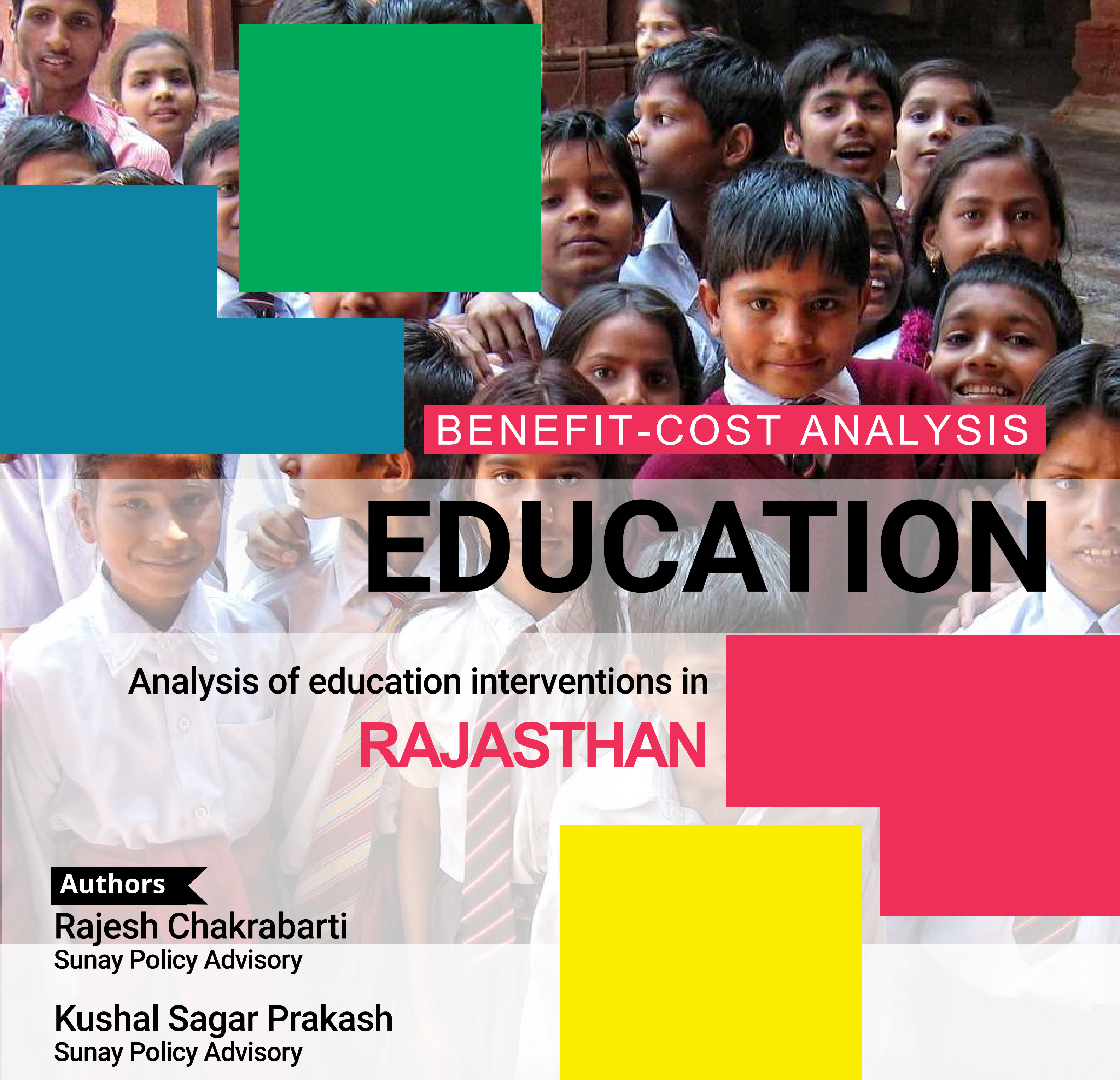

BENEFIT-COST ANALYSIS

EDUCATION

Analysis of education interventions in RAJASTHAN

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TATA TRUSTS

Cost- Benefit Analysis of Education Interventions in Rajasthan

Rajasthan Priorities
An India Consensus Prioritization Project

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Academic Abstract

The paper uses earnings data from the Fifth Annual Employment -Unemployment Survey (2015-16) and costs from government specific reports, along with existing studies to conduct a cost-benefit analysis of five education-related interventions. The first three are teaching at the right level, computer assisted learning at the right level and performance based incentives to teachers that are very cost-effective, evidence backed approaches to addressing declining student-learning outcomes in the state of Rajasthan. BCRs for these interventions are 51, 74 and 24 respectively at the 5 percent discount rates. The other two interventions are those that are given greater prominence after the enactment of the Right to Education Act. These interventions are expanding the in-service training of teachers and reducing the pupil-teacher ratios. These interventions are likely to have cost-benefit ratios of 1 and 5, respectively. As India is in a period of high proportion of workers relative to dependents—the period of so-called demographic dividend—in its demographic transition, now is the critical window to enact reforms that would improve the human capital base of the country. Focusing on education interventions that deliver greater benefits at lower cost is therefore imperative.

Policy Abstract

The Problem

Education plays a massive role in enhancing the human capital of the population and results in individuals and society achieving high rates of invention and innovation (Hanushek, 2005). In India, over a million schools are run by governments (UDISE, 2016). Even with the country having one of the largest public school education systems in the world, the literacy rate stands at only 74 percent. Further, the government's ability to achieve high rates of enrolment, primarily as a result of the implementation of the Right to Education Act, is yet to translate into high learning outcomes.

The Annual Status of Education Reports (ASER) published by an Indian NGO (Pratham) have consistently brought the abysmal learning levels of Indian students into the limelight. Starting from 2005, where the first ASER showed that three out of five children in Grade 5 were able to read a Grade 2 textbook, the outcome deteriorated to only one out of two children being able to do that in 2016. The learning outcomes for basic arithmetic (such as subtraction and division) also saw a significant plunge in the same period from 48.6 percent of Grade 5 students who could do division in 2005 to 26 percent in 2016. Overall, the learning outcomes fell from 61 percent to 48 percent between 2005 and 2016 (ASER, 2005, ASER, 2016).

The governments, over time have taken several initiatives to make the education system of the country robust. Education being a part of the concurrent list in India undergoes legislation from both the central and the state governments. The Ministry of Human Resource and Development under the central government has introduced several initiatives over the years, including the Sarva Shiksha Abhiyan (SSA), Rashtriya Madhyamik Shiksha Abhiyan (RMSA), Mid-day meal scheme, National Means Cum-Merit Scholarship Scheme, Mahila Samakhya, etc. Bodies such as District Institutes of Education and Training (DIETs), State Councils of Educational Research and Training (SCERTs), Block Resource Centers (BRCs), Cluster Resource Centers (CRC), etc. are also set up by the state governments in close coordination with the Centre to make the system robust. These initiatives, though have improved enrolment and retention rates dramatically over years, have stopped a step short of improving the learning outcomes.

Rajasthan—India's seventh largest state by population and home to over 68 million people—is also impaired by low learning outcomes. The percentage of Grade 5 students who could do division in Rajasthan shows a decrease from 37 percent in 2007 to 28 percent in 2016. And while the state registered a growth of about 7 percentage points (from 47 percent to about 54 percent) for Grade 5 students who could read a Grade 2 text-book between 2014 and 2016, the increase in not monumental considering about 51 percent of the students were capable of doing that in 2007. This also implies that the state still has about 46 percent of Grade 5 students who cannot read a Grade 2 text-book.

The objective of the current paper is to contribute to the state's efforts to improve its learning outcomes by providing measures of the cost-effectiveness of five considerably established interventions using the benefit-cost ratio approach. The five interventions the paper will focus on are segregated further into evidence based interventions and interventions congruent with Right to Education Act.

Evidence-based interventions for improving education quality:

1. Teaching at the right level
2. Computer assisted learning at the right level
3. Performance based incentives to teachers

Interventions congruent with Right to Education Act:

4. Expansion of in-service training of teacher
5. Reduction in pupil-teacher ratios

As India approaches a period in its demographic transition of high proportion of working population relative to dependents (so-called demographic dividend), now is the critical window to enact reforms that would improve the human capital base of the country. Focusing on education interventions that deliver greater benefits at lower cost is therefore imperative.

Intervention 1: Teaching at the right level

Teaching at the right level (TaRL) refers to organizing children in groups based on their current learning levels, and then teaching them using level appropriate teaching, learning activities, and relevant materials. The approach does away with grade level curriculum completion and adopts teaching the children from the level at which they are. TaRL in India was pioneered by Pratham under the Read India program, and is conducted in the form of remedial education. The intervention is deployed in two ways. The first approach involves running intensive camps with trained Pratham staff and community volunteers over short intervals, usually 80-100 hours long. The second broad approach involves partnership with government where attempts are made to embed the intervention at scale (i.e. one or more districts) using both Pratham staff and in circumstances where capacity is sufficient, government teachers. TaRL can be done with extra time that is set aside exclusively for this, either outside or within the existing school time. In the paper, we refer to this mode as the 'scaled' form of TaRL intervention. The benefit cost calculation pertains to this mode of the intervention.

As per *Rajasthan Priorities* protocols we then value time at 50 percent of wages, so the final calculation for valuing children's time is 50% * 30% * pre-primary adult wage of 30,000 per year. For teachers it is 50% * actual wages of INR 3,30,000 per year. For volunteers we use the average income per year of INR 123,819.

The total cost per child per year under scenario 1 (without extra hour) is 1,157 INR which represents the direct costs and the opportunity cost of volunteers. For scenario 2 (with extra hour) the cost is 3028 INR which also includes cost of teacher's and children's time. The breakdown of costs is presented below.

The cost components for teaching at the right level, along with their estimated values in INR for the year 2017 can be found in the table below:

Table 1: Cost of Intervention Teaching at the Right Level

Cost heads	Value (INR)
Direct Cost Per Child	813
Opportunity cost of Volunteer time per child per year	344
Opportunity cost of teacher's time per child per year	2215
Scenario 1 total costs	1157
Scenario 2 total costs	3028

Source: Spreadsheet accompanying the paper

The benefits are measured as the implied wage gain from the boost to learning outcomes. The gain in the test scores is linked with the labour market outcomes to find that the net effect is a 3 percent boost to wages over the lifetime. The same is benchmarked against the income level associated with primary level completion to calculate the gain in income. We also assume that an individual starts working at the age of 15 and works till the age of 59.

We present estimated benefits, costs and their ratios for the intervention in to scenarios: First, where an extra hour is taken. Second, where an extra hour is not taken.

Table 2: BCR for Teaching at the Right Level without and extra hour

Discount Rate	Benefit	Cost	BCR
3%	104924	1157	91
5%	58525	1157	51
8%	27441	1157	24

Source: Spreadsheet accompanying the paper

Table 3: BCR for Teaching at the Right Level with an extra hour

Discount Rate	Benefit	Cost	BCR
3%	104924	3028	35
5%	58525	3028	19
8%	27441	3028	9

Source: Spreadsheet Accompanying the Paper

Intervention 2: Computer assisted learning at the right level

Computer assisted learning (CAL) refers to the application of personalized technology for increased positive effect on the learning outcomes among students. This technology helps in effectively catering to the wide variations in student learning levels through instructions that are based on the level of students' preparations. The intervention has an interactive user interface, is adaptive, employs differentiated remedial instruction and aims at leveraging technology to improve education through an improvement in design details. The benefit cost calculation pertains to this particular intervention.

