teacher Ratio and School Performance	
• Peeling the First Layer	
• The fog of “Average PTR”	
• Correlation between superior school performance and PTR	
• Is very small PTR counter productive?	
• The converse picture: High PTR and poor performance	
<u>Section C</u>	12
What is a desirable Pupil Teacher Ratio?	

ABSTRACT

This paper is based on the analysis of data from the evaluation of 766 government lower primary schools under the Learning Guarantee Programme in North East Karnataka in July – September 2005. The programme, a joint initiative of the state government and Azim Premji Foundation, ran as a pilot in seven districts of North East Karnataka during 2002-2005. A key element of the program is that it sought voluntary participation of schools. 1887 schools volunteered and were assessed on the criteria of enrolment, attendance and learning achievements of the children in their primary grades. Of the 1887 schools that volunteered, 766 were lower primary schools.

The empirical evidence is from the results of the assessment of learning outcomes of 61709 children in classes 1 to 4 in these 766 schools. The learning achievement scores of the children in Language (Kannada) and Math were taken into account as one of the three criteria for evaluating the performance of the schools. The performance of the schools in these tests reveals a wide variety – from schools whose average achievement scores exceed 90% to those schools where practically no learning is happening.

A *post facto* research carried out in late 2005 to understand factors that enabled the outstanding schools to achieve higher learning levels, provided valuable insights. The research showed that the Head Teacher is the key driver of the school unit and plays the pivotal role in the performance of the school. The teacher was found to be the largest and most critical gear of the unit. It was observed that in high achieving schools the teachers go the extra mile. The study did not throw up specific barriers to school performance. Most infrastructure parameters, many teacher demographics and whether teacher resides in the same habitation or not etc. do not have any major bearing on the school's performance. And while community support certainly helps school performance, the absence of community support is not a show stopper.

In the course of the study, details were gathered on the Pupil Teacher Ratio (PTR) in each of the lower primary schools that participated in these assessments. A quick analysis showed that the average pupil teacher ratio in the top 10% lower primary schools was 24:1 – while the average pupil teacher ratio for the remaining 90 % of the primary schools was 39:1. This suggested that a detailed study of the pupil teacher ratio and school performance be made.

What this study shows is that the best performances in terms of – (a) average scores; (b) maximum children with over 90% and (c) minimum children with low scores – are being delivered by schools whose Pupil Teacher ratio is in the sub 20 band. Interestingly – perhaps not surprisingly – very low PTR (less than 10) schools performances are not good. As schools PTR increase, particularly from 30 upward there is a gradual and continuous drop in performance.

The other grim finding is only a reinforcement of a grim fact: Although average PTR for government primary schools in many states may be not far from the 1:40 mark, the averages hide the huge variations that exist and perhaps millions of children in our country are studying in schools whose PTR is inimical. This point is supported by facts from this study. The average PTR of the 766 primary schools that participated in the assessment is 37. Good. But 29% of schools have PTR that is above 40. In fact nearly 10% of schools have a PTR beyond 60. Of the 766 lower primary schools in this study, 50 schools (6.5%) are single teacher schools; **3.6%** of schools in the sub 40 PTR band are single teacher schools and **13.9%** of the schools in the above 40 PTR band are single teacher schools. In fact an estimated 16.41% of all rural schools all India, are single teacher schools.

The case is for administrators to strive to remove these discrepancies, provide schools with a level playing field and demand results.

The authors on the basis of this study suggest that the 40:1 Pupil Teacher Ratio norm has inadequate rationale. The study shows that less than 2% of the schools with Pupil Teacher Ratio in excess of 40:1 are able to

demonstrate that a majority of their children are learning. On the other hand at the sub 20 Pupil Teacher Ratio, at least 27 % of the schools demonstrate such a performance and there is a 15 % success rate in the 20-30 PTR band. Studies of school performance outside India establish that the ideal pupil teacher ratio is in the range of 20 to 25. Therefore it may be worthwhile for administrators and experts in the domain of primary education to re-visit the PTR norm and suggest that PTR be kept below at least 30. The Tapas Majumdar committee recommendation too is for the PTR norm of 30:1. On the flip side, is the more fundamental question: Why are good performances as evidenced in the study of these 766 schools of Karnataka, being turned out at sub 20 PTR? Does the answer lie with the way our system prepares our teachers through pre and in service training? Therefore while advocating lowering of PTR one must simultaneously look at the way we prepare and enable our teachers so that we do not realize sub optimal efficiency. The first step is to acknowledge the facts and look at both aspects – Pupil Teacher Ratio and the processes – to ensure equitable quality of education is provided by our schools.

