Determinants of Schooling Quality:

A case study of the Schools of Burdwan, West Bengal

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Sudatta Banerjee and Swati Alok*

ABSTRACT:

This paper measures schooling quality in terms of student achievement across schools. About 490 students (Class VIII) were surveyed in the city of Burdwan, West Bengal. Student achievement was measured in terms of mathematics and language score. The questions asked were basic and captured the basic level knowledge which a Class VIII student should know provided he/she gets a good quality education. This paper uses a multivariate framework for examining this issue. It categorizes the various factors that determine the quality of education and examines how these factors affect a student's performance. It then explores the idea of predicting which students are studying better based on these factors using Discriminant Analysis and thus investigated the difference between the two groups (performing well and not). The factors emerging as important determinants of schooling quality in terms of performance in mathematics are perceived competence (i.e. a student's feeling on his/her competence level), class support (infrastructural facilities in school), student attitude (attitude of the student towards the subject) and socio economic state (financial status). The discriminant function thus formed is used for prediction purpose. The prediction accuracy for predicting Math's proficiency is 69.5%. For language, the important determinants are perceived competence, teachers' support, class support, student attitude, gender, home support and socio-economic status. The prediction accuracy for the discriminant function formed in this case is 71.3%.

Key words: Education, Schooling Quality

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* Sudatta Banerjee and Swati Alok: Assistant Professors, Department of Economics & Finance; BITS-Pilani, Hyderabad Campus

Address: BITS-Pilani, Hyderabad Campus, Jawahar Nagar; Shameerpet Mandal; Hyderabad-500078, India.

Phone: +91-40-66303625 (office);E-mail address: sudatta@hyderabad.bits-pilani.ac.in swati@hyderabad.bits-pilani.ac.in

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1. INTRODUCTION

1A. OVERVIEW

The question of why some students studying in various schools excel in their lives while others do not is becoming increasingly important as quality school education is an integral role in an individual's life. The quality of education in the schools is highly influential in shaping a student's career and life and also determines the development in the country. Quality of education is much more important compared to just quantity of education. Filling schools with students without proper quality education will not provide positive outcomes both at individual and societal level. There have been many studies which find the effect of education, proxied by enrolment rates or average years of schooling, on growth rates of economies (e.g. Barro, 1991, 1999, 2001; Mankiw, Romer and Weil, 1992). But actually these measures do not capture the quality of education of education provided to the students, rather they only capture quantity.

According to the EFA Global Monitoring Report, UNESCO (2011), "the quality of education remains very low in many countries. Millions of children are emerging from primary schools with reading, writing and numeracy skills far below expected level" (page 1). So in this present scenario important determinants of quality of education should be identified, so that they can be improved in order to provide quality education to all.

Recently various studies have been done to capture the effect of quality of education on economic growth (e.g. Hanushek and Woessmann, 2008, 2012; Barro, 2003 etc.) and they show the positive effects of good quality education. So it is to be noted that good quality education is not only the right of every child for his/her future but it is also positively related to economic prosperity of nations.

According to Hanushek (2005), "one of the challenges in understanding the impact of school quality differences in human capital has been simply knowing to measure quality" (page 270). There have been many studies which have measured quality of education by test scores or earning after completion of certain levels of education. These studies have identified various determinants of educational qualitywhich includes family characteristics like family income, parents' education and race or school characteristics like class size, pupil teacher ratio skills of teachers, infrastructural facilities of the school etc. It is seen that differences in schooling quality

across and within countries are considerable and can be explained in part by a set of quantifiable explanatory variables.

1B. REVIEW OF LITERATURE

India lags behind on educational front both absolutely (in terms of many indicators) and in comparison to many developing countries with almost the same income levels. India has 17 percent of the world population but has 40 percent of the world's illiterates. However, in the 1990's, there was a visible acceleration in the rate of progress in this front (Kingdon et al. 2004). The total literacy rate in India increased from 43.6 percent in 1981 to 74.04 in 2011.

The average years of education was a mere 3 in 1990 and it rose to 5.4 by 2010. Also, percentages of total population completing primary, secondary and tertiary education (for persons aged 25 years and over) in 2010 were only 13.6, 20.8 and 6.1 respectively (Barro and Lee, 2013).