The studies examining the application of CAL programs have largely had mixed results. While most studies have shown positive results, there have also been studies resulting in the contrary. However, results of such studies that have shown no impact or a negative impact on student outcomes have been attributed to poor detailing and poor implementation of the program. Moreover, the statistically significant results arising from the studies with positive results show that the benefits of CAL program is real and that they can be maximized when carefully detailed and efficiently implemented.

For the calculations, we have examined the implementation of Mindspark, a personalized technology aided intervention in India, as found in Muralidharan et al (2017). The evaluation pertains to after-school Mindspark centres which run the program for a period of 5 months.

The costs of the intervention include cost of infrastructure, hardware, staffing and pro-rated costs for software development. This was estimated at 15 USD per student per month. However, when the intervention is conducted at a scale of 50 schools for 5 months we apply the estimated cost reduced to USD 4 per child (INR 267 approx). Hence the total cost is INR 1333 (cost per student* time duration of the intervention which is 5 months).

For calculation of benefits, estimates of Aslam et al. (2011) to link gain in test scores with labour market returns have been used. Further, primary level income, based on the analysis of the Fifth Annual Employment-Unemployment Survey, is used as the benchmark to calculate the gain in income using Aslam et al. (2011) estimates. Thereafter, the gain in income is adjusted by labour force participation rate (LFPR) and unemployment rate (UE) to arrive at the net benefit. We also assume that an individual starts working at the age of 15 and works till the age of 59.

We present the benefits, costs and their ratios in the scenarios for the computer assisted learning intervention as below:

Table 4: BCR for Intervention Computer Assisted Learning

Discount Rate	Benefit	Cost	BCR
3%	177173	1333	133
5%	98825	1333	74
8%	46337	1333	35

Source: Spreadsheet Accompanying the Paper

Intervention 3: Performance based incentives to teachers

Teachers respond to incentives, and a World Bank study suggests how these incentives can be structured differently. Some incentives affected who entered and remained in the teaching profession while others determine how they performed in the classrooms. The incentives can also be classified on lines of building supply side capability, directly incentivizing changing preferences and behaviour, and using participatory and community management approach. In this paper we take into consideration only those models that incentivizes teachers through bonus pay for improved performance of students.

A review of literature suggests that interventions that involved incentivizing teachers to improve performance of students have occasionally failed to yield positive results. This, however, does not mean that there is no study that has observed positive outcomes. Muralidharan et al (2011) shows that there has been net positive impact on student performance and also gain in terms of future wages for the participants of the intervention. They observe these results in the state of Andhra Pradesh, India and we analyze the results obtained by them and run a cost benefit analysis for the intervention.

The performance pay incentives in Andhra Pradesh concluded that teacher performance pay resulted in higher success in student test scores, with no evidence of any adverse consequences. The cost components along with their values are detailed in the table below:

Table 7: Cost Components for the intervention Performance based Incentives to Teachers

Cost component	Amount (INR)
Total Program Cost	10000
Administrative Cost	5000
Annual cost per student adjusted for inflation	552

Source: Spreadsheet accompanying the paper

The benefits are measured as the implied wage gain from the boost to learning outcomes. We find that the gain in the test scores, which is linked with the labour market outcomes gives us a net effect of 7.32 percent boost to wages over the lifetime. According to Muralidharan (2012) students who completed their full five years of primary school (grade 1 to 5) under the individual incentives program performed significantly better than those in the control schools by 0.54 SD in math and 0.35 SD in language test. The same is benchmarked against the income level associated with primary level completion to calculate the gain in income. We also assume that an individual starts working at the age of 15 and works till the age of 59.

Table 8: BCR for the intervention Performance based Incentives to Teachers

Discount Rate	Benefit	Cost	BCR
3%	112011	2529	44
5%	58442	2391	24
8%	24864	2205	11

Source: Spreadsheet accompanying the paper

Intervention 4: In-service training of teachers

Teacher training refers to the process of building necessary skills and values in teachers that are required for them to be effective, as well as to improve their confidence to teach. The recognized benefits of teacher training include increased standards of pupil achievement, high-quality learning and teaching in schools, positive and sustained impact on the outcomes students achieve, enabling learners to become more engaged, effective and motivated, and developing a common vocabulary to enable practitioners to converse across all sectors, settings and phases (Estyn.gov.wales, n.d.). Today, training of teachers to develop relevant skills and the right pedagogy practices has become critical to the success of education system in every country.

Two kinds of teacher training is provided in India. The first is pre-service training which entails training given to teachers before they enter into service. The other form is in-service training which is conducted in the form of formal and informal programs, and are either educational or social (Sooraj, 2017). The calculation of costs and benefits in the paper is one for the in-service training of teacher that takes place periodically during the year.

The costs involved in execution of the in-service teacher training intervention include direct costs of training the teacher at the BRC and CRC levels, as well as training the trainers for the same. Indirect cost associated with the intervention in terms of opportunity cost of teachers' time that is spent on availing the training forms another cost component. The benefit can be measured as the implied wage gain from the boost to learning outcomes of the students.

We assess the BCR of this intervention to be around 1, though the quality of evidence behind this is limited. This is drawn from the literature review, which demonstrates the benefits to students of the intervention are likely to be limited. Given that lengthy and in-depth tertiary courses and pre-service training have zero to modest effects on student learning outcomes, it seems likely that in-service training, which only occurs for a matter of days per year is not likely to fare any better.

This is not to imply that in-service training is a poor idea in theory. International evidence points to many examples of valuable in-service training. If the current approach to in-service teacher training is improved, and modest student learning outcome improvements of 0.01 SD are made, the intervention can yield a BCR of 6 in the state.

Intervention 5: 50 percent Reduction of Pupil Teacher Ratio

This intervention deals with reducing the pupil-teacher ratio (PTR) in a given geography or unit. PTR is defined as the average number of pupils per teacher at a given level of education, based on the headcounts of both teachers and students. The Right to Education Act, 2009 mandates the pupil teacher ratio 30:1 at the primary level and 35:1 at the upper primary level. Under this metric, Rajasthan is well within the target, with a PTR of 19:1. The literature review of the intervention suggests mixed results. In India, however, it has been largely observed that a reduction in PTR has resulted in improved student outcomes. Evidence from international studies have shown positive, negative as well as statistically non-significant results. The cost components for the intervention is listed in the table below:

Table 9: Cost Components for 50 percent reduction of PTR:

Cost component	Value (INR)
Cost Per Teacher	3,30,000
Cost Per Student	17368

Source: Spreadsheet Accompanying the Paper

Table 10: BCR for the intervention Reduction in PTR

Discount Rate	Benefit	Cost	BCR
3%	164721	17368	9
5%	85944	17368	5
8%	36565	17368	2

Source: Spreadsheet accompanying the Paper

Introduction

India, with more than 1.5 million schools—73 percent of them being run by government—has one of the largest school education systems in the world (UDISE, 2016). Despite such large numbers, India's literacy rate stands at only 74 percent. In recent years, the government has managed to achieve high rates of enrollment, primarily as a result of the implementation of the Right to Education Act. It is, however, well acknowledged that the quality of education needs a significant overhaul.

As established by the World Development Report 2018, 'schooling' is not the same as 'learning' and a core concern in the Indian education reality is just that. The Annual Status of Education Reports (ASER) published by an Indian NGO (Pratham) have consistently brought the abysmal learning levels of Indian students into the limelight. Starting from 2005, where the first ASER showed that three out of five children in Grade 5 were able to read a Grade 2 textbook, the outcome deteriorated to only one out of two children being able to do that in 2016. The learning outcomes for basic arithmetic (such as subtraction and division) also saw a significant plunge in the same period from 48.6 percent of Grade 5 students who could do division in 2005 to 26 percent in 2016. Overall, the learning outcomes fell from 61 percent to 48 percent between 2005 and 2016 (ASER, 2005 and ASER, 2016).

Against a backdrop of deteriorating education system, it is imperative to understand the relationship between education and economic growth. A study by Eric Hanushek (2005) suggests that human capital of the population is significantly enhanced by a strong and effective education system, which eventually facilitates economic growth. Needless to say, education both to individuals and society culminates in higher rates of invention and innovation. And this logic has not been neglected by governments in India.

Education being a part of the concurrent list in India undergoes legislation from both the centre and the state governments. The Ministry of Human Resource and Development under the central government has introduced several initiatives over the years, including the Sarva Shiksha Abhiyan (SSA), Rashtriya Madhyamik Shiksha Abhiyan (RMSA), Mid-day meal scheme, National Means Cum-Merit Scholarship Scheme, Mahila Samakhya, etc. Bodies such as District Institutes of Education and Training (DIETs), State Councils of Educational Research and Training (SCERTs), Block Resource Centers (BRCs), Cluster Resource Centers (CRC), etc. are also set up by the state governments in close coordination with the Centre to make the system robust. These initiatives, though have improved enrolment and retention rates dramatically over years, have stopped a step short of improving the learning outcomes.

Staying consistent with the national trend, the school education system of Rajasthan (India's seventh largest state by population and home to over 68 million people) is also impaired by low learning outcomes. The percentage of Grade 5 students who could do division in Rajasthan shows a decrease from 37 percent in 2007 to 28 percent in 2016. And while the state registered a growth of about 7 percentage points (from 47 percent to about 54 percent) for Grade 5 students who could read a Grade 2 text-book between 2014 and 2016, the increase in not monumental considering about 51 percent of the students were capable of doing that in 2007. This also implies that the state still has about 46 percent of Grade 5 students who cannot read a Grade 2 text-book. Initiatives such as establishing close to 10,000 *Adarsh* senior secondary schools and the around the same number of *Utkrisht* schools at the Panchayat level to provide education till Grade 12 and Grade 8 respectively (starting from Grade 1), is aimed at changing the scenario (PTI, 2016).

An RBI study published in 2016 suggests that the state has reduced its total budget on education from 19 percent in 2009-10 to just over 17 percent in 2015-16 (RBI, 2016). The same percent plunged to below 17 percent in 2016-17 (Khan, 2016). Clearly, the state has other pertinent areas to direct expenditure, and in a scenario such as this, improving the effectiveness of the money currently spent would prove vital to changing the education reality in the state. The objective of the current paper is to contribute to the above discourse by providing measures of the benefit-cost ratios of a few interventions. The paper focuses on five considerably established interventions aimed at improving the quality of education in the state of Rajasthan and assesses their effectiveness using benefit-cost analysis. The five interventions the paper will focus on are as follows:

Evidence-based interventions for improving education quality:

1. Teaching at the right level
2. Computer assisted learning at the right level
3. Performance based incentives to teachers

Interventions congruent with Right to Education Act:

4. Expansion of in-service training of teacher
    a. (The RTE, under section 29, requires the state governments to develop its in-service training design by notifying the State Council of Educational Research and Training (SCERT) or its equivalent body)
5. Reduction in pupil-teacher ratios
    a. (The RTE Act, under section 25, stipulates the PTR ratios to be not more than 30:1 at the primary level and 35:1 at the upper primary level)

While all the above interventions are evaluated in some capacity in India and countries outside India with substantial evidence of their positive or negative outcomes, this is the first attempt to systematically evaluate the benefit-cost ratios of these interventions in India. The literature review presented in the paper looks at the precise or related description of the given interventions in settings comparable to the context in the state. It also goes on to explore evidence from other geographical regions. The effectiveness of an intervention frequently depends upon several qualitative factors such as the nature of the roll out. Consequently, the literature review provides more a summary of experience of the past rather than a precise performance forecast of the intervention in the relevant context, though they are within the correct order of magnitude. Finally, the Benefit-cost ratio (BCR) calculations made here entail several inevitable assumptions and the quality of evidence or data estimates used in the analysis is not uniform across initiatives. The spreadsheet mentions the quality of evidence for the different interventions considered and this qualitative information should be factored in while assessing the level of confidence to be placed on it as a likely measure of the actual BCR in case of a roll-out of the intervention.