SECTION A: Snap shot of school performance – Learning Guarantee Programme 2005

Learning Guarantee Programme is a joint initiative of the state government and Azim Premji Foundation. The programme ran as a pilot in 7 districts of North East Karnataka between 2002 and 2005. The seven districts of north east Karnataka have a total of 9270 lower and higher and primary schools of which a total of 1887 schools chose to participate in the three years of the pilot Learning Guarantee Programme. These schools offered themselves for evaluation. The criteria for assessment were enrolment, attendance and learning achievements of the children in their primary grades.

LGP has two key objectives: One objective is to create a spirit of accountability among schools and education functionaries for the learning of every child. The other, is to advocate a classroom teaching learning reforms through systemic shift in assessment - from the traditional test of rote learning to test of a child's understanding, application and problem solving ability.

In the pilot program in Karnataka, every child in classes 2, 3, 4 and 5 was tested through oral and written tests for competencies of their previous class. The tests were not based on the text book but were designed specially to evaluate learning, understanding and application of the expected competencies of the children. The evaluation of schools in the Pilot programme was done in July – September of each year and hence the children were assessed for the previous grade's competencies. Oral tests were administered for about 15 minutes per child for each subject, while children were provided 90 minutes for written tests for each subject. A team of 4 independent evaluators conducted these tests. A school that has about 80 children in Classes 1 to 4 (or 2 to 5) would take 4 members of an evaluation team, 3 days to complete the evaluation. During this evaluation, the team also collected data pertaining to enrolment and attendance of every child.¹

Qualifying schools in the Learning Guarantee Programme met the following criteria:

Enrolment:	100% of children in the 6 – 11 age groups in the habitation are enrolled in school
Attendance:	Minimum of 90% of the enrolled children attended at least 75% of total number of working days in school during the academic year
Learning achievement:	Minimum of 60% of all children enrolled in classes 2, 3, 4 and 5 scored 90% on competency based tests

The focus of this report is on the relationship between PTR and school performance. Therefore this section will only briefly touch upon the key statistics pertaining to the 766 primary schools to provide readers with the context. For readers interested in fuller details on the Learning Guarantee Programme, these are available in earlier reports¹. The essential facts in brief are:

¹ "The Learning Guarantee Programme", Seminar 536 – April 2004

" Learning Guarantee Programme: 2003", Learning Curve, Issue 11, March 2004

"The Learning Guarantee Programme: A Learning Journey 2002-05", D D Karopady and S. Giridhar, UNESCO – Pratham November 2005

" Assessment Reforms Through Voluntary Participation of Schools" , S. Giridhar, D D Karopady and Umashanker Periodi - NCERT Pupil Assessment Workshop , March 06

"Strengthening the government school system: Lessons from promising practices", Kameshwari Jandhyala and Vimala Ramachandran, May 06, Report commissioned by Department of Elementary Education, MHRD, GOI and International Labour Organisation, New Delhi

Snap shot of the Learning Guarantee Programme

Total Number of schools evaluated in 2005: Voluntary participation of 1887 government primary and higher primary schools out of 9270 schools in the seven districts of North East Karnataka.
Of the 1887 schools that participated, 766 schools are lower primary schools (Class 1 to 5).
Total number of children assessed in the 1887 schools: 254577
Total number of children assessed in the 766 lower primary schools: 61709
94.4 % of the 1887 schools fulfilled the criteria of demonstrating 100% enrolment
56.35 % of the 1887 schools fulfilled the criteria of enrolment <u>and</u> regular attendance of at least 90 % of the children enrolled in the school
7.63 % schools could meet the learning criteria in addition to the enrolment and attendance criteria. Thus any reference in this paper to “qualifying schools” is for the schools that met all three criteria.

The proportion of qualifying schools was significantly higher among the lower primary school segment (LPS) as compared to the higher primary school (HPS) segment.

Type of School	% qualifying schools
Lower Primary School (LPS)	10.43%
Higher Primary School (HPS)	5.71%

The average Pupil Teacher ratio in qualifying lower primary schools is much lower than the non – qualifying (other) lower primary schools.

	No of participating lower primary schools	Number of Qualifying Schools	The Other Schools
	766	80	686
Average Pupil Teacher Ratio	37.4	24:1	39:1

- The average scores in language tests across the 4 classes in 2005 was in the range of 59 – 66%;
- The average scores in Math tests across the 4 classes in 2005 was in the range of 53 – 63%;

Kannada	Average achievement	Math	Average achievement
Class 1	59.56	Class 1	63.03
Class 2	61.72	Class 2	61.48
Class 3	58.53	Class 3	52.74
Class 4	66.21	Class 4	55.21

- The scores of 52% of children were greater than 60 %.
- The scores of 62% of the children showed average achievement level of 50% or more.