In addition to this, there is a lot of variation in schooling quality in India. According to Kingdon (1998), quality varies in India in terms of both outputs and inputs. In terms of output some people are very well educated according to international standards and on the other hand some people have little ability to read and write. Similarly in terms of inputs, there are some high resource schools and also there are schools where there are no buildings, blackboards, drinking water, toilets etc. There are several factors which affect quality and there have been some important studies about educational quality and its determinants in India in the recent past.

Learning achievement data at national level on was first collected by Pratham (educational NGO) in 2005, through Annual Status of Education Report (ASER). The aim was to find the progress of basic level of learning in rural areas. These reports have come out since 2005. These surveys are household level surveys and not school level surveys. Data are collected from households in villages from each district. Questions relate to households and schools in which the children go. Moreover, tests (basic reading and arithmetic) are conducted of children aged 5 to 16 in the households. The reports indicate that the children have difficulty in reading and solving arithmetic problems and there is a lot of inter-state variation. Pratham (2011) indicates through linear probability model that learning outcomes are not determined by infrastructural facilities or pupil-teacher ratio and they conclude that policies should be in favour of improving quality of education in schools. Pratham (2015) finds that of all the children

enrolled in Standard V, about half cannot read at Standard II level. Children are finishing 8 years of schooling without learning basic skills in mathematics.

Kingdon (1994) did a sample survey of 30 schools in urban Lucknow in Uttar Pradesh in 1991. The data related to 902 children aged 13-14 years in class VIII. Data were collected for all the children enrolled in any one section for class VIII for all the schools. Tests were conducted for numeracy and literacy. Questions were on the basis of tests prepared for Knight and Sabot (1990) by Educational Testing Service, Princeton, NJ. Information was also collected about the schools and about the teachers who taught the students who gave the tests. On the basis of this survey, Kingdon (1998) showed that both family and school factors affect student achievement in India. School facilities and materials, length of instruction per week, school management type, and teachers' cognitive skills are the institutional factors which are important to affect student achievement. Family factors like parents' education and income (monetary value of assets in the household) also emerge as important determinants of student achievement.

Again, on the basis of the same survey, Kingdon (1996a, 1996b, 1998) has shown that private schools performed better in terms of student achievement. On the basis of this survey in Uttar Pradesh, these studies conclude that fee charging private unaided schools are popular as they are of superior quality in terms of cost efficiency and technical efficiency like good school management, teacher monitoring, availability of better school facilities and teaching materials etc.

NCERT (2008) found that community participation in schools and the number of teachers in schools had the maximum impact on student achievement.

Banerjee (2011) in her study of 344 districts (2004-05 to 2007-08) found that parents' education and small class size improve for student achievement. This study also focuses on the needs to improve the quality of schooling of SC students. NCERT (2012) found that there is variation is quality of education across states.

In this present study also, we want to enquire about the determinants of schooling quality in terms of student achievement in the city of Burdwan, West Bengal. The purpose of this study is to examine the impact of socio demo graphical characteristic, psychological factors like student's attitude, and facilitating conditions (classroomsupport, home support, and teacher support) on students' mathematics/language achievement of the West Bengal secondary school students.

2. CONCEPTUAL FRAMEWORK AND METHODOLOGY:

A survey was conducted on four hundred and eighty nine students about their school life, home life and cognitive skills. Those students are from Krishnapur High School, Vidyasagar High School, Bidyanthi Girls' High School, BidyanthiBhaban Boys' High School, Burdwan Model School, Harisabha Girls' High School, Municipal Boys' in West Bengal region. All the students are of 8th standard. The survey among students was done during 2014. The cooperation rate was 95% and the overall response rate was 74%. Analysis of the demographic data and completion status of the final sample in general showed the sample to be representative.

In our study we have considered the dependent variable 'Student's Performance'. The performance or cognitive skills were measured based on the student's mathematics skill and the student's language skill.

In case of mathematics, each student was asked to solve five questions. Each correct answer was given 1 and a wrong or unwritten answer got 0. The student's performance was gauged based on how many questions he answers correctly. The students who answered 0 or 1 or 2 questions correctly are scaled to 0 and the students who answered 3 or 4 or 5 questions correctly are scaled to 1. The sums are given in Appendix 1. In case of language, each student was asked to correct four mistakes in a paragraph. The paragraph was in English or Bengali depending on the medium of instruction. For each correct identification, one mark was given otherwise zero. The student's performance was gauged based on how many mistakes he identifies correctly. The students who identified 0 or 1 or 2 mistakes correctly are scaled to 0 and the students who identified 3 or 4 mistakes correctly are scaled to 1. The details of the language test are given in Appendix 2. The two dependent variables thus formed which we name as 'Student's Performance' is of ordinal scale.