The broad message of this paper is that there are several interventions – Teaching at the Right Level, Computer Assisted Learning at the Right Level, and (to a lesser extent) teacher incentives – that are very cost-effective, evidence backed approaches to addressing declining student-learning outcomes in India and Rajasthan. BCRs for these interventions are 51, 74 and 24 respectively at the 5% discount rates. Despite significant uncertainty in the calculations, these approaches are likely to be more cost-effective than further expansion of traditional education quality approaches that were given greater prominence after the enactment of the Right to Education Act, namely expanding in-service teacher training and further reducing pupil-teacher ratios. These are likely to have BCRs of 1 and 5 respectively. As India approaches a period in its demographic transition of high proportion of workers relative to dependents (so-called demographic dividend), now is the critical window to enact reforms that would improve the human capital base of the country. Focusing on education interventions that deliver greater benefits at lower cost is therefore imperative.

Intervention 1: Teaching at the right level

Description of intervention

Teaching at the right level (TaRL) refers to organizing children in groups based on their current learning levels, and then teaching them using level appropriate teaching, learning activities, and relevant materials. This may be in the form of remedial education, where those with the lowest learning levels are brought up to the average, or via streaming, where all students are grouped and taught according to their current learning levels.

According to J-PAL and Pratham (n.d.), "*this approach requires shift of focus away from grade-level curriculum completion to ensure that children are taught from the level at which they are, regardless of their grade in which they are currently enrolled and are allowed to progress at their own pace. This approach is based on the understanding that children in countries like India, are often several grade levels below where they are expected to be*".

In the Indian context as the quote above highlights, TaRL has typically meant remedial education and was pioneered by the education group Pratham more than ten years ago under their *Read India* program. According to Pratham, the approach focuses on students in grades 3 to 5 and involves the following components:

"One, learning goals are clearly articulated so that teachers and parents know what is to be achieved. Two, simple assessment is used at the beginning of the program. This is done both to understand the level of individual children and of the group and also forgrouping them for instruction. Later in the program, similar assessments are used to track children's progress and for making course corrections. Third, for instruction, children are grouped by level rather than by grade. Fourth, the method relies on a set of combined daily activities to maximize learning; for example, for building number knowledge and operations in arithmetic – children

will do tasks that require them to listen, speak, do, read and write. Children do activities in big groups, in smaller groups and also individually. Fifth, appropriate teaching-learning materials are developed for the program and used in a way that there are materials for each group and their activities" (Pratham, 2016)

The model has been deployed in two ways. The first approach involves running intensive camps with trained Pratham staff and community volunteers over short intervals, usually 80-100 hours long. The scale of an individual intervention is small, typically operating at the school or village level. That said, the overall reach of this model is significant. Pratham has successfully worked with 10,000 schools and villages since 2014, reaching one million children (Pratham, 2016).

The second broad approach involves partnership with government where attempts are made to embed the intervention at scale (i.e. one or more districts) using both Pratham staff and in circumstances where capacity is sufficient, government teachers. Besides the features named above, this version of the intervention also involves training of government teachers, firstly targeting cluster teachers who then train other teachers in the Pratham approach. Another critical feature is that time is set aside to devote entirely to the TaRL method. This may take the form of an additional hour added to the school day reserved exclusively for this purpose, incorporation within the existing school time or as devoting extra time in intensive camps. This 'scaled' form of the intervention is the one that is the subject of this cost-benefit analysis. Pratham has partnered with governments in Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kashmir, Madhya Pradesh, Telangana, Uttar Pradesh, Uttarakhand and West Bengal (Banerjee et al, 2016, Pratham, 2017, Pratham 2018).

It should be noted that, in theory, this intervention does not need to be wedded to a particular organization's specific approach. The basic concept of teaching students according to learning levels has presumably been attempted in schooling systems across the world for decades if not centuries. Certainly remedial education is not a new concept. That said, given the prominence of Pratham's approach in India and increasingly globally, as well as the availability of significant rigorous evaluations conducted by JPAL of this model, our study invariably focuses on the Pratham approach.

Literature review

Indian evidence on government-partnered scaled version of TaRL

While Pratham has had numerous partnerships with state governments, only a handful have been subject to rigorous analysis. Banerjee et al (2016) summarise the evidence and history of scaling TaRL in a few states of India – Bihar, Uttarakhand, Haryana and Uttar Pradesh. The experiences in Bihar and Uttarakhand, occurring between 2008 and 2010, were mostly unsuccessful. Banerjee et al (2016) put this down to a failure of implementing the TaRL methods. Children were not organised into learning levels, teachers maintained business-as-usual approaches, and Pratham volunteers were not used as they had been intended.

Subsequent iterations improved upon the scaled approach and in Haryana (Duflo et al 2014) and Uttar Pradesh (Banerjee et al 2016) significant gains in learning outcomes were seen of 0.15 sd and 0.61-0.71 sd respectively. In Haryana, the key success criteria appear to have been adding an extra hour to the school day to emphasize the importance of the intervention, and also having government buy-in and monitoring. In the Uttar Pradesh experience, volunteers essentially took over government schools for 10-20-day bursts, with minimal involvement from government teachers. For obvious reasons, this significantly increased the likelihood of implementing the intervention as it was intended.

Outside of these studies, there is some descriptive evidence that TaRL has had significant impact. TaRL was implemented in Maharashtra in December 2014 for several months. ASER surveys conducted in September each year, show significant gains in learning outcomes in the state between 2014 and 2015. In 2014 only 53%, 69% and 73% of children in grades 3, 4 and 5 respectively could read materials suitable for grade 1. By 2015, after the intervention, these numbers jumped to 63%, 76% and 78% respectively, defying a downward trend that had been occurring for at least half a decade (ASER, 2015).

As of the time of writing this paper, another evaluation in Andhra Pradesh is underway (Patel, 2016). The approach for this partnership involves 7703 primary schools in three districts of the state (Pratham 2018). It requires two hours of the school day (Patel, 2016), and none of these are extra hours (private correspondence, Banerji 2018). Initial results for 1600 schools seem to be promising with the number of children being able to read at a first grade level increasing from 46% to 57% and similarly encouraging results noted for math (Patel, 2016). Unfortunately, final results of that intervention are not yet available, even though they are clearly relevant to this cost-benefit exercise.

Indian evidence on non-scaled versions of TaRL

Pratham's Balsakhi (child's friend) program—a non-scaled program completely driven by community participation through recruitment of young women—was their first attempt towards implementing teaching at the right level between 2001 and 2003 in states like Maharashtra and Gujarat (urban cities of Mumbai and Vadodara). Daily instruction of 2 hours within schools by women with atleast secondary level education tailored to a child's learning level led to an average test score increase by 0.14 SD in the first year and 0.28 SD in the second year.

Another variation of a non-scaled TaRL by Pratham was an intervention called the Learning Camps, which was implemented directly by Pratham staff along with locally recruited and trained volunteers in Sitapur and Unnao districts of Uttar Pradesh. Students in grades three through five were grouped according to their learning levels and were taught using level-appropriate materials tailored for them, for 3 hours per day that extended to 8-10 days at a time for up to 2 months. Students in the camps moved up roughly 0.9 to 1.3 learning levels. A variant of the model that involved community based classes run by Pratham without government aid in Jaunpur district increased the likelihood of children (who could not read) to read by 8 percent (Pratham, 2015)

International evidence of TaRL

Few other countries have implemented interventions that taught students at the right level in some way. In fact, a review of literature suggests that Kenya and Ghana were the only countries to do that except India. And both seem to have experienced impressive results.

In 2005, the Western Province of Kenya, in order to address the large class sizes and heterogeneity in student preparation in the Kenyan school system, sorted students by their initial level of preparedness. About 140 primary schools received funds to hire an extra grade one teacher and 121 of the first grade classes were split into two sections. The distribution of students was done in a way where they were tracked by their prior achievement scores.

The intervention which led to students being taught at the right level showed promising results. It raised scores for all students. J-PAL's evaluation found that on an average, after 18 months, test scores were 0.14 standard deviations higher in tracking schools than in non-tracking schools (Duflo, Dupas, and Kremer, 2011).

In Ghana, when it was established that 95 percent of the enrolled children in school were not keeping up with the curriculum, Innovation for Poverty Action (IPA) in collaboration with Ghana Education Services, Ghana National Association of Teachers, and the National Youth Employment Program developed and evaluated an intervention called the Teacher Community Assistant Initiative (TCAI). The intervention trained teachers and community assistants to teach basic skills to children lagging behind and tested four different models of the intervention that involved around 25000 students in 42 districts. The models that focused on teaching homogenous groups of students identified based on their learning levels (with a focus on weak students in this case) showed the highest improvement on basic skills in both numeracy and literacy (Duflo and Kiessel, 2013).

Calculation of costs and benefits

In applying existing evidence to an *ex-ante* cost-benefit analysis of this program, the key challenge is deciding which approach to model. In this case there are only two options: the Haryana experience where TaRL is embedded as part of the daily routine with government staff or the Uttar Pradesh experience where TaRL is provided as a short intensive camp without government staff.

We have decided to use the experience in Haryana as the appropriate comparator for Rajasthan. This is motivated by the fact that both Haryana and Rajasthan have relatively mature and capable school systems.

To the best of our knowledge, there is limited documentation of the costs of the program in the scaled form. The intervention requires:

- Training of cluster leads over 15 days
- Subsequent training of other teachers by cluster leads
- Materials
- Support from Pratham staff or volunteers
- Setting aside time to ensure compliance with TaRL methods

A recent Brookings case study suggests costs are between $10 and $15 per child (Brookings, 2016). It seems plausible that this refers to direct costs including training, teaching and materials, but excludes opportunity cost of volunteers, teachers and children.

Assuming that one volunteer is required at the same ratio as current teacher to pupil ratios in the state, and that volunteers are required to be present for three hours per day (for preparation, travel and assisting), we estimate the costs of volunteer time at Rs. 344 per child. This is based on 50 percent of the average wage in Rajasthan, following protocols developed for *Rajasthan Priorities*, representing leisure time (it is assumed that volunteers, if they were gainfully employed, would not be in a position to volunteer, and thus their time is valued at leisure time rates).