SECTION B: Pupil Teacher Ratio and School Performance

- **Peeling the First Layer**

In the previous section we have the first inkling of how PTR seems to be linked with school performance. The 80 qualifying schools – which is in effect the top 10% of the lower primary schools - have an average PTR of 24:1, as compared to the remaining 686 schools – the other 90 % of the lower primary schools - where the average PTR is 39:1.

This is just the beginning. The next visible item of information is how much skewed the PTR is even within these 80 qualifying schools. 75% of these crème de la crème schools have a PTR of less than 30:1. Just 5% of these top schools have a PTR of > 40:1 and there is not even one qualifying school whose PTR is greater than 60:1. In other words, the schools with adverse PTR seem to have hardly any chance of meeting standards of equitable excellence. Thus schools which are in the vicinity of the “government desired norm” of PTR of 40:1 appear disadvantaged in this kind of comparison. Figure 1 and 2 below summarize the tale of how heavily skewed the picture looks when one compares the top schools and their PTR.

Figure1

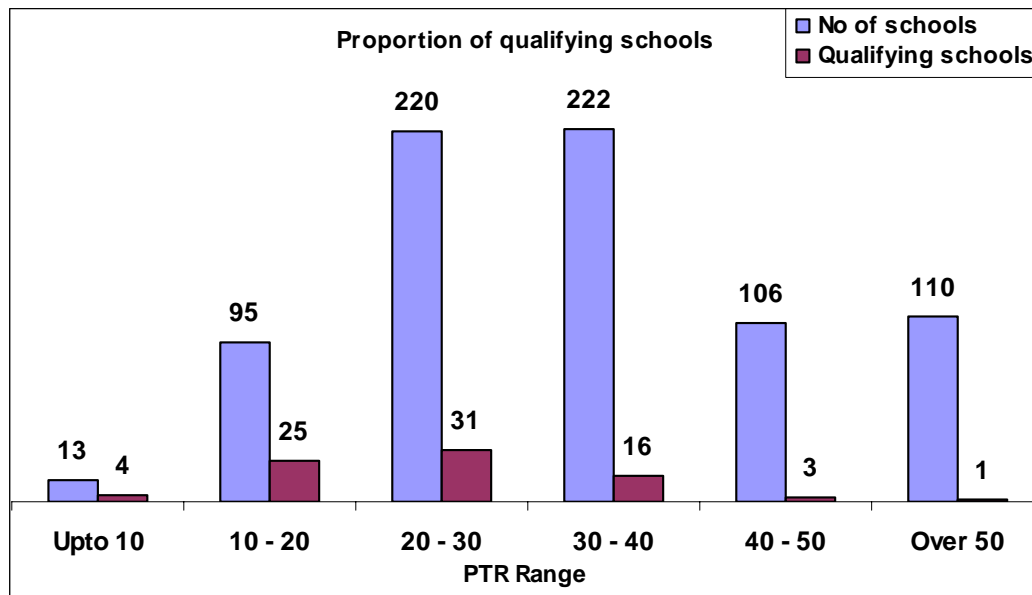
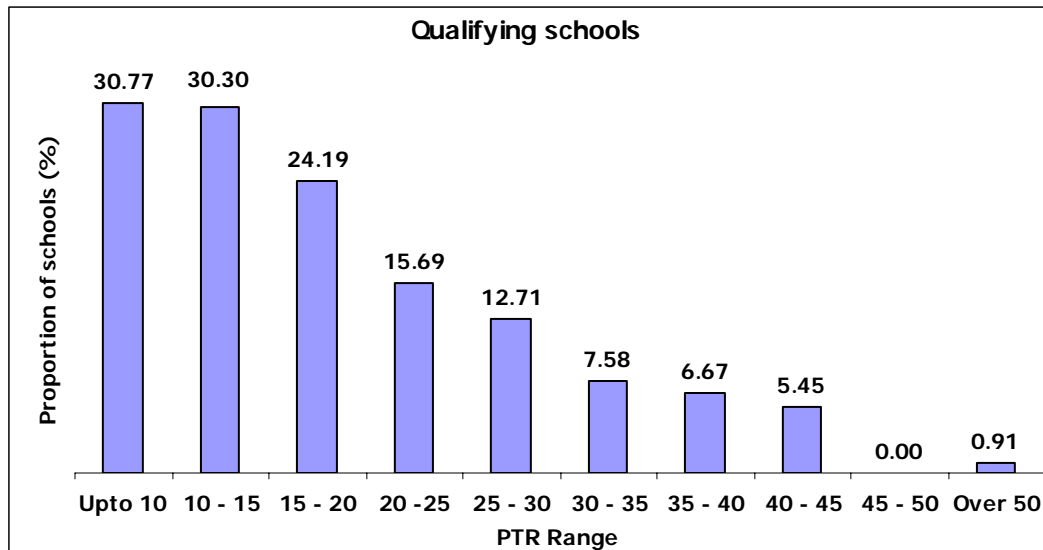
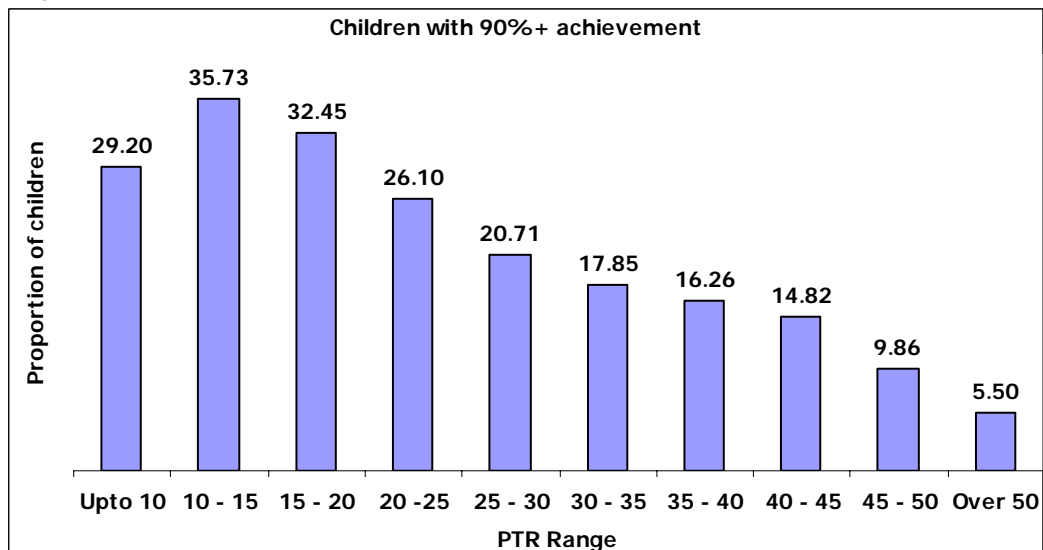