On the basis of previous studies, one can classify the factors contributing to a student's performance into general categories. The first set consists of those characteristics which students bring to the educational process at the time of entry, such as educational preparation, socioeconomic and demographic status, the support a student receives at home from his parents and the student's gender. These characteristics are either fixed or slowly changing throughout the duration of a student's involvement with a school or we can say they have a constant influence on the performance of students. The second category consists of the goals, commitment, attitude, perceived competence and perceived value of a student. These factors vary from student to student and are an important factor to determine the student's success. The third group contains

factors that can be termed institutional, that is, under the control of the educational provider. These include quality and difficulty of instructional materials, access to and quality of tutorial support, and the administrative and other support service provided. In our model, all these factors are independent variables as they don't get affected by any other factors. The dependent variable is the student's performance. The overall performance of a student is largely affected by the above mentioned factors. We apply discriminant analysis between the independent variables and the dependent variable. Though the dependent variable is of ordinal scale, the independent variables are either of ordinal scale or mean scale. Ideally, a comprehensive explanation of student's performance would involve the systematic development and testing of valid and reliable measures within the context of such a framework. This is a formidable task, both in terms of data collection and in statistical modelling. Fortunately, only some of the many factors are significant enough to affect the student's performance. All the insignificant factors can be neglected. Now, only those few significant factors need to be taken into the framework for systematic progress toward a comprehensive assessment of the student's performance.

The survey was done with 48 different questions i.e. 48 independent variables. Analysing so many variables is very difficult, but the potential number of variables to be analysed in a multivariate analysis can be reduced. First, variables with a large proportion of missing data, in most cases contingency questions applying to sub-groups of the sample, were excluded. Secondly, single measure and composite items with highly skewed distributions were removed. Finally, the remaining variables were, in most cases, grouped to increase the reliability of the measures to be used in the multivariate analysis and to reduce the possibility of highly correlated variables being entered into the predictive equation. Questions were grouped if conceptually they seemed to measure similar phenomena, and were found to be mathematically correlated. For example, the questions 'Do you get good marks?', 'Do you like difficult problems?', 'Does your teacher says that you are good?' all point to the student's perceived competence and thus can be grouped into one variable. The mean of all the questions of a group is found out to represent the value of the combined variable.

The final independent variables taken in our model for student's performance based on mathematics skill are Perceived Value, Perceived Competence, Teacher Support, Class Support, Student Attitude, Socioeconomic Status, House Support, Gender and Life Dream. For the student's performance based on language skills, all the above variables except Perceived Value and Life Dream are taken in our model. The answers were in either yes or no or ranged from

never, rarely and always. Gender and Life Dream are represented in nominal scale. All other variables are represented as means.

We thus, classify the factors contributing to a student's performance into three general categories. 1) Socio-demographic Characteristics 2) Attitude towards Mathematics 3) Facilitating conditions.

1. Socio-demographic Characteristics: The first set consists of those characteristics students bring to the educational process at the time of entry, such as educational preparation, socioeconomic and demographic status, and the student's gender. These predisposing characteristics are either fixed or slowly changing throughout the duration of a student's involvement with a school and, as such, exert a relatively constant influence on student's performance. Most students were in the age range 12 to 14 years. Few students were also a little older in the age rage 15-16 years. 47 % of the respondents out of 489 were girls and the rest were boys. To find, the socio-economic background of the students, we inquired about ownership of certain assets in the household as we felt that Class VIII children won't be able to tell us the exact household income. The survey asked about the following assets: Computer, Laptop, Study table, Own books, Bike/scooter, Car, Bicycle, Cellphone, TV, Fridge, AC, Air cooler, Microwave, Landline telephone, Gas, Own room and own House following Kingdon (1996a) (Presence of an asset was given one and zero otherwise).