As for accounting for the time of children and teachers, the first question that needs to be addressed is whether extra hours outside the normal school day are required. It is clear that some dedicated time for TaRL methods are required for the intervention to work but it is unclear whether that needs to happen outside or within existing school hours. In Haryana an extra hour added to the day appears to have been a critical success factor with Banerjee et al (2016) reporting that it signaled 'that the program was not optional, but an integral part of the school routine, slotted in a specific time-period'. That said, the Andhra Pradesh program currently underway has not required any extra hours to be added to the school day (private correspondence, Banerji 2018), and the Uttar Pradesh experience also suggests TaRL can be done within normal teaching hours.

Estimating the total costs and benefits using different discount rates gives the benefit-cost ratios as reported in the tables below. For scenario 1 the BCR at the 5% discount rate is very large at 51. Unsurprisingly, the inclusion of the extra hour reduces the BCR by a significant amount, though the BCR remains high at 19 INR for every rupee invested.

Table 11: Costs of teaching at the right level in Rajasthan

Cost heads	Value (INR)
Direct Cost Per Child	813
Opportunity cost of Volunteer time per child per year	344
Opportunity cost of teacher's time per child per year	2215
Scenario 1 total costs	1157
Scenario 2 total costs	3028

Source: Spreadsheet attached with this paper

Table 12: BCR for Teaching at the Right Level without and extra hour (scenario 1)

Discount Rate	Benefit	Cost	BCR
3%	104924	1157	91
5%	58525	1157	51
8%	27441	1157	24

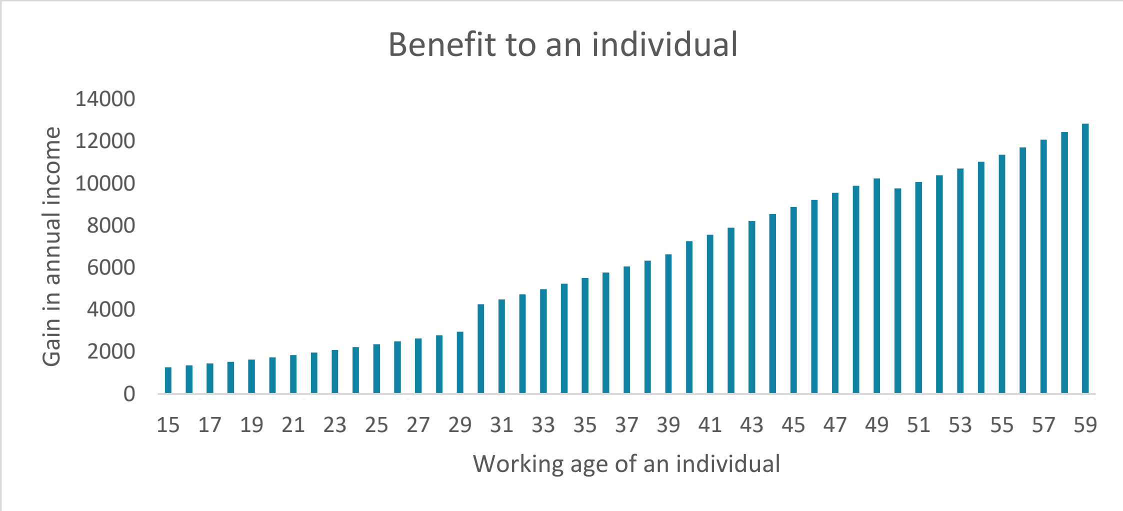
Source: Spreadsheet Accompanying the Paper

Table 13: BCR for Teaching at the Right Level With an extra hour (scenario 2)

Discount Rate	Benefit	Cost	BCR
3%	104924	3028	35
5%	58525	3028	19
8%	27441	3028	9

Source: Spreadsheet Accompanying the Paper

Diagram 1: Benefit accrued to individuals across different ages due to the intervention



Source: Spreadsheet attached with this paper

Intervention 2: Computer assisted learning at the right level

Description of intervention

Computer assisted learning refers to the application of personalized technology for increased positive effect on the learning outcomes among students. This technology helps in effectively catering to the wide variations in student learning levels through instructions that are based on the level of students' preparations.

An effective computer assisted learning medium is aimed at leveraging technology to improve education through improving design details. Its features include the following:

- Adaptive nature: such technology collects data and creates a benchmark for a student's learning. This is then used to design modules and present activities to each student on the basis of their performance.
- Differentiated remedial instruction: since different students may have specific conceptual misunderstandings, maintenance of a database with millions of student question level observations to map patterns of student errors is beneficial. Analysis of these errors made by students helps in alleviating conceptual 'bottlenecks'.
- Interactive user interface: the many benefits of employing an interactive user interface include promoting continuous learning, collaborative learning and knowledge retention among others.
- Media non-specific: they can be used both online as well as offline.

Mindspark, a technology developed by an Indian software firm is one such computer assisted learning medium. It reflects over 10 years of product development, providing 400,000 students with a database of over 45000 test questions and administration of a plethora of tests everyday while providing analysis for the same (Muralidharan et al., 2017). The software created by Education Initiatives (EI), was administered in three low income neighborhood schools in Delhi. The study was done on 305 control students and 314 treatment students and proved that the software leads to student specific progress rather than the 'one type fits all' method of education. However, the shortcomings of the product do take into account the implementation at a large-scale level. Given that, that is still to be accounted for, at least for the three areas in Delhi, the Mindspark software was a success.

Another example of applying technology to teach at the right levels was done by The EdTech Promise which endeavored to catalyze quality school education at scale through analyzing the progress made by both public and private sectors in the Education Technology (EdTech) ecosystem. Results from an assessment of 215 students across 20 English sessions in 29 Marathi schools revealed that students scoring 100% in one of the eight phonic skills increased by approximately 10 times while students scoring 0% decreased from 108 to 73.

It should be noted here that the present study only takes into account that form of computer assisted learning which is customized according to students' performance and is aimed at directly enhancing learning outcomes. It does not include blanket technological aided interventions such as the one laptop per child policy, using digital technology in classrooms like smart boards, digital microphones or smartphones, creating class websites and blogs or usage of online media in the classrooms.

Additionally, in theory, this intervention does not need to be wedded to a particular research based adaptive Computer Assisted Learning (CAL) program. While this study focuses on Mindspark, the cost benefit analysis is broadly applicable to all technology aided interventions in education that aim to teach at the right level.

Finally, it is noteworthy that while the results of interventions like Mindspark conclusively point out that computer assisted learning at the right level has huge benefits, there are likely to be issues with scaling it up. India's infrastructure can be notoriously unreliable and constraints such as availability of electricity is a serious concern. Also, the ability of the teachers to use the software effectively, particularly in non-urban settings, can be a serious issue. These factors ought to be kept in perspective while considering or evaluating this initiative.

Literature review

Given the rapid progress of technology over the last few decades and an expansion in its reach to even remote parts of the world, its importance in the education sector has dramatically increased. Today, technology aided interventions are becoming essential to keep up with the fast pace of advancements and knowledge changes and thereby, leading to an improvement in the quality of education.

In a world that is personalized and engaging, lack of personalization in school education results in students being distant and 'unplugged' from the concepts taught at school (West, 2011) and this is found to have a negative impact on their learning levels. This observation has highlighted that while application of technology in education is inevitable, blanket technological interventions will not be as effective as a customized one that caters to the specific needs of the students, based on their performance.

Overall, the evidence thus far suggests that realizing the potential of computer assisted instruction to improve education will require paying careful attention to the details of the specific intervention, and the extent to which it alleviates binding constraints to learning (Bulman and Fairlie, 2016).

Evidence from CAL Programs in India

Muralidharan et al. (2017) studied Mindspark to provide experimental evidence on the positive impacts of using technology within the classroom. By examining students who were enrolled in the instruction program against a control group that did not use Mindspark, the research showed that use of technology to teach at the right level improved productivity in the delivery of education. It was found that those who used Mindspark scored 0.36 SD higher in Math and 0.22 SD higher in Hindi relative to those who did not use Mindspark. This study also revealed that there may be large returns to further innovation and research on effective ways of integrating technology-aided instruction into classrooms, and on effective ways of delivering these benefits at a larger scale (Muralidharan et al., 2017).

An IDinsight (2014) study that evaluated Mindspark centres found positive results for both language and Math. Here, the treatment group comprising students who regularly used Mindspark (about 14-17 hours on average per subject) was measured against a control group comprising students who used the platform for less than 7 hours on average per subject. The study revealed that for language questions, students who used Mindspark were 22 percent more likely to give the correct answer to a question while in the case of Math questions, the treatment group of students was 14 percent more likely to give the correct answer. While these numbers are not dramatically high, the study indicated that in case of larger sample sizes or longer durations of exposure to the platform among students, the numbers will be more statistically significant.

Outside of these specific studies that evaluate Mindspark, there is evidence of the success of CAL interventions that focus on teaching at the right level. Banerjee et al. (2007) examined a randomized experiment that was conducted using a CAL program in government run primary schools in Vadodara, by the government of Gujarat. The exercise involved a remedial instruction program to improve the scores of students who lagged behind in basic numeracy and literacy skills. For the CAL program applied to improve language scores no significant impact was observed. However, the program yielded positive results of 0.35 SD at the end of the first year and 0.47 SD at the end of the second year for Math scores. After the completion of the program, while results were still positive, they reduced to 0.10 SD.

Mixed results in the intervention were found in the study undertaken by Linden (2008). He evaluated a CAL program applied to both an in-school and an out-of-school set up, using a pair of randomized evaluations in India, in order to study the various strategies of integrating this technological intervention into the education system. The study revealed contrasting results between the two cases. For the in-school CAL program, it was observed that the program was a poor substitute to 'teacher delivered curriculums'. The result was a -0.57 SD, showing that the students would have performed better if the CAL program was not implemented. On the other hand, the application of the CAL program in an out-of-school set up generated average gains of 0.28 SD after one year of implementation of the program. It should be noted that this study was of a CAL program that reinforced the existing curriculum. In this respect it is different to the interventions examined in the previous two studies as CAL approach was not tailored to student learning levels.

Evidence from CAL programs in other countries

Darrel West (2011) studied new models of instruction facilitated by digital technologies that enable personalizing education as well as real time assessment of students. He observed that teachers in some areas employed social media tools such as Facebook for personalized learning among students. Facebook was seen to be actively used to post comments, receive reactions from students, set up meetings and gauge student opinion regarding a particular class. It was found that students who used this learning management system "engaged more in questioning through Facebook messages directed to the instructor than asking them verbally in the face-to-face classroom". Thus, the method was successful in ensuring customized learning of students, according to their needs.

A 2017 study examining 12 peer reviewed studies, including comparison group studies and single case studies, was conducted to investigate the benefits of computer assisted instructions on reading comprehension levels to students with learning disabilities (Kim et al. 2017). Various kinds of instructions like electronic text, instructions with a reading strategy embedded and speech synthesis were examined. The software employed gave feedback, either positive or corrective, for every answer given by the student. It was found that the overall evidence provided by both the comparison group studies as well as the single case studies suggested potentially positive effects on students with learning disabilities.

Personalized instructions enabled by computer systems yielded positive outcomes in the US too. A 2009 study conducted by the U.S Institute of Education Sciences examined computer-assisted learning and it impact on scores of 3280 students in math and reading. It was found that personalized instructions led to an improvement in learning engagement, collaboration, participation and communications. While in the first year the results were not statistically significant, in the second year itself, results were positive for all the students examined. Thus, this proved that CAL methods are effective in the long run (West, 2011).

