Chapter 6

Direct and Indirect Effects of the Factors Affecting Quality of Education in Primary Schools of Navi Mumbai -- Path Modelling and Analysis

6.1 Introduction

In the previous chapter, using statistical models for causal analysis we attempted to find the total effect of each of the selected predictors on the dependent/response variable i.e., quality of education of Primary Schools assessed as the percentage of students securing 60 or more percent of marks in final examination. The statistical models considered hitherto do not handle the situation if the predictor variable(s) affect the response variable not only directly but also indirectly through one or more intervening variables. Path modelling is a statistical technique for analyzing this kind of causal relationship (Retherford and Choe 1993). In previous chapter it has been found that three factors, namely ‘Student-Teacher Ratio’, ‘Type of School Management’ and ‘Size of Class’ affect the quality of education. In this chapter we tried to find direct and indirect effects of the above three predictors on quality of education through other intervening variable(s). Therefore in this chapter the main aim was first to propose suitable path model depicting the effects of selected predictors (with causal direction) affecting directly and also indirectly through intervening variable(s), on the response variable and later to estimate these effects using multiple regression analysis. Quality of primary education is directly and indirectly related to causal factors such as school governance and management, teachers’ qualifications as it affects the learning outcome of students. The education scenario in India is fast changing. Today, competition among students to score in final examination is increasing leaps and bounds. In such a situation it becomes all the more important to identify the factors which promote quality of education.

Figure 6.1A furnished a simple conceptual framework showing how school management affects directly the school outputs (result) and also affects indirectly through school inputs and school production process.
School management is a source of both inputs and constraints. At the same time school management is essentially responsible for generating the desired school outputs, in the sense of achieving the goals of schooling. The input factors such as teacher’s appointment criteria, teacher’s salary, teacher’s training; organisational and managerial characteristics of schools, effective teaching, and expenditure per student. School output (in the present study) is performance of students in the sense the marks obtained by students in the final examination. School processes includes factors related to teaching at classroom and school level, the disciplinary atmosphere and achievement etc. An example of a process variable at the classroom level is the amount of teaching time spent on a particular subject (Organisation for Economic Co-operation and Development (OECD 2005)).

6.2 Factors Affecting Quality of Primary School Education

We hypothesize that educational performance of student was mainly affected at two levels namely at school level and at teacher’s level in this chapter. In this chapter two models have been proposed and estimated from the empirical data.

a. School Management Factor

The school management package of integral or built-in factors affect the quality of education. The school management package comprises of the factors such as – intake capacity of school, class size, admission and selection policies of students’, administrations; and source of finance, requirements of number of teaching and non teaching staff, and criteria for
appointment of teachers, teacher’s development policy and programmes, work load of
teachers, school infrastructure and other facilities, curriculum, governance, accountability,
and other school-level characteristics such as disciplinary climate which may also influence
the quality of educational outcomes. A good management can uplifts the spirit of principal
and teachers and inspire them for excellence performance. However, the Management may
lend a hand with other stakeholders in the community to improve the physical and academic
status of the school. The public-private partnership generally takes place in private schools
only. The organisation environment in schools may be expressed by the description of
desired school conditions and level of satisfaction about those conditions (Kremer & Kurtz,
1985). According to Zak (1981), school management may develop a built-in process for
monitoring the functioning of the principal. School management is also responsible for
providing conducive environment in school needed for academic, physical and social
development of students. To achieve this it is important to have friendly and helpful gesture
of faculty members towards their colleagues and students.

Teacher Factor

It has always been said that you cannot give what you do not have, thus, teachers in schools
should be encouraged to attend training programmes and/or seminars/conferences to discuss
new teaching skills in order to improve their teaching. The teachers can make a significance
difference in quality of education. A good student-teacher communication may yield better
results. Studies have shown that a good interaction between teacher and student in the
classroom can create better result which is only possible if student - teacher ratio is low.

Generally, research reviews indicated that factors that are closer to the students’ actual
learning process have the strongest impact. School factors have more impact such as
classroom management, administrative characteristics of the education system (Wang et al.,
1993). Some researchers identify the variables at the classroom level which had strong
impact on students’ educational performance (Scheerens, 2003). Byrne (1998) found that low
salaries, high workload and denial of timely promotions of teachers may contribute to low
morale of teachers.
These variables/factors may affect the response variable indirectly through other variables/factors. This is why we chose to find both direct and indirect effects of the predictors on dependent variable using path modelling.