2. **Attitude towards Mathematics/Language:** Attitude may be considered as the degree to which an individual has favourable or unfavourable assessments of the behaviour in question. We can find many studies that examined the influences of attitude on students' mathematics score. Else-Quest et al. (2010) and Winheller et al. (2013) indicate that attitude towards mathematics are positively and significantly associated with mathematics achievement. Kupari, (2006) and Singh et al. (2002) also demonstrate that a mathematical attitude is a salient predictor of achievement in mathematics. Likewise, adolescents who reported higher levels of positive affect toward mathematics performed statistically significantly better in mathematics than did their peers who reported lower levels of positive affect toward mathematics (Arens et al., 2011). Furthermore, the study of Vandecandelaere et al. (2012) gives support how to create the learning environment in enhancing the attitude towards mathematics. However, mathematical attitude being complex and a multidimensional construct, this study divided the construct into three dimensions, namely 1) Perceived Competence 2) Enjoyment of mathematics/Student's attitude

3) perceived value of learning mathematics. Similarly, language learning can be influenced by attitude. The study divided the construct into 1) Perceived Competence 2) Student's attitude (Steven and Slavin, 1995).

2.1. Perceived competence: Perceived competence is an individual's perception that he/she has mastery of the skills necessary to meet environmental demands (Klein & Magill, 1998). The skills that children learn during childhood involve consistent and constant practice at both explicit and subconscious levels. As a result of increased practice and consequent mastery, the child develops a perception of his own competence in the world – a view that is relatively stable over time and contributes to emotional, social, and academic development. Cho, Weinstein, & Wicker, (2011) have demonstrated the positive predictive effects of self-perceived academic competence on achievement outcomes. Shen and Pedulla (2000), drawing on data from the Third International Mathematics and Science Study and employing Bandura's (1997) self-efficacy theory, explored the relationships between self-perceived competence in mathematics and science and student achievement. Within country data suggested a positive relationship between self-perceived competence in mathematics and science and student achievement. Adolescents who perceived themselves to have higher mathematical competence performed statistically significantly better in mathematics than did their peers who perceived themselves to have lower mathematical competence. Also, we assume that students who have perceived competence should perform well in language (Steven and Slavin, 1995). Based on above studies, it is postulated that

H1: Perceived competence is positively and significantly associated with mathematics/ language achievement.

To measure perceived competence we have asked the students questions like 'I get good marks in mathematics', 'My classmates do better than me in mathematics' (used in reverse), 'Mathematics makes me nervous', 'I like to solve difficult problems' and 'Teacher says I am good'. In case of language, the questions ranged from 'I read well', 'My classmates are better than me', 'Reading makes me nervous', I find reading to be hard' and 'I don't understand difficult words'.

2.2. Student's attitude: Attitude of students contains the extent to which the student enjoys mathematics or language lessons and the subject matter (Mcleod, 1994, Steven and Slavin,

1995). It measures how much students like the subjects or how difficult they perceive the subjects. So this study postulates that:

H2: Student's attitude is positively and significantly associated with mathematics/ language achievement.

To measure student's attitude in mathematics, we have asked the students questions like 'I love Mathematics', 'I wish I didn't have to study mathematics' (used in reverse) and 'I do mathematics as it is important'. In case of language, the questions are like 'I like reading in class', I read as it is compulsory', I understand what my teacher says in class' and 'The class is interesting'.

2.3. Perceived value of mathematics: Perceived value of mathematics refers to the beliefs the student holds about the importance of mathematics in every day and later life (Midgley et al., 1989). It captures dimensions like how doing well in mathematics helps him/her to get good job, pursue higher studies and important for life. This variable is not considered in case of language. So this study postulates that:

H3: Perceived value of mathematics is positively and significantly associated with mathematics achievement.

To measure perceived value of mathematics, we have asked the students questions like 'I study mathematics as it is useful for higher studies' 'I want to do higher studies in mathematics' and 'I study mathematics to get a good job'.

3. Facilitating conditions: The third category contains the conducive environmental or the facilitating conditions that motivates students to achieve high score in mathematics/ language. Facilitating conditions includes teachers support, classroom support and home support. These include quality and difficulty of instructional materials, access to and quality of tutorial support, and the administrative and other support service provided. The following things have been asked about facilitating conditions:

3.1. Classroom support (we can say also Infrastructure support): Presence of Good Classroom, Classroom requiring repair, Playground, Drinking Water and Toilets. Kingdon (1998) shows the importance of infrastructure on students' grades.