Figure 2



A similar pattern is observed if we look at the proportion of children who have scored overall 90% or more.

(Figure 3)



Of the 766 government lower primary schools that participated in the Learning Guarantee Programme, less than 2 % of schools with a PTR of over 40 were able to demonstrate that a majority of the children in their schools had achieved the learning outcomes for their age or grade. On the other hand, 27 % of schools in the sub 20 PTR band meet the learning guarantee criteria. In the 20-25 PTR range, the success rate is over 15% and in the 25-30 PTR range it is over 12%. The success rate drops sharply when the PTR goes beyond 30. In fact, this is almost negligible in the over 40 PTR band. , The study shows that if a school has a PTR of more than 40 it has very little chance of demonstrating that a majority of the children in the school achieve the learning outcomes for their age or grade.

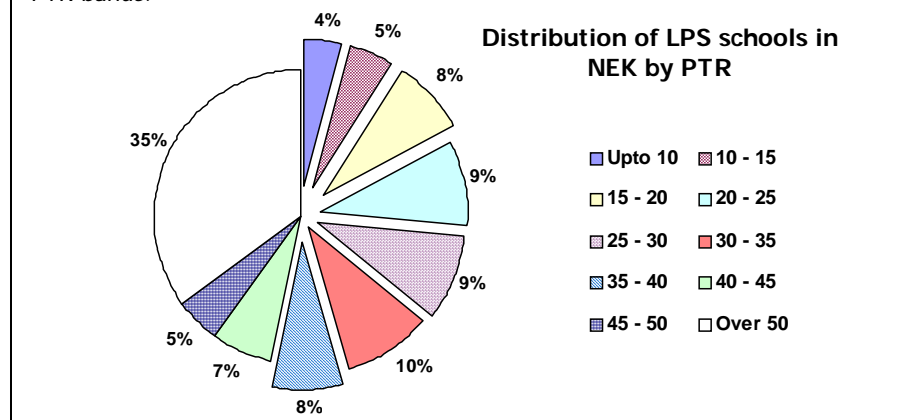
- **The fog of “Average PTR”**

“Hundreds of people drown in rivers that are reported to have an average depth of three feet”. The statistics of average PTR in schools conveys the same story. Invariably one sees data that the average PTR in schools – at a district or state or national level, are either meeting the “desired 1:40” mark or within shooting distance of this magic number. And like most averages, they hide the inequity. The distribution of the 766 participating schools by PTR was as follows:

PTR Range	# of participating schools	% distribution
upto 10	13	1.67%
10 – 15	33	4.31%
15 – 20	62	8.09%
20 – 25	102	13.32%
25 – 30	118	15.41%
30 – 35	132	17.23%
35 - 40	90	11.75%
40 – 45	55	7.18%
45 – 50	51	6.66%
Over 50	110	14.36%

Our study shows that while the average PTR for the 766 lower primary schools is around 35:1, over 28 % of these schools had PTR in excess of 40. There are 14.36% schools whose PTR was over 50. One must remember that the data presented above only pertains to the 19 % of 3990 government lower primary schools in North East Karnataka that volunteered for the Learning Guarantee Program.

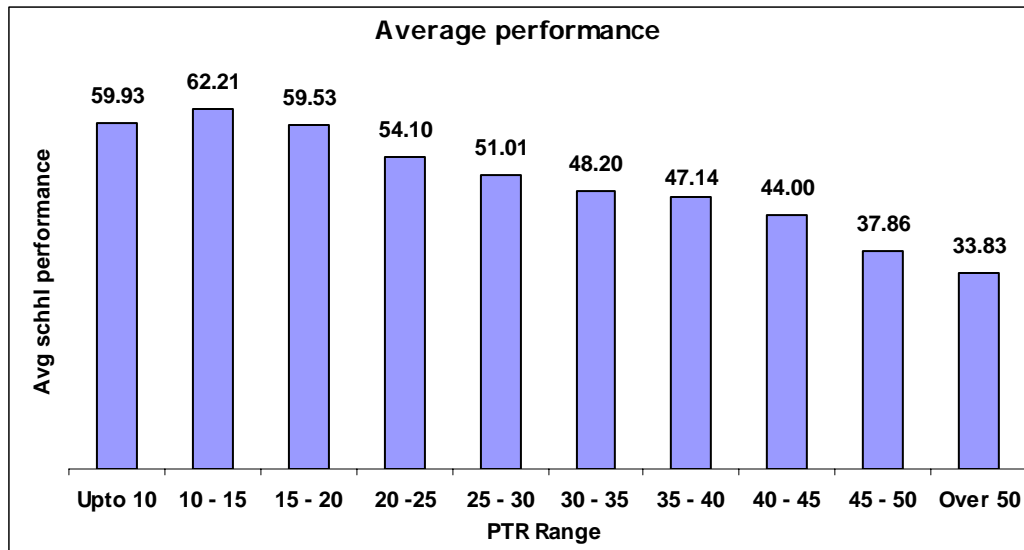
The picture for the 3990 government lower primary schools in North East Karnataka is far grimmer. Based on the data of enrolled children and sanctioned posts of teachers collected in 2003 at the beginning of the Learning Guarantee Programme, of the 3990 schools, 47% of the schools have a PTR greater than 40 while 35 % of the schools have a PTR greater than 50. An analysis of the DISE data compiled and published by NIEPA would provide a more complete picture of the scenario in Karnataka with regard to the distribution of schools across the PTR bands.



- **Correlation between superior school performance and PTR**

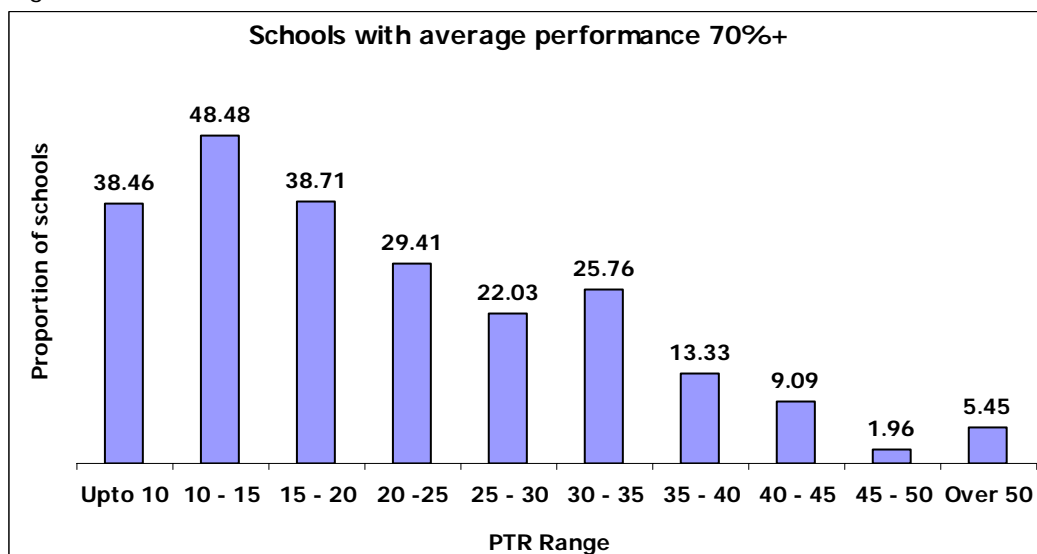
It may not be enough to merely look at the way outstanding schools and PTR are correlated. Therefore one can also turn to a school's overall average scores (the average of the learning achievement scores of the children in the school in Classes 1 to 4) and see how the schools stack up on this indicator. See Figure 4 below:

Figure 4



A similar downward trend is seen when another parameter – the proportion of schools whose average scores are greater than 70% - is compared across the various Pupil Teacher Ratio bands. Figure 5 reinforces the strong and obvious correlation between low PTR and superior school performance.

Figure 5



- **Is very small PTR counter productive?**

Thus far, the data shows that as the PTR rises, the school performance dips. And in confirmation of this fact it also appears that the probability of turning in "outstanding performances" for schools goes down as the PTR rises. The best probability is for schools in the 10 – 15 and the 15 – 20 PTR range.

But interestingly, this phenomenon is from a PTR of above 10. At a PTR below 10, the performance is again

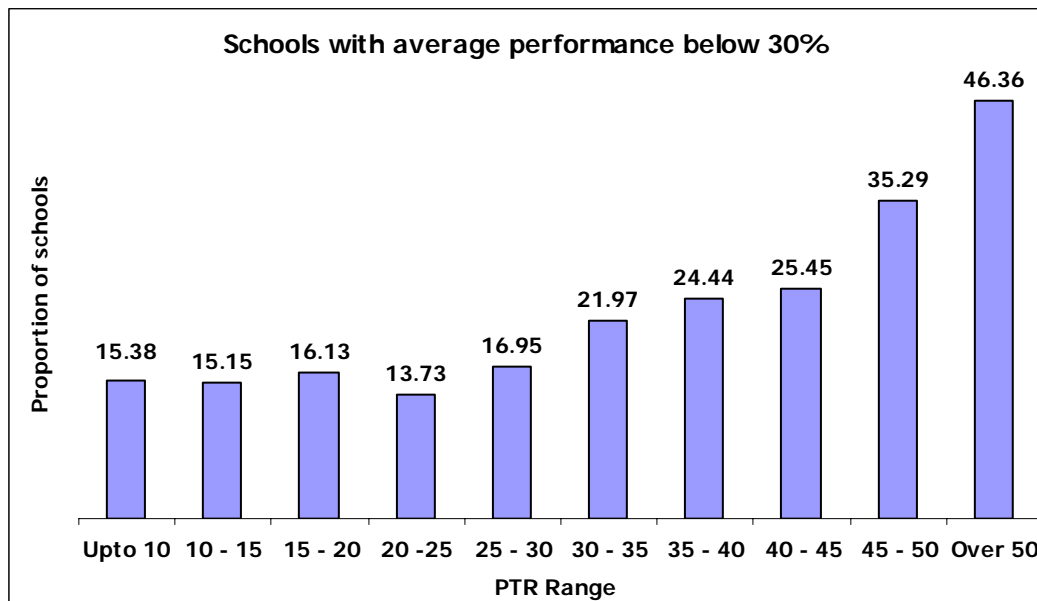
poorer. The sample in this category is only 13 schools and in fact, a closer look at schools in this category indicates that the performance of schools with PTR below 9 is very poor and appears that such schools have just the same low probability of turning in outstanding performances as schools hamstrung by high PTR of 50 and more.

What does the fact that schools with a PTR of less than nine do not perform as well as the schools in 10-30 PTR band indicate? Perhaps a class room where there are not enough peer interactions? Perhaps a class where teachers cannot engage with a minimum number of children may become boring for the teacher? Perhaps beyond a point, individual attention to a child becomes counter productive? This point is mentioned to draw the attention of the experts in learning theories who can explain this particular observation more meaningfully. The only caveat is that the above conclusion is drawn on the basis of a sample of just 6 schools – of the total of 766 schools that form the basis of this study; just 6 schools have a PTR of less than nine.