Positive effects of CAL over a period of time was also recorded in China. A group of studies conducted in China involving providing remedial instructions to students have been mentioned in Glewwe and Muralidharan (2015). Lai et al. (2011) measured the effectiveness of a CAL in Math among migrant children in Beijing. It was found that after a period of one year, scores in the subject increased by 0.14 SD relative to a control group that did not use the intervention. Lai et al. (2013) examined the benefits of CAL programs on scores obtained by students in the Chinese language in a remote province of China called Qinghai. Here, it was found that performance among the treatment group increased by 0.20 SD, which is statistically significant. Mo. et al. (2014) examined a CAL program in a rural area and found that the intervention resulted in an improvement of math scores among grade 3 students by 0.25 SD and grade 5 students by 0.26 SD.

The above studies take into consideration, CAL programs that account for the learning levels of students in some ways. There is also abundant literature on generic CAL programs that do not take into account the learning levels of the students they are targeted at, and are merely a technology add-on. A study of the effects of investing in new ICT on educational standards in England was undertaken by Machin, McNally and Silva (2006). The results showed that such investments, backed by a favourable background, led to a positive impact on the performances of primary school students in the country.

Instances of no or negative impact from generic CAL programs were also found. The former was observed on Spanish and Math scores of students in selected schools of Colombia. The latter observation of negative impact on student performance was found in a Malamud and Pop-Eleches (2011) study. It found a negative relationship between CAL programs and student test scores by using a regression discontinuity model to study the effects of providing vouchers for purchasing home computers on child and adolescent outcomes in Romania. Students who had purchased the vouchers had lower GPAs than those who did not go for the voucher.

Overall, it is evident from various studies that the results of applying a CAL program to improve test scores have shown positive results when the program is customized to students' levels and takes into consideration their learning. CAL programs that are generic in nature yield mixed results. Having said this, given the statistically significant results of several studies, it is evident that focused, thoughtful and detailed CAL interventions, along with effective implementation do lead to an improvement in the student learning levels.

Calculation of costs and benefits

For the calculation of costs and benefits we draw primarily from Muralidharan et al (2017) randomized controlled trial of Mindspark use in Delhi.

The costs involve infrastructure, hardware, staffing and pro-rated costs for software development. Taking into account all types of costs, Muralidharan et al. specify a cost of INR 1000 per student per month in their experiment. The paper further notes that because the intervention involved high fixed costs of product development, the cost will be substantially reduced if the intervention is conducted at scale. The paper states that if implemented at a modest scale of 50 government schools, per-pupil costs, including hardware costs, reduce to about USD 4 per month. At larger scales of 1000 schools or more, as would be the case if scaled across the state, the authors note costs of USD 2 per year (or about 0.17 USD per student per month).

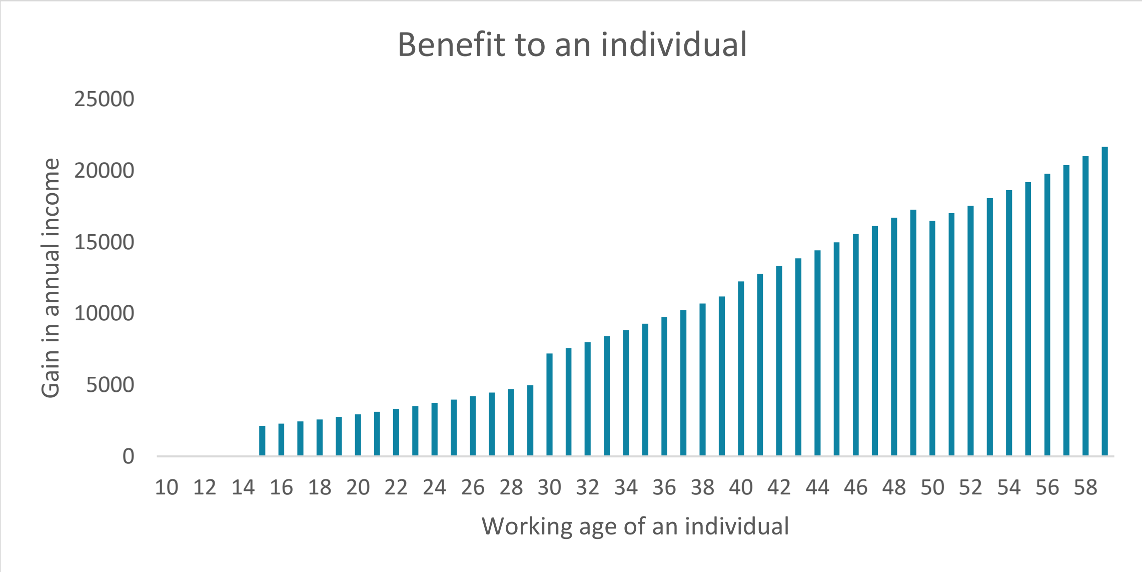
We use the middle scenario of USD 4 per month as the cost of intervention, as opposed to the low bound number of USD 2 per year. This is to account for potential challenges of implementation at scale. As noted by Banerjee et al (2016), in Pratham's attempts to scale another education intervention (TaRL as discussed in the previous section), several failures were encountered before hitting the right model. This suggests that some conservatism is warranted when extrapolating small pilot experiences to scale.

Since we want to appropriately match costs to effects, we apply the costs for 5 months, the length of the experimental study. This results in a total cost of INR 1333 per student at an exchange rate of 65 INR to 1 USD.

Muralidharan et al. (2017) note that just after five months of access to the program, students scored 0.36 S.D. higher in Math and 0.22 S.D. higher in Hindi relative to the students who didn't have access to Mindspark. For benefit we use estimates of Aslam et al. (2011) to link gain in test scores with labour market returns of about 16 percent for one SD increase in standardized Math test and 20 percent for one SD increase in standardized language test. We use the primary level income (based on the analysis of the Fifth Annual Employment-Unemployment Survey) as the benchmark to calculate the gain in income using Aslam et al. (2011) estimates. We further adjust the gain in income by labour force participation rate (LFPR) and unemployment rate (UE) to arrive at the net benefit. We also assume that an individual starts working at the age of 15 and works till the age of 59.

We present the net benefit to the individual (adjusted for LFPR and UE) in terms of gain in annual income graphically in the figure below.

Diagram 2: Benefit accruing to individuals upon undertaking this intervention



Source: Spreadsheet Accompanying the Paper

Table 14: BCR for Computer Assisted Learning at the right level

Discount Rate	Benefit	Cost	BCR
3%	177173	1333	133
5%	98825	1333	74
8%	46337	1333	35

Source: Spreadsheet Accompanying the Paper

Intervention 3: Performance based incentives to teachers

Description of intervention

Countries over time have used different models to incentivize school teachers, and a World Bank study (Vegas, 2004) lays out the different structures for the same. In Latin America, some incentives affected who entered and remained in the teaching profession while others determined how teachers performed in the classrooms. The figure below provides a schema of various determinants of providing effective teaching services.

Source: The World Bank

Another study by Masino and Niño-Zarazúa (2015) suggested that teachers can be incentivized by:

a. Building supply side capabilities like improving infrastructure, providing teaching materials, training and hiring extra teachers, etc.
b. Inducing changes in preferences that alters behaviour
c. Using participatory and community management approaches to raise awareness and increase involvement

Developing nations often face resource constraints and have weak organizational mechanisms in place for teachers and staff management. This leads to poor motivation of teachers and as a result, poor quality of education imparted to students (Rabbani, 2016). However, having an incentives system tends to make the teachers highly motivated towards improving the performance of students, thus benefiting all.

In the Indian government schools, teachers are often paid according to their education level and years of experience, rather than on the basis of the quality of their performance. Thus, they have limited incentives to be present to work, apply sincere effort and ensure that students in their classrooms are learning the skills they need to succeed. As a result, there has been an interest in promoting performance-based incentives for teachers to improve quality of instruction, which is also the model of teacher incentives that is evaluated in the study.

We calculate the benefit cost ratio of teacher performance pay by applying a conservative effect size from a suite of Indian studies on incentives and the cost structure of a well-known teacher incentive study in the Indian context (Muralidharan and Sundaraman 2011). Due to the possibility of rising resentment owing to unhealthy competition, and the possibilities of manipulation, incentives systems must be carefully designed to ensure that it is effective through only seeking to further the overall interests of the teachers as well as the students.

Literature review

Evidence from studies in India

In the Indian scenario, there are only a handful of robust studies that examine teacher incentives though all have shown positive results. Duflo et.al (2012) studied a teacher incentive program run by the NGO Seva Mandir that administered single-teacher non-formal education centers in the rural villages of Rajasthan. In the randomized experiment, where the teachers in the treatment group were monitored and given financial incentives for better attendance, absenteeism of teachers fell by 21 percentage points relative to the control group and children's test scores increased by 0.17 standard deviations.

The outcomes of the Duflo et al (2012) study were corroborated by another study by Muralidharan and Sundararaman (2011). In a randomized evaluation of a teacher performance pay incentive program, the study examined the effect of the intervention on the 50 government-run rural primary schools in Andhra Pradesh. As done in most other performance pay incentive model, the bonus payments to the teachers were linked to the improvement in student's test scores. At the end of two years of the program, students in incentive schools performed significantly better than those in control schools by 0.27 and 0.17 standard deviations in math and language tests respectively. Students in incentive schools also performed better on subjects for which there were no incentives, suggesting positive spillovers. Muralidharan and Sundararaman (2011), however, conclude with suggesting that though performance pay for teachers is frequently suggested as a way of improving education outcomes in schools, the theoretical predictions regarding its effectiveness are ambiguous and the empirical evidence to date is limited and mixed.

Muralidharan (2012) in a longer term follow up to the same experiment above, note even larger gains of 0.54 SD in math and 0.35 SD in language over five years. The students of teachers assigned to the treatment group also experienced gains of 0.52 SD in science and 0.3 SD in social science even though these subjects were not incentivized under the experiment. The authors argue this indicates that true learning was being encouraged under the incentive scheme rather than merely 'teaching to the test'.

Evidence from studies outside India

Behrman et al. (2011) evaluated the efficacy of alternative performance based incentive schemes in 88 Mexican high schools. The experiment was modelled with three treatment groups and a control group. Treatment one provided individual incentives for performance on curriculum-based mathematics tests to students only. Treatment two provided incentives to teachers only and treatment three gave both individual and group incentives to students, teachers and school administrators. The evaluation suggested that providing incentives only to teachers did not lead to any impact, while incentives to only students led to a small impact of 0.2 to 0.3 SD increase in the mathematics score. The treatment arm with incentives to both students and teachers registered the highest impact with test scores going up by 0.3 to 0.6 SD.

In line with Mexico, where providing teachers with incentives did not result in performance boost, an experimental study undertaken by economists Roland G. Fryer et al (2012) in Chicago pointed out that domestic attempts to use financial incentives for teachers to increase student achievement have been ineffective. He proved the same by using two treatment arms for the study. In the first treatment arm, he employed a new model of performance pay incentive in the form of loss aversion, where the teachers were paid in advance and asked to give back the money if their students do not improve. In the second arm, he studied the standard form of performance pay incentive. For the former, the increase registered in the math test scores was in the range of 0.076 and 0.129 SDs. The latter part yielded much smaller and statistically insignificant results. The experiment concluded that it is loss aversion rather than the performance pay incentive that improved the performance of students as a result of better performance from teachers.