3.2. Teachers support: Questions were asked whether students' understand easily what the teacher says in class, whether class is interesting and teacher's view on him/her as perceived by the student. Importance of teachers' support on student achievement have been shown in various studies (Klem and Connell, 2004; Rockoff, 2004).

3.3. Home support: Questions were asked whether parents enquire about studies, the student talk to parents about studies, parents oversee and help in homework. Smith and Hausafus (1998) show that students have higher test scores if parents help them see the importance of taking advanced science and mathematics courses, emphasize the importance of mathematics in today's careers, set limits, and visit science/mathematics exhibits and fairs with their child.

Other than this, we also include a variable Life dream, which incorporates how far one is interested to study to get his/her anticipated job.

Drawing from the literature review, it is proposed that students'achievement is dependent onstudents' socio-demographics characteristic, attitude and the facilitating conditions as given in the following table.

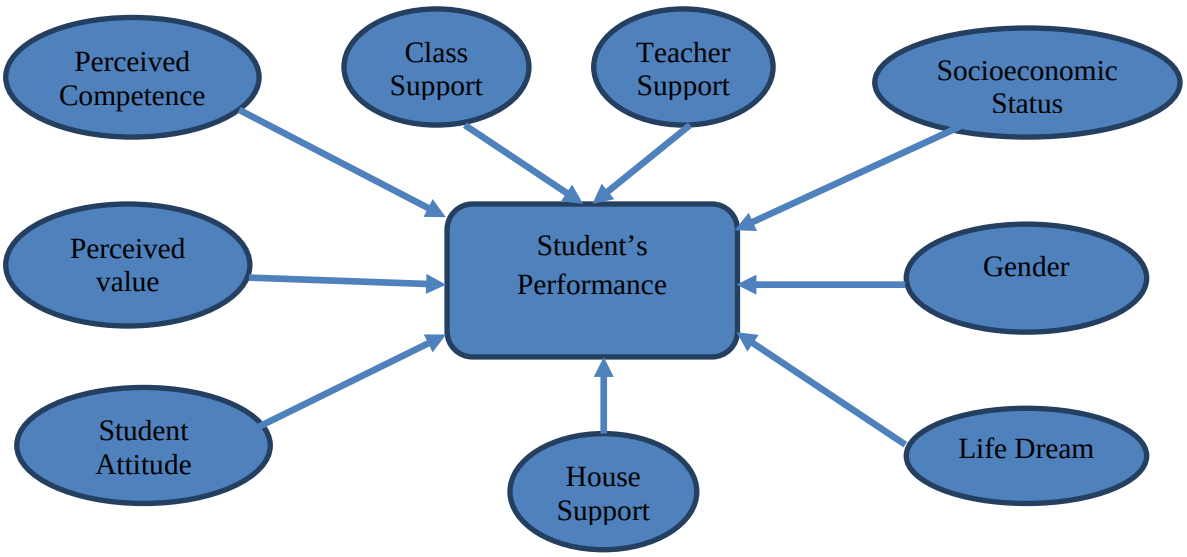

Figure 1: Proposed Model to show factors affecting Students' Performance

The multivariate technique selected for the data analysis is Discriminant Analysis. Multiple regression is not used as most of the variables used are discrete. Discriminant analysis permits both mean valued and nominal scaled variables to be used as discriminating variables. Research as done by Gilbert (1968) and Moore (1973) shows that this method performs quite well in case of categorical predictors. Thomas et al. (1996) used discriminant analysis to predict student performance in an introductory electromagnetism course at Georgia Tech. Using information available from student's records, the study predicted 50% of the students who eventually failed the class. Divjak and Oreški (2009) used discriminant analysis to analyse the effect of 30 variables upon the dependent variable- Student success at the Faculty of Organization and Informatics, University of Zagreb. This method analyses the interactions among a number of significant variables to arrive at a single, composite value that allows one to predict outcomes on a case by case basis. Finally, the information provided by the Discriminant functions can be used to classify future samples of individuals.

3. DISCRIMINANT ANALYSIS:

We choose a discriminating function that best discriminates the groups more precisely. In case of mathematics, we have only two groups i) whether the student is good at mathematics and ii) whether the student is not good at mathematics. And in case of language, the two groups are i) whether the student is good at language and ii) whether the student is not good at Language in Language Proficiency. We get only one discriminant function in each of the cases.