- **The converse picture: High PTR and poor performance**

While the above analysis has drawn comparisons and correlations between favourable PTR and superior school performances it may also be relevant to look at whether PTR impacts or does not impact an average performance (the range of 40-70% as average performance scores). Simply put, what the authors did was to check if adverse PTR also indicated a trend of poor school performance. The analysis shows a picture of “mirror image robustness”. In other words, as the PTR increases, the % of schools that turn in poor scores (average school performance <30) also increases. Figure 7 below is a virtual mirror image of the earlier graphs that plot the PTR and superior school performances.

Figure 7



SECTION C: What is a desirable Pupil Teacher Ratio?

Any which way one looks at the data they all point to one thing: If we expect schools to put in a good performance and fulfill our solemn promise to every child in the country, we cannot ignore the fact that a PTR of less than 30 will help the cause while a PTR of over 40 may certainly hamper.

PTR Range	No. of schools	Average score for classes 1- 4	Proportion of schools with average score over 90%	Proportion of schools with average score below 30%
Upto 10	13	59.93	15.38	15.38
10 – 15	33	62.21	15.15	15.15
15 – 20	62	59.53	20.97	16.13
20 – 25	102	54.10	10.78	13.73
25 – 30	118	51.01	9.32	16.95
30 – 35	132	48.20	2.27	21.97
35 – 40	90	47.14	4.44	24.44
40 – 45	55	44.00	5.45	25.44
45 – 50	51	37.86	0	35.49
Over 50	110	33.83	0.91	46.36

** The best among the PTR bands are indicated in bold font in the table*

The disadvantages of the schools whose PTR are high and have to also contend with an extremely challenging multi-grade environment are well captured by Govinda and Biswal: "Apart from the fact that teachers have to deal with crowded classes in these states, they have also to contend, in a large number of schools, with very minimal infrastructure and academic facilities. Around three out of four primary schools in the country involve multi-grade teaching requiring the teachers to be innovative in simultaneously teaching students of several grades....a substantial proportion of schools do not have even a proper building, leave alone other facilities. This complex situation in which the teachers have to work gets further compounded when one considers the figures for single teacher schools."²

Towards the end of 2005, the Government of Karnataka carried out an evaluation of 6464 schools (32 from each of the 202 blocks) using the Learning Guarantee Programme model. Of these, 800 schools were short listed on the basis of their better performance for further assessment by Azim Premji Foundation. It is interesting to note that the 518 LPS among these short listed schools had a PTR of 20:1. Of these 518 LP schools, the Foundation identified 247 schools which qualified based on the LGP criteria. These qualifying schools in fact had a PTR of 18.3:1. All these numbers need to be viewed in the backdrop of a state average of about 37:1 PTR for all Lower Primary Schools in the state.

In this domain as in all sociological domains, there are so many variables and parameters that are interlinked that one does not say that merely lowering the PTR is the answer. Nor is one blind to the economics while recommending the lowering of the PTR norm in the country. At the same time, it is obvious that other processes and factors must be addressed simultaneously in addition to lowering the PTR. For although the study reveals that schools with a PTR of less than 30:1 have a 20 % probability of turning out very good results, the same evidence can be used to indicate that even if the PTR is reduced only one in five schools

² Elementary Education in the Tenth Plan Promise, Performance and Prospects: *A Background Paper for Mid-Term Assessment*" R. Govinda and K Biswal, NIEPA, New Delhi

would still deliver. This argument is presented to underscore the fact that while PTR is a critical factor the interplay and dependence of a whole lot of other school, teacher and environment related variables need to be considered at the same time.

In the year 2004, a study was carried out by Azim Premji Foundation in 80 schools that participated in the Learning Guarantee Program (40 qualifying schools and 40 non qualifying schools). The socio-economic, demographic and environmental indicators on the one hand and the in-school processes on the other were studied. The study was repeated after the assessment in 2005 in 240 schools. The findings brought out the significant differentiators between the LGP qualifying schools and non qualifying schools. The key differentiator appears to be the aspect of school management and practices. The qualifying schools display significantly higher level of discipline, commitment and teacher involvement. The manifestations of this are Head teacher/ teacher presence, maintenance of good records, good TLM in the school, cleanliness and good appearance of the school. The open ended responses further reinforce the teacher commitment aspect. The teachers in the qualifying schools seem to have traveled that extra mile and spent extra time (even on holidays) with the children, got them to practice competency based question papers, identified weak children and given them special attention by way of remedial teaching etc. The SDMC members and also the parents by and large have shown greater involvement in the process and made more of a contribution to the school's efforts. The social background does seem to have a correlation with the success or otherwise of the schools on the Learning Guarantee parameters.³ In sum, the most critical differentiators seem to be an 'efficient teacher system' comprising the commitment, discipline and efforts of the Head Teacher and other Teachers on the one hand and an 'involved community system' comprising active and supportive SDMC and parents.⁴ It is clear that while many of these differentiators are PTR dependent several others are not.