The failure of the teacher incentive program was not only confined to Mexico and the US, the same model was studied by an Australian Education Union (2012). The study examined the effects of performance pay and concluded that there is little to no evidence for the claim that teachers will be more motivated to improve student learning if they are evaluated or monetarily rewarded for student test score gains. It was instead found that a system of rewards and sanctions to teachers based on their students' performance will most likely result in inaccurate personnel decisions and large scale demoralization of teachers. It may also cause talented teachers to avoid “high-need students” and schools, or leave the profession entirely, along with discouraging potentially effective teachers from entering the domain altogether. The study, however, also stated that the effectiveness of such programs varies from place to place and proper need analysis of the landscape would enable the improvement of effectiveness.

A study by Glewwe et al. (2003) in Kenya found that whilst teacher incentives based on students’ test scores improved the performance of students during the course of the program, the effects were not persistent once the program was discontinued. The randomized evaluation also suggested that providing incentives to teachers did not usher in attitudinal or pedagogical change. The paper rightly identifies one of the dangers of using performance based pay viz. teachers increasing their efforts in the short term only, directing it towards preparation for the test as opposed to improving long run learning.

Keys and Dee (2005) assessed an incentive improving teacher career ladder program in Tennessee and discovered that students when assigned randomly to classrooms with teachers participating in the performance pay program had made exceptional gains in Math and reading. They, however, conjectured that these results could also have been driven by selectivity in the teachers that choose to participate in performance pay programs, rather than the incentives of the program itself. In addition to this, Figlio and Kenny (2006), in their independent survey of 534 schools in the US, also found that the test scores were higher in schools where teachers were individually rewarded for students’ classroom academic performance.

Podgursky and Springer (2003) identified the various forms of teacher performance pay across the world and examined the economic case for performance related pay in K-12 education system. As they analysed the literature of the teacher incentive programmes right from the 18th century they concluded that while the literature is not sufficiently robust to prescribe how systems should be designed as for example, optimal size of bonuses, mix of individual versus group incentives, etc. It is sufficiently positive to suggest that further experiments and pilot programs by districts and states in the USA are very much in order.

Susan Moore Johnson (1986) looked into the need for teachers' incentives from the perspective of what motivates them and what encourages teachers to perform better. She examined the performance of high school students taking SAT's and how they can be influenced with a simple teacher qualitative improvement. The paper discusses the pros and cons of intrinsic versus extrinsic rewards given to teachers. She criticizes merit pay as an incentive programme and offers suggestions on how to improve on the existing career ladder programs. The paper concludes with the fact that better pay and higher status might draw those with an interest in teaching to the profession but are probably not sufficient to retain or sustain the outstanding staff member.

Calculation of costs and benefits

The above literature review highlights the challenges of extrapolating from past experience to a future program. If the intervention in Muralidharan and Sundararaman (2011) were to be run again tomorrow, what would be the effect?

In the Indian context two experiments highlighted in three studies suggest significant learning gains can be achieved through teaching incentives. However, international evidence is more mixed, with some evidence of positive outcomes, some evidence of 'teaching to the test', and some evidence of null and negative outcomes. McEwan (2015), in a meta-analysis of several studies of teaching incentives, including the ones from India, notes an effect size of 0.09 SD. This value is 50%-66% lower than the experience of India suggesting that Indian studies might be relative outliers in the distribution of effects. This is distinctly different to TaRL and CAL at the right level interventions, discussed previously, where Indian evidence is more or less congruent with international evidence.

Additionally there is the real risk that expanding such an incentive program at scale in the Indian context would lead to unforeseen consequences or would face political backlash derailing proper implementation. All of this suggests some moderation of the effect sizes documented in India.

To account for this we assume a five year program of teacher incentives as per Muradliharan (2012) would lead to the effects of a one or two year program as per Duflo et al (2012) or Muralidharan and Sundararaman (2011). In Muralidharan (2012), the average annual cost of an individual incentive program was Rs. 10,000 per school and the program administration roughly cost another 5,000 rupees. We divide the total cost of Rs. 15,000 by the number of students per school to arrive at per student cost for a year. We have also taken inflation into account and this results in an annual cost of INR 552 per student in 2017 rupees.

Table 15: Cost components of performance based incentives to teachers

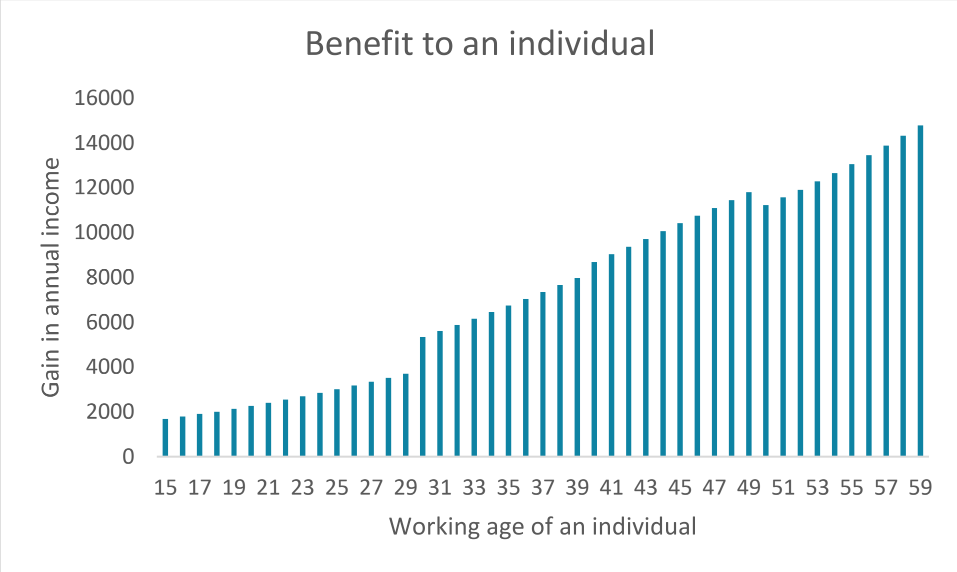
Cost component	Amount (INR)
Total Program Cost	10000
Administrative Cost	5000
Annual cost per student adjusted for inflation	552

Source: Spreadsheet accompanying the paper

For the effect size we apply a boost to learning of 0.17 SD. This represents the effect from Duflo et al (2012) and the effect on language from Muralidharan and Sundararaman (2011). These are the most conservative estimates from the suite of Indian studies, and approximately halfway between the global effect size or ~0.1 SD documented in McEwan (2015) and some of the larger effect sizes of ~0.3 SD documented for math in Muralidharan and Sundararaman (2011), and in Muralidharan (2012) for language.

As per the previous analyses we apply the effect of this improvement using Aslam et al. (2011) to lifetime primary completion wages. The results are shown below.

Diagram 3: Benefits accrued to individuals due to the intervention



Source: Spreadsheet accompanying the paper

Table 16: BCR for intervention Performance based incentives to teachers

Discount Rate	Benefit	Cost	BCR
3%	112011	2529	44
5%	58442	2391	24
8%	24864	2205	11

Source: Spreadsheet accompanying the Paper

Intervention 4: In-service training of teachers

Description of intervention

Teacher training refers to the process of building necessary skills and values in teachers that are required for them to be effective, as well as to improve their confidence to teach. Further, teacher effectiveness training (TET) is a part of teacher training that chiefly imparts the essential skills of communication and conflict resolution. It seeks to improve social skills of teachers in order to manage their students effectively, thereby increasing their performance. Owing to the central role played by teachers in education, teacher training is critical to the success of any education system (Boudersa, 2016).

The recognized benefits of teacher training include increased standards of pupil achievement, high-quality learning and teaching in schools, positive and sustained impact on the outcomes students achieve, enabling learners to become more engaged, effective and motivated, and developing a common vocabulary to enable practitioners to converse across all sectors, settings and phases (Estyn.gov.wales, n.d.). For a developing country like India, these benefits become further magnified with respect to the outcomes they yield.

Teacher training in India is primarily conducted by District Institutes of Education and Training (DIETs) which were established as part of National Policy of Education, 1986. The National Council of Training and Education (NCTE) is responsible for planning and coordinating development of teacher training in India. Additionally, the National Council for Educational Research and Training (NCERT) also prepares teacher training modules. Other bodies involved in teacher training include National University of Educational Planning and Administration (NUEPA) and State Council of Educational Research and Training (SCERT).

Two kinds of teacher training are provided in India. The first is pre-service training which entails training given to teachers before they enter into service. This kind of training is intended to support and enhance teacher learning, and instill in them a greater degree of self-confidence. The other form is in-service training which is conducted in the form of formal and informal programs, and are either educational or social (Sooraj, 2017).

The calculation of costs and benefits in the paper is one for the in-service training of teacher that takes place periodically during the year. This is not to imply that pre-service training is unimportant as a policy matter. The focus on in-service training is motivated by the fact that the policy applies to a wider group of teachers – all teachers currently active in the state – whereas pre-service training is only relevant for the relatively smaller group of aspiring teachers. Furthermore, as per the 2016 DISE report, 88 percent of government teachers in India are professionally trained. However, for the teachers who taught only at the primary level in 2015-2016, only about 20 percent availed any form of in-service training. Thus the gap in in-service training is much larger than pre-service training. It has also been reported that the quality of in-service training is often not personalized to the needs of the teacher, and they hence fail in enhancing effective teaching (Vyas, 2015). The New Education Policy (2016) reiterated that in order to improve the quality of a teacher and the quality of education in the country, comprehensive teacher training must be undertaken (Vakil, 2016).

Literature review

Training of teachers to develop relevant skills and the right pedagogy practices has become critical to the success of education system in every country. Research has consistently demonstrated that training teachers develops students' learning pace and increases their ability to grasp new concepts.

Slater, Davies and Burgess (2012) found that teachers have largely been found to vary in their effectiveness in improving pupils' performance in academic tests, a direct product of the level of training undertaken by teachers. This has largely contributed to the belief that a "good" teacher, with the right skills obtained from effective training programs, will improve students' academic abilities and performance levels (Rockoff, 2004).

Teacher Training research in India

To the best of our knowledge, there has been no robust study that assesses the relationship between in-service training and student learning outcomes in India. The available evidence focuses on the effects of pre-service training and qualifications on learning outcomes, or general assessments of in-service training focusing on suitability, relevance and teacher satisfaction.

Kingdon (2006) studied the data sample of 186 schools affiliated with the Council for Indian Secondary Certificate Examination (CICSE) and observed that the pre-service training given to teachers, led to the student outcome being 0.09 SD higher than when taught by a non-trained teacher.

Kingdon along with Azam, in a 2015 study, went on to examine 8319 pupils across 10 schools in an Indian district to estimate the importance of individual teachers in student outcomes. By controlling for prior achievements at the tenth grade level and pupil fixed effects, the study addressed the issue of non-random sorting of students. It went on to establish that a one standard deviation improvement in teacher quality adds 0.366 standard deviation points in students score. It, however, also found that the effects of teacher training and teachers' qualifications do not yield any statistically significant results on student's performance. It was concluded that the variation in teacher quality was not an outcome of factors like their qualification, prior training and even age. It may have more to do with unobserved factors like drive, passion, connection with students, empathy, attitude to effort, communication skills, etc. (Azam and Kingdon, 2015).