3A. MATHEMATICS PROFICIENCY:

The variables to explain mathematical proficiency are perceived competence, perceived value, teachers' support, class support, student attitude, gender, house support, life dream and socio economic status. The details of the questions asked in each case are given in Appendix 3.

Among the original 489 observations 44 observations were excluded because of missing at least one discriminating variable. So only 445 observations (i.e. 91%) was taken into account for our calculation.

Group means and standard deviation are calculated for each variable of both categories. Means of perceived competence, perceived value, teachers' support, class support, student attitude, gender, house support, life dream and socio economic status are denoted by PC_mean,

PV_mean, TS_mean, CS_mean, SA_mean, G_mean, HS_mean, LD_mean and SSS_mean respectively. By examining the difference between the group means and the standard deviations, it is possible to see whether the variables can differentiate between both categories. The group's statistics of the two-groups can be used as characteristics profile**.** For a variable, which has Wilk's Lambda less than 0.95, the groups means are different and the variables are significant, but if it is greater than or equal to 0.95, the variables do not differentiate between the groups successfully yet they can be significant based on further analysis. As seen from Table 1, here PC_mean, CS_mean, SA_mean, SSS_mean can be used to differentiate between the groups successfully, whereas, LD_mean, PV_mean, G_mean and HS_mean cannot be used to differentiate successfully.

Table 1 : Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
PC_mean	0.901	48.833	1	443	0.000
PV_mean	0.994	2.625	1	443	0.106
TS_mean	0.974	11.985	1	443	0.001
CS_mean	0.939	28.720	1	443	0.000
SA_mean	0.946	25.297	1	443	0.000
G_mean	0.994	2.472	1	443	0.117
HS_mean	0.987	6.052	1	443	0.014
LD_mean	1.000	0.002	1	443	0.968
SSS_mean	0.927	34.681	1	443	0.000

Canonical discriminant function coefficients show the relative importance of the variables. The one having the highest value irrespective of sign is having more weightage than that of the variable having less value. The structure correlations are also called as Discriminant Loadings. The variables are ordered by absolute size of the correlations between the discriminating variables.

Here in our case, the order is as in the structure matrix table given in Table 2 and the Canonical discriminant function coefficients in Table 3.

Table 2: Structure Matrix:

PC_mean	0.669
SSS_mean	0.564
CS_mean	0.513
SA_mean	0.481
G_mean[a]	-0.204
HS_mean[a]	0.193
TS_mean[a]	0.158
PV_mean[a]	0.060
LD_mean[a]	0.034

a. This variable is not used in the analysis.

Table 3: Canonical Discriminant Function Coefficients

PC_mean	1.536
CS_mean	1.322
SA_mean	0.831
SSS_mean	1.652
(Constant)	-4.729

Discriminant Function:

The discriminant function is of the form

$$D = v_1X_1 + v_2X_2 + v_3X_3 + v_4X_4 + \ldots\ldots v_iX_i + a$$

where:

D = discriminate function; v = the discriminant function coefficient or weight for that variable

X = respondent's score for that variable; a = a constant

i = the number of predictor variables

So the discriminant function in this model becomes:

*F = -4.729 + 1.536*PC_mean + 1.322*CS_mean + 0.831*SA_mean + 1.652*SSS_mean*

In this model, the number of students who scored zero in mathematics was 218 and number of students who score one was 227

The unstandardized canonical discriminant functions evaluated at group means are given in Table 4.

Table 4: Unstandardized canonical discriminant functions evaluated at group mean

0	-0.505 (=Z_A)
1	0.485 (= Z_B)

The above information helps us at calculating the cutoff score for each observation: We get Z_{cutoff} = -0.0200.

If the discriminant Score of the observation is greater than Z_{cutoff} (i.e. > -0.0200) then it is classified to Group 1 (i.e. students who are good at mathematics) else to group 0.

After getting the discriminating function, all the observations are classified based on the discriminating functions as seen in Table 5. For the observations whose actual group is 0 and predicted as 0 and for observations whose actual group is 1 and predicted as 1 are correctly classified. But for observations whose actual group is 0 and predicted as 1 and vice versa are wrongly classified. In our case the prediction accuracy is 69.5% as can be seen in Table 5 also.

Table 5: Classification of observations based on discriminant functions

		MP_ordinal	Predicted Group Membership		Total
			0	1	
Original	Count	0	175	78	253
		1	71	165	236
	%	0	69.2	30.8	100.0
		1	30.1	69.9	100.0

a. 69.5% of original grouped cases correctly classified.