Studies elsewhere have also shown that the impact of class sizes depends on the capability of teachers to take advantage of smaller class sizes to apply superior teaching methods. (Lant Pritchett, Kennedy School of Government, Harvard University, 2004)⁵

All these indicate that while strongly recommending lowering the Pupil Teacher ratio, one should also advocate that the system simultaneously address the core issue of developing the capacity of teachers and class room processes to raise the quality of schools.

• In Conclusion

The study indicates that schools will be greatly enabled to turn in very good performance if their Pupil Teacher ratio is less than 30:1. Clearly there is a need to face up to the fact that the current norm of 40:1 is not supported by any rationale and there is a serious need to work towards a more effective norm of 30:1. It would perhaps be fitting to draw reference to the Tapas Majumdar Committee report that recommended a Pupil Teacher ratio of 30:1.

At the same time there is a need to simultaneously address the other issues that weigh down a school – infrastructure, the environment or building the academic and pedagogic capability of teachers to take advantage of lower PTR. It is necessary to acknowledge that many of the crucial class room processes can be so much better implemented if the teacher could operate in an environment of favourable PTR. The best way forward is for the system to face the fact that we must work towards reducing the Pupil Teacher Ratio in our schools and create an environment where all the schools and teachers are motivated enough to emulate the heroes who turn out outstanding performances.

³ "Factors Affecting Success in The Learning Guarantee Programme", Research report, Azim Premji Foundation, April 2004

⁴ "Factors Differentiating Winning Schools LGP 2004-05", Research report, Azim Premji Foundation, April 2005

⁵ "Towards a New Consensus for Addressing the Global Challenge of the Lack of Education", Copenhagen Consensus 2004, Lant Pritchett, Kennedy School of Government, Harvard University

ⁱ The assessment process followed in the Learning Guarantee Programme:

The evaluation of schools was conducted in July – September and hence the children of classes 2, 3, 4 and 5 were assessed for their respective previous grade's competencies. The children were assessed in Language (Kannada) and Mathematics. Every child's learning outcomes were assessed through written and oral tests. Oral tests were for about 15 minutes per child for each subject while for written tests the children were given 90 minutes for each subject. Children were not given more than one written test on any day.

In Karnataka, 460 evaluators were engaged for three months (74 working days in July, August and September) to conduct evaluation of 1887 schools. These evaluators were volunteers who were at least a graduate and in quite a few cases had an additional degree in Education or social work. They were selected through written test and personal interview. The selected candidates were trained in a 4 day residential programme – including a one day live trial of evaluation in a school – in batches of preferably less than 60 evaluators by master trainers (those who had either designed the evaluation process or developed the assessment tools and question papers).

Since every child is being assessed, the question papers have to be printed in such quantities. In Karnataka, for the evaluation of 1887 schools, 261590 question papers in Math and Language were printed; packed school wise in the required quantities and dispatched to the block head quarters so that the concerned evaluation team could collect this bundle and go to that school. Multiple sets of question papers of similar pattern were used across the schools.

The 460 evaluators in Karnataka formed 115 teams of 4 members each. Each team was assigned a maximum of 18 schools to complete in 3 months. A school with 80 children in Classes 2 to 5 took the 4 members of an evaluation team, 3 days to complete the evaluation. During this evaluation, the team collected data pertaining to enrolment and attendance of every child. Each member took responsibility for one class to conduct the oral and written tests. These evaluators checked and scored the answer papers at the end of each day. The team completed the evaluation, prepared a score sheet for every child, tallied the score sheets and along with the answer papers submitted the "school evaluation set" to the block head quarters. At the block head quarters, one person was assigned the task of converting the child wise score sheet for the school into an "Intelligent Character Reader sheet" that could then be scanned and processed by the computer. Using the ICR top sheet eliminated possible errors at the data entry stage. A detailed evaluation process manual is available in English, Kannada and Hindi as well as the training manual which guides the training of the evaluators who are assigned the responsibility of conducting the evaluation.

Monitoring, supervision and technical support to these evaluators to ensure integrity and morale was provided by a team of 55 area coordinators, three program supervisors and the program leader. There was no complaint from any of the 1887 schools assessed who acknowledged the fairness and integrity of the process and the results of these evaluations.

Karnataka government adopted this process subsequently when they assessed over 40000 schools under the Karnataka School quality assessment Organization in January 2006.