Drawing upon longitudinal survey data from the Young Lives Study in Andhra Pradesh, Singh and Sarkar 2015 found that while having a bachelor's degree significantly improved student test scores beyond having only secondary or senior secondary school, there was no difference between teachers with professional teaching qualification (i.e. degrees in Education) and those that possessed general tertiary degrees (i.e. degrees in Arts).

In another 2011 study, Murlidharan and Sundararaman found that teacher training and education were non-determinants for increased student performance in mathematics and language. In a randomized evaluation of a teacher performance pay program in 500 rural primary government-run schools across 5 districts in Andhra Pradesh, the incentive schools students were found to perform significantly better than students in control schools--students showed an improvement of 0.27 SD in Math and 0.17 SD in language tests. The interaction of teachers' education and training with incentives was found to be positive and significant, whereas, teacher education and training by themselves were deemed to be insignificant predictors of value addition. This also suggested that that teacher qualifications were not associated with better performance by students (Murlidharan and Sundararaman, 2011).

In terms of in-service teacher training, the study by Kidwai et al. (2013) examined in-service teacher training for public primary school teachers in Morigoan (Assam) and Medak (Andhra Pradesh) to gauge the benefits of training from the perspective of teachers themselves. It used a mixed-method design which combined qualitative data from individuals and focus group interviews, along with quantitative data from a cross-sectional survey of a random sample of 789 primary school teachers across the two districts. The results showed that over 90 percent of the teachers obtained useful knowledge and skills during their training period, aiding them in more effective teaching. The paper also notes significant shortfalls in the in-service teacher training program

Another significant set of evidence on teacher training comes from Banerjee et al. (2016), who examined teacher training as one of the crucial components in improving the quality of education and facilitating teaching at the right level in India. In their study conducted across four states in India, namely, Bihar, Haryana, Uttarakhand and Uttar Pradesh, they considered components such as providing students with the necessary material and having volunteers work with students outside the school, along with teacher training. The intervention in Haryana focused on teacher training with supervisory support and a dedicated school hour was implemented. The results of this intervention showed a 0.15 SD increase in the language scores of students.

The outcomes in Bihar and Uttarakhand did not yield positive outcomes. The intervention led to positive results in Bihar only when teacher training was implemented with Pratham learning materials and volunteer support, suggesting that teacher training *did not bring about a statistical difference in learning outcomes*. In Uttrakhand, teacher training did not show positive results, even when dovetailed with Pratham learning materials and volunteers. However, it should be noted that these results are the product of not teacher training alone, but the overall results of applying all 3 components.

Overall, it is evident that most of the existing literature shows a mixed picture of the value of teacher training in India. It likely possible that having tertiary qualifications and some pre-service training is beneficial for student outcomes, though this is far from conclusive. The weight of evidence on the effects of in-service training, while limited, suggest that this type of training is of little value to students.

Teacher Training research in other countries

McEwan (2015), in a meta-analysis of several randomized controlled trials globally since 1970 identified that teacher training leads to a 0.12 SD improvement in test scores of students. This is suggestive that teacher training improves learning outcomes as a general rule. However, the meta-analysis was not able to clearly disentangle the effects of teacher training from other pedagogical approaches and interventions, of which teacher training was one component. Some caution is warranted in applying this effect size to teacher training generally.

Korthagen et al. (2001) in their book, ‘Linking Practice and Theory- Pedagogy of Realistic Teacher Education’ did a literature review of various studies undertaken regarding teacher training and its effects. According to them, despite the several problems that arise during the process of training, such as the problem of change as well as a difficulty in the positioning of teachers, choosing a realistic approach and not restraining to the traditional routes of teacher education and training is beneficial.

The Institute of Fiscal Studies and Nuffield Foundation conducted a cost and benefit analysis of the different teacher training routes in England. The report explored the short-term costs and benefits associated with each alternate route. In schools, it was found that majority of schools reported that their benefits of participating in initial teacher training outweigh the costs incurred in the exercise. Additionally, school-based routes were to most likely have the advantage that schools expect to hire the trainee after qualification, thus lowering the future cost of recruitment (Allen et al., 2014).

Adu and Nketsiah (2012) examined Teacher Community Assistant Initiative (TCAI) and its application in Ghana. It was observed that teacher training had positive effects on literacy levels in the upper half of the class, with an increase of 3.4 percent. However, they noted that merely training teachers to target their lessons did not have any significant impact on the test scores of the students. It was asserted that in order to achieve more effective results with increased improvement in students' scores, innovative delivery models for basic skills training among teachers must be adopted.

Abeberese et al. (2011) study based in Philippines involved teacher training for the purpose of conducting engaging activities among fourth grade students and aid in the implementation of their "Read-a-thon" program. This study showed that effective teacher training, in addition to mere supply of story books increased reading habits among children by 0.13 SD. Further, 3 months after the implementation of the program, results were still positive, with a 0.06 SD improvement.

An examination of school effectiveness in 14 sub-Saharan African countries revealed a positive relationship between teacher training and student outcomes. In this study, teacher quality was calculated using the teacher's number of years of education, pedagogy courses undertaken, number of years of experience in the education field as well as the scores on a literary test that was administered to both the teachers and students (Lee et al., 2005).

In contrast to their findings, another study based in Southern Africa had mixed results. Spreen and Fancsali (2005) studied reading and Math levels in Tanzania, Mozambique, Botswana, South Africa and Namibia. The results of this study showed that a positive relationship between teacher training and student outcomes in Math levels in South Africa and Mozambique and in reading levels in Namibia and South Africa. However, there was a negative relationship observed in case of math levels in Tanzania and Botswana.

Teacher effectiveness training (TET), a complementary intervention to traditional teacher training, was also found to aid in indirectly increasing student performance levels. This relationship was observed by Markus Talvio (2014) who showed that social interaction skills are imperative for teachers to create an autonomous and supportive climate in the classroom, along with inculcating an inclusive feeling among students. The results implied that TET resulted in improved social interaction skills, along with making teachers socially and emotionally more competent. The resulting positive impact on the learning environment, aided in improving learning outcomes among students.

However, not all studies have shown favourable outcomes of teacher training. A study by Woodcock (2011) examined the effectiveness of teacher training through an analysis of 467 prospective teachers in Australia aspiring to be primary school and secondary school teachers, enrolled in the first and last year of pre-service training. The results of this study showed that pre-service training given to primary school teachers did not have a significant impact while for secondary school teachers, training led to an increase in GTE and a decrease in PTE.

Calculation of costs and benefits

The costs involved in execution of the in-service teacher training intervention include direct costs of training the teacher at the BRC and CRC levels, as well as training the trainers for the same. These costs are taken from the SSA Project Approval Board meetings in both the states and account for only the number of teachers who attended the in-service training program (this data was taken for DISE). We also take into account the indirect cost associated with the intervention in terms of opportunity cost of teachers' time that is spent on availing the training. Considering most of the in-service trainings are scheduled on days where the school remains closed, the opportunity cost of their time is the value of their leisure time which is 50 percent of the average wage of a trained teacher in the state, following protocols developed for Rajasthan Priorities.

Table 17: Costs of in-service teacher training in Rajasthan

Cost	Value (INR)
Direct cost of training 1 teacher	4558
Opportunity cost for in-service training of 1 teacher	6346
Total in-service training cost of 1 teacher	10904
Cost per student (INR)	574

Source: Spreadsheet attached with this paper

However, as the literature review demonstrates the benefits to students of the intervention are likely to be limited if existing system continues. Given that lengthy and in-depth tertiary courses and pre-service training have zero to modest effects on student learning outcomes, it seems likely that in-service training, which only occurs for a matter of days per year is not likely to fare any better. We assess the BCR of this intervention around 1, though the quality of evidence behind this is limited.

This is not to imply that in-service training is a poor idea in theory. International evidence points to many examples of valuable in-service training. Indeed, one potential saving grace of in-service teacher training is that it is inexpensive. On a per student basis the cost is merely Rs. 574 in Rajasthan. If the current approach to in-service teacher training is improved, providing a modest 0.01 SD improvement in test scores the intervention yields a BCR of 6 in the state. The current approach to in-service training is poor, but there still is an opportunity to craft an improved offering that could be effective.

Intervention 5: 50 percent Reduction in the pupil-teacher ratio

Description of intervention

Late in the writing of this paper, Copenhagen Consensus suggested undertaking a 'back-of-the-envelope' style analysis of a further 50% reduction in the pupil-teacher ratio. According to DISE 2016-2017, for primary schools in Rajasthan this is 19:1.

This intervention deals with reducing the pupil-teacher ratio (PTR) in a given geography or unit. PTR is defined as the average number of pupils per teacher at a given level of education, based on the headcounts of both teachers and students. The main purpose of pupil-teacher ratio is to determine the level of human resources input in terms of the number of teachers in relation to the size of the pupil population. PTR can be reduced by approaches like hiring more contract teachers or expanding the existing public infrastructure through creating more schools and recruiting permanent teachers.

The Right to Education Act, 2009 lays down pupil teacher ratio in order to ensure that schools maintain smaller classrooms that enable personal attention to each student by the teacher, thereby making the environment more conducive to learning. It mandates the PTR to be 30:1 at the primary level and 35:1 at the upper primary level. Under this metric, Rajasthan is well within the target, with a PTR of 22:1. However, as a review of literature suggests that further reductions may enable the state to increase student performances.

Literature Review

An OECD report on education considered the pupil-teacher ratio to be an important indicator of the quality of education. The impact of PTR on learning achievement has been widely debated with some studies claiming that school participation and grade attainment is positively influenced by PTR (Dreze and Kingdon 2001).

Evidence from India

Muralidharan and Sundararaman (2013) examined the impact of reduced pupil teacher ratios on learning outcomes of students, through the hiring of additional contract teachers in 100 government run primary schools in rural Andhra Pradesh. The paper aimed to answer if untrained contract teachers improve learning outcomes of students and measure their effectiveness, relative to the qualified civil-service teachers. The results of the study showed that at the end of two years of the program, students in the treatment schools performed significantly better than those in comparison schools, with 0.16 SD in math scores and 0.15 SD in language scores. Further, they observed that the extra contract teachers were as effective as the regular civil-service teachers in improving learning outcomes of students, thus establishing that an improvement in learning outcomes was the result of a reduction in pupil teacher ratio.

Similarly, Giridhar and Karopady (2006) gave empirical evidence of the criticality of pupil teacher ratios by examining 766 lower primary schools in North East Karnataka. The learning achievements of students in math and language was used to determine school performance. Additionally, during the course of the study, PTR ratio details were gathered. The final results of the study revealed that for the top 10 percent (based on the learning achievements of students) of the schools, the PTR was 24:1 while for the remaining 90 percent, it was at 39:1. The study showed that best performances were achieved when PTR is in the "sub 20 band". Interestingly, it was also noted that very low PTR, such as 10:1, did not enhance student performances. Further, it was observed that as the PTR increases, especially above 30, there is a gradual and continuous drop in the performance of students.