If we go to predict the groups by chance our prediction accuracy will be 51.01% (=227/445). As per the standard, 1.25*51.01% = 63.76% < 69.5% shows that we had an advantage of having discriminant analysis.

So we can predict the dependent variable 69.5% accurately for given set of observations. Thus, we can estimate student performance by just knowing the factors influencing his/her studies.

3B. LANGUAGE PROFICIENCY:

The variables considered to explain language proficiency are perceived competence, teachers' support, class support, student attitude, gender, house support, and socio economic status. The details of the questions asked in each case are given in Appendix 4.

Among the original 489 observations 39 observations were excluded. So only 450 observations (i.e. 92%) were taken into account for our calculation of results.

Group means and standard deviation are calculated for each variable of both categories. By examining the difference between the group means and the standard deviations, it is possible to see whether the variables can differentiate between both categories. Here, CS_mean, SA_mean, SSS_mean can be used to differentiate between the groups successfully, whereas, PC_mean, PV_mean, G_mean and HS_mean cannot be used to differentiate successfully.

Table 6: Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
PC_mean	0.978	9.919	1	448	0.002
TS_mean	0.972	12.716	1	448	0.000
CS_mean	0.928	34.567	1	448	0.000
SA_mean	0.904	47.780	1	448	0.000
G_mean	1.000	.011	1	448	0.915
HS_mean	0.984	7.302	1	448	0.007
SSS_mean	0.921	38.670	1	448	0.000

Canonical discriminant function coefficients show the relative importance of the variables. In this case, the structure matrix with canonical discriminant function coefficients is given in Table 7 and 8 respectively.

Table 7: Structure Matrix

SA_mean	0.627
SSS_mean	0.564
CS_mean	0.533
TS_mean	0.323
PC_mean	0.286
HS_mean	0.245
G_mean	0.010

Table 8: Canonical Discriminant Function Coefficients

PC_mean	0.605

TS_mean	1.151
CS_mean	1.209
SA_mean	1.307
G_mean	0.750
HS_mean	0.384
SSS_mean	2.057
(Constant)	-7.653

The discriminant function in this model becomes:

*F = -7.653 + 0.605*PC_mean + 1.151*TS_mean + 1.209*CS_mean + 1.307*SA_mean + 0.750*G_mean + 0.384*HS_mean + 2.057*SSS_mean*

In this model, the number of students who scored zero in language was 197 and who scored one was 253. The unstandardized canonical discriminant functions evaluated at group means are given in Table 9.

Table 9: Unstandardized canonical discriminant functions evaluated at group means

0	-0.589
1	0.459

The Z_{cutoff} in this case, is thus Z_{cutoff} = -0.1302.

If the discriminant Score of the observation is greater than Z_{cutoff} (i.e. >-0.1302) then it is classified to Group 1 (i.e. students who are good at Language) else to group 0.

After getting the discriminating function all the observations are classified based on the discriminating functions. In our case the prediction accuracy is 71.3%, as can be seen in Table 10. If we go to predict the groups by chance our prediction accuracy will be 56.22% (=253/450). As per the standard 1.25*56.22% = 70.28% < 71.3% shows that we had an advantage of having discriminant analysis. So we can predict the dependant variable 71.3% accurately for given set of observations. That is we can estimate student performance by just knowing the factors influencing his/her studies.

Table 10: Classification of observations based on discriminant functions

	LP_ordinal	Predicted Group Membership	Total

			0	1	
Original	Count	0	130	67	197
		1	62	191	253
		Ungrouped cases	5	4	9
	%	0	66.0	34.0	100.0
		1	24.5	75.5	100.0
		Ungrouped cases	55.6	44.4	100.0

a. 71.3% of original grouped cases correctly classified.

4. CONCLUSION:

Thus from our study we get the prediction accuracy for predicting Math's proficiency is 69.5% and the prediction accuracy for predicting Language proficiency is 71.3%. With the estimated function, we can identify the students who are at risk (getting the score zero) and then proper steps can be taken to affect the determinants to move the student to a no-risk situation (getting score of one).