### Table 6.1A

**Path Models by Selected Predictors Affecting Quality of Education**

<table>
<thead>
<tr>
<th>Model 6.1</th>
<th>School Factors</th>
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<tbody>
<tr>
<td></td>
<td>Type of School Management</td>
</tr>
<tr>
<td></td>
<td>Student-Teacher Ratio</td>
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<td></td>
<td>Class Size</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Model 6.2</th>
<th>Factors Related to Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type of School Management</td>
</tr>
<tr>
<td></td>
<td>Employment Status of Teachers</td>
</tr>
<tr>
<td></td>
<td>(Permanent or Temporary)</td>
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<td></td>
<td>Status of Training (Trained or</td>
</tr>
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<td></td>
<td>Untrained Teachers)</td>
</tr>
</tbody>
</table>

### 6.3 Path Modelling

Path modelling is a statistical technique used primarily to examine the hypothesized (causal) direct and indirect relationship through one or more intervening variables. Path analysis is used mainly in the attempt to understand comparative strengths of direct and indirect relationships among a set of variables. In this way, path analysis is unique from other linear equation models:

In path analysis mediated pathways (those acting through a mediating variable, i.e., “Y,” in the pathway X ->Y ->Z) can be examined. A series of parameters can be estimated by solving two or more structural equations of the model. The simplest path model in the form of a single regression equation is as follows. As an example, let us consider the model

\[
\hat{Q} = a + b S \tag{6.1}
\]

Where Q = quality of education, S = Type of School Management. The above Table 6.1A presents the variables used in each of the two proposed path models discussed in this chapter. Path Model-1 employed the type of school management, student - teacher ratio and class size as
the causal factors in determining the quality of education in primary schools. Path Model-2 utilized the type of school management, percentages of trained teachers and of permanent teachers as the contributing factors to the quality of education in primary schools.

Model 1

6.3.1 Analyzing the Effect of Type of Management of School on Quality of Education through Intervening Variables – Student - Teacher Ratio and Class Size:

6.3.1 Rationale of Selection of Response and Predictor Variables

A. Dependent/Response Variable

*Students’ Performance as a Measure for Quality of School*

Students’ performance in examination is a good indicator of quality of education. India’s education system is predominantly examination-oriented, where passing examinations is the benchmark for academic performance of student. There is no internal system of monitoring learning achievements at other levels within an education system in India.

B. Predictors

i) *Type of School Management*

Primary Schools in India can be broadly classified under two types of managements of schools, namely, Public Schools and Private Schools. In the present study, we have bifurcated Public Schools into the categories of Navi Mumbai Municipal Corporation (NMMC) Schools and Zillah Parishad (ZP) Schools. These public schools are funded by NMMC and District Board Administration – both are Government statutory bodies. The reason for considering two types of public schools is that these are under the administrative control of different managements. Also, NMMC schools are located in urban areas; whereas ZP schools are situated in rural areas of Navi Mumbai\(^1\). The third

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\(^1\) The NMMC: Private: ZP was given 0:1:2 scores for applying path analysis. The rational of assign these score is that average performance of ZP school is best followed by private and NMMC schools. Therefore
type of primary schools is Private Schools. These schools are either run by Societies registered under government Act or function under a Trust. The finances of these schools mainly through tuition fees charge to students and also from the interests earned on the donations received from philanthropists and other casual donors. The Private Schools charge heavy tuition and other fees.

(ii) **Student-Teacher Ratio**

Student-teacher ratio is another important factor influencing the quality of education. In fact this is a direct indicator of Government’s focus on education (Kingdon 2007). A low student-teacher ratio provides more possibility for students and teacher to interact in the class. Also, students can discuss their problems and clear their doubts if any frequently with their teachers. The ratio of students to teacher is obtained by dividing total number of students enrolled in a school by the total number of teachers.

(iii) **Class Size:**

The success of the education system is judged by class sizes that are acceptable or manageable for teachers. Class size is defined as the number of students in a class PISA (Programme for International Student Assessment, 2009) analysis has shown that reduction in class size is generally expensive, and is less efficient spending choice for improving learning outcomes than, investing in the quality of teachers. Class size also seems to be more important in the earlier years of schooling than it is for 15-year-olds (Finn etal., 1999). According to Banerji (2003) overcrowding in lower classes might be contributing to the reasons for the schools to appear unattractive to the child. One cannot imagine ‘Joyful learning taking place in a small class room’ (when majority of them were not of adequate size) with more than 60 children with one teacher. Keeping this in view, information on class size is considered valuable for assessing the quality of school education.