Evidence from other countries

A study by Lee and Barro (2000) presented a panel data-set including inputs and outputs for measuring schooling quality in 58 countries, based on the performance of students. Here, among the various school resources that were considered, PTR was one. The regressions observed showed a negative relation between PTR and test scores, with a 1 SD decrease in PTR resulting in an increase in the student test scores by 1.8 percentage points. Thus, the results implied that an increase in school resources, enabling a reduction in the PTR led to positive student performance.

Strauss and Sawyer (1986) did a statistical analysis of the determinants of average student performance on standardized examinations. The results of this study showed that while pupil teacher ratio does not affect the failure of students, a lower ratio has moderate positive impacts on average student achievement.

A study by Centre for Civil Society examining the effects of the various input reforms under the RTE Act examined various international evidences pertaining to PTR, revealing largely mixed results. Positive effects of a low PTR was observed in South Africa where marginalized black students were benefited, demonstrated by improved test scores (Case and Deaton, cited in Centre for Civil Society, 2015). In the US too, it was observed that lowering PTR resulted in improved labour market outcomes in the long run (Chetty, cited in Centre for Civil Society, 2015). In Mozambique it was observed that increase in student performances could be achieved with the same level of effectiveness through a reduction in PTR as well as through creation of new schools (Handa and Simler, cited in Centre for Civil Society, 2015).

However, statistically non-significant impacts on test scores were also observed. Hanushek (1997) did a literature reviewing study of studies across the US examining the effects of school resources on student performance including teacher numbers per student. The results of this study showed that out of the 277 studies that examined the effects of pupil teacher ratio on student performance, only 15% of them had statistically significant positive results.

Overall, the literature paints a mixed picture. In India, it has been largely observed that a reduction in PTR has resulted in improved student outcomes. However, evidence from international studies have shown positive, negative as well as statistically non-significant results.

Calculation of costs and benefits

The Right to Education Act passed in 2009, and enacted in 2010 mandates pupil teacher ratios across the country of 30:1 in primary school and 35:1 in upper primary. Under this metric, Rajasthan is well within the target. However, further reductions in PTRs could be considered on the grounds that there is reasonably robust empirical evidence that reductions to 15-20 students per teacher would have even greater effects on learning (Giridar and Karopady, 2005, Muralidharan and Sundararaman 2013). Indeed, Muralidharan and Sundararaman (2013) showed that halving pupil-teacher ratios would lead to at most 0.25 SD improvements in test scores. This effect size is large, in line with interventions examined in this study (except for in-service teacher training).

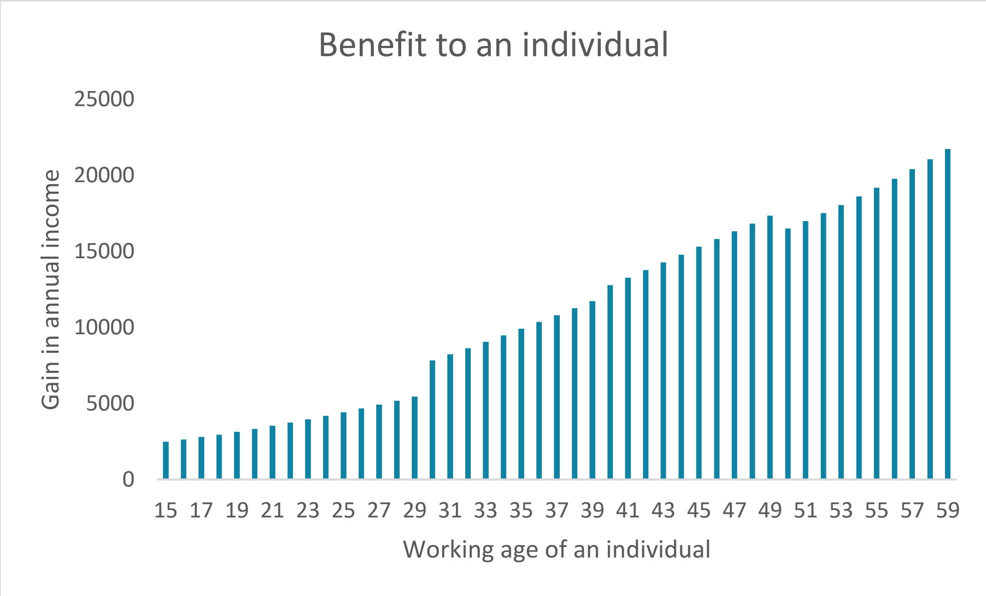
The current salary of a trained teacher is INR 3,30,000 per year. This implies a yearly cost per student of moving from a PTR of 19 to 10 (i.e. doubling the cadre of primary school teachers) of INR 17,368. Applying the 0.25 SD effect size to future wages results in benefits per student of INR 85,944 at 5 percent discount rate, the BCR for this intervention is in the vicinity of 5. In this admittedly crude analysis, we have used the maximum value of learning improvements, and have not factored in costs and additional challenges of identifying and training significantly more teachers. In this regard the BCR is probably an optimistic assessment of the effects of further reductions in the PTR.

Table 18: Cost Components in Reduction of PTR

Cost head	Value (INR)
Cost Per Teacher	3,30,000
Cost Per Student	17,368

Source: Spreadsheet Accompanying the Paper

Diagram 5: Benefit of reducing PTR by 50 percent in Rajasthan



Source: Spreadsheet Accompanying the Paper

Table 19: BCR for Reduction of PTR

Discount Rate	Benefit	Cost	BCR
3%	164721	17368	9
5%	85944	17368	5
8%	36565	17368	2

Source: Spreadsheet Accompanying the Paper

Conclusion

After almost successfully tackling the problem of out of school children, the next big challenge for India is to ensure that every child learns. ‘Schooling’ is not equivalent to ‘learning’ (WDR, 2018) and as pointed out by several ASER reports, Rajasthan, along with other states in the country, needs to improve the quality of education substantially to ensure better learning outcomes. Against the backdrop of limited and even declining proportion of expenditure on education in the state, a significant way to enhance learning is by adopting and implementing interventions that have high cost-effectiveness.

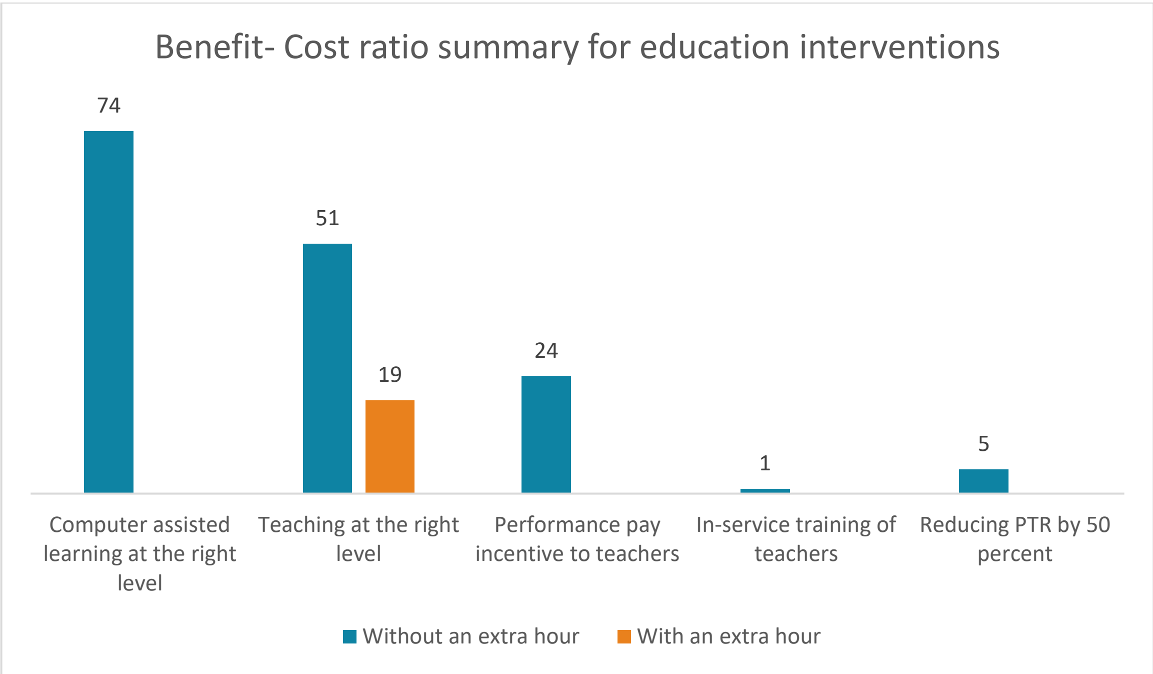
Five education interventions are studied in the paper. The first three, namely, teaching at the right level, computer assisted learning at the right level and performance based incentives to teachers yield a high benefit cost ratio of 51, 74 and 24, respectively. The other two interventions, namely, the in-service training of teachers and reducing the pupil-teacher ratios are also provisioned by the RTE and are likely to have cost-benefit ratios of 1 and 5, respectively. The greater than 1 BCRs validate the wide belief that targeted interventions will help in solving India's problem of education and sustainability.

Our results suggest that there are significant gains from supporting students' learning with technology which takes into account their current learning levels or personalize learning for children in some way. Teaching students at the right level also yields huge gains, followed by providing performance pay incentives to teachers. It may, however, be noted that ensuring robust implementation of all of these interventions is pivotal to achieving these BCR numbers. The paper also observes that the interventions that are based on RTE, result in much smaller BCR ratios. The same is also indicated by a review of existing academic literature, especially the ones where implementation took place under largely similar conditions.

To further ensure effectiveness of these interventions, the state machinery needs to be on-board with investing and allocating resources, along with integrating a strong monitoring and evaluation framework. This will lead to a more precise identification of the impact of interventions, assessment of alternate strategies, facilitation of higher efficiency through periodic revamp of the model and elimination of gaps in the implementation process.

Ensuring that resources are allocated to high impact interventions, along with implementing them well, would not only mend the country's ailing public education system at the school level (lately, also marred by high competition from private schools, resulting in a consistent decline of enrolment in public schools), but it will also enable India to unshackle its growth potential by reaping the dividend from a favourable demography.

Diagram 4: BCR summary



Source: Spreadsheet attached with this paper

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Rajasthan is the largest Indian state. It has a diversified economy, with mining, agriculture and tourism. Rajasthan has shown significant progress in improving governance and tackling corruption. However, it continues to face acute social and economic development challenges, and poverty remains widespread. What should local, state and national policymakers, donors, NGOs and businesses focus on first, to improve development and overcome the state's remaining issues? With limited resources and time, it is crucial that priorities are informed by what can be achieved by each rupee spent. To fulfil the state vision of "a healthy, educated, gender sensitive, prosperous and smiling Rajasthan with a well-developed economic infrastructure", Rajasthan needs to focus on the areas where the most can be achieved. It needs to leverage its core competencies to accelerate growth and ensure people achieve higher living standards. Rajasthan Priorities, as part of the larger India Consensus – a partnership between Tata Trusts and the Copenhagen Consensus Center, will work with stakeholders across the state to identify, analyze, and prioritize the best solutions to state challenges. It will commission some of the best economists in India, Rajasthan, and the world to calculate the social, environmental and economic costs and benefits of proposals.

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