With the assumption that the schooling quality in similar districts of West Bengal, India as compared to Burdwan, can be proxied by these few schools, we can say our prediction might be valid approximately for them also. Our analysis shows that some of the variables are important to affect mathematical and language efficiency. If students' views can be boosted by parents, teachers and counselors, outcomes can be improved. Similarly, a student can move from 'not good' to 'good' if infrastructure or socio-economic status or teaching support or home support is improved. Our estimates can tell how much either all or any one of the determinants should be increased to move a student from 'not good' to 'good'.

Government investments in school infrastructure or improving the lot of the poor population with school going kids (through employment generation programmes) can be very helpful. Teachers' recruitment should be done very carefully. Teachers should not only be judged based on mere educational qualification but also on their attitude which can motivate students. Existing teachers can be sent for training for the same. Parents should also be counseled and made to involve themselves in students' studies. All these changes can definitely improve the cognitive skills from 'not good' to 'good' for a major chunk of students which will develop the future growth opportunities of the country.

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Appendix 1: Mathematics test

The following simple sums were given them to solve to analyse the cognitive skills.

Some simple brain teasers for you- try to solve them quickly.

i. $\begin{array}{r} 74393 \\ +\ 43981 \\ \hline \end{array}$ ii. $\begin{array}{r} 90012 \\ -\ 49659 \\ \hline \end{array}$ iii. $\begin{array}{r} 4294 \\ \times\ \ 69 \\ \hline \end{array}$ iv. $15\overline{)46440}$

v. $(26456 - 9321) \times 26 =$

Appendix 2: Language test

The following simple passage was given to the English medium students to identify four spelling mistakes. It is to be noted that the Bengali medium students got a Bengali passage.

Sushmita is a very good student. She generaly gets good marks in examinasions. Physics is her favourite subject. She wants to go for higher studies in the said subgect. Her house is far from school. She travels in school bus. Tina is her best friend. Playing Sudoku is there preferred past time.

i. Underline the four spelling errors in the above passage.

Appendix 3: Questions in each variable to explain mathematical proficiency

The questions asked to the students in mathematics were related to:

1. Perceived Competence
    a. I get good marks
    b. Classmates are better in mathematics
    c. Mathematics makes nervous
    d. I like to solve difficult problems
    e. Teacher says I am good
2. Perceived Value
    a. I study mathematics as it is useful for higher studies
    b. I want to do higher studies in mathematics
    c. I study mathematics to get a good job

3. Teacher Support
    a. I understand what the teaches says in class
    b. Class is interesting
4. Class Support (Presence of)
    a. Good classroom
    b. Classroom requiring repairs
    c. Playground
    d. Drinking water
    e. Toilets
5. Student Attitude
    a. I love mathematics
    b. I wish I didn't have to study mathematics
    c. I do mathematics as it is important
6. Gender: Boy or girl
7. Home Support
    a. Parents enquire about studies
    b. I talk to parents about studies
    c. Parents oversee homework
    d. Parents help in homework
8. Life Dream: Finish school (till class 10) or Till Class 12 or Graduate or Post graduate and above, I don't know and I feel like leaving now
9. Socio Economic Status (Presence of)
    a. Computer
    b. Laptop
    c. Study table
    d. Own books
    e. Bike/scooter
    f. Car
    g. Bicycle
    h. Cellphone
    i. TV
    j. Fridge

k. AC
l. Air cooler
m. Microwave
n. Landline
o. Gas
p. Own room
q. House

Appendix 4: Questions in each variable to explain language proficiency

The questions asked to the students were related to:

1. Perceived Competence
    a. I read well
    b. My classmates are better than me
    c. Reading makes me nervous
    d. I find reading to be hard
    e. I don't understand difficult words
2. Teacher Support
    a. My teacher says I am good
3. Class Support
    a. Good classroom
    b. Require repair class
    c. Playground
    d. Drinking water
    e. Toilets
4. Student Attitude
    a. I like reading in class
    b. I read as it is compulsory
    c. I understand what my teacher says in class
    d. The class is interesting
5. Gender

6. Home Support
    a. Parents enquire about studies
    b. I talk to parents about studies
    c. Parents oversee homework
    d. Parents help in homework
7. Socio Economic State
    a. Computer
    b. Laptop
    c. Study table
    d. Own books
    e. Bike/scooter
    f. Car
    g. Bicycle
    h. Cellphone
    i. TV
    j. Fridge
    k. AC
    l. Air cooler
    m. Microwave
    n. Landline
    o. Gas
    p. Own room
    q. House