ZP schools were assigned the highest score 2, private schools were assigned 1 and NMMC schools were assigned 0.
6.3.2 Path Model and Path Coefficients

Figure 6.1 shows the direction and causation for the hypothesized model predicting quality of school education using type of school management, student-teacher ratio and class size as predictors.

Figure 6.1: Path Model Portraying the Direct and Indirect Effects of Type of School Management, through Student-Teacher Ratio and Class Size on Quality of Education

The equations for the three models are:

(a)  
\[ S \rightarrow Q \]

(b)  
\[ S \rightarrow R \rightarrow Q \]
The equations for the three models are:

Model (1a)
\[ \hat{Q} = a + b S \]

Model (1b)
\[ \hat{R} = c + d S \]
\[ \hat{Q} = e + f R + g S \]

Model (1c)
\[ \hat{R} = h + i S \]
\[ \hat{C} = j + k R + m S \]
\[ \hat{Q} = n + p C + q R + r S \]

Where, S (type of school management) was the cause of variation in Q (Quality of primary school education). To view (6.1) in the context of path analysis, it has to be drawn into path diagrams, shown in model 6.1a. In path diagrams, arrows between variables indicate the direction of causation, and numbers written on the arrows represent effects in the form of
regression coefficients are called path coefficients. The causal ordering, as specified by path diagram is derived from the theory, not from the data themselves. A third variable R (student teacher ratio), where, theoretically three variables were causally related as in model 6.1b. Because S has no arrow coming towards it, it is not determined by other variables in the model and was therefore called an exogenous variable. In contrast, R and Q were endogenous variables, because they had arrows coming towards them and are determined, at least in part, by other variables in the model.

In figure 6.1b, there were no feedback loops; that is, we could not start from a variable, follow the arrows, and get back to the same variable. A model without feedback loops and with uncorrelated errors (between equations as well as within equations) is called recursive model.

In the model 6.1b, a regression equation was written for each endogenous variable. In each such equation, the endogenous variable was the response variable, and other variables with arrows coming directly to the response variable were predictor variables. The estimated model 6.1b had two endogenous variables, R and Q, and was accordingly represented by two equations:

\[ \hat{R} = c + dC \]  \hspace{1cm} (6.2)

\[ \hat{Q} = e + fR + gS \]  \hspace{1cm} (6.3)

Because (6.2) and (6.3), taken together, represented a single model, they were estimated simultaneously. This model was recursive, as this one was, and the errors in the underlying population regressions were statistically independent, as we assume they are, then it can be shown simultaneously estimation of (6.2) and (6.3) was equivalent to estimating (6.2) and (6.3) separately by ordinary least-square regression. This means that we can treat path analysis as an extension of ordinary multiple regression.

In the estimated model represented by equations (6.2) and (6.3), Q is the ultimate response variable and S is the exogenous variable. By substituting (6.2) into (6.3), we can represent Q solely in terms of the exogenous variable S. The resulting equation, called the reduced form model, can be written as
\[ \hat{Q} = (e + cf) + (g + df) S \]  \hspace{1cm} (6.4)

In (6.4), the coefficient \( g \) is called the direct effect of \( S \) on \( Q \), and the product of coefficient \( df \) is called the indirect effect of \( S \) on \( Q \). In model 6.1b the direct effect, \( g \), is written on arrow that goes directly from \( S \) to \( Q \); this arrow is called the direct path from \( S \) to \( Q \). The indirect effect, \( df \), is the product of coefficient \( d \) over the arrow from \( S \) to \( R \) and coefficient \( f \) over the arrow from \( R \) to \( Q \). This path, because it involves an intervening variable \( R \), is called the indirect path from \( S \) to \( Q \). The direct path is denoted as \( S \to Q \) and the indirect path as \( S \to R \to Q \). Direct paths are sometimes called simple paths, and indirect paths are sometimes called compound paths.

Intuitively, the direct effect is \( df \). If one unit increase in \( S \) augments \( R \) by \( d \) units, and a one unit increase in \( R \) augments \( Q \) by \( f \) units, then over the entire path, a one-unit increase in \( S \) must augment \( Q \) by \( df \) units.

When the comparison of equations (6.1) and (6.4) is done, it can be seen that they have the same form. Thus \( a = e + cf \) and \( b = g + df \). The coefficient \( b \) is called the total effect of \( S \) and \( Q \). The total effect equals sum of the direct effect and the indirect effect.

It can be noticed that the addition of intervening variable \( R \) to the model 6.1b does not invalidate the simpler model in 6.1a. The total effect of \( S \) and \( R \) is the same in either case. The addition of \( R \) to the model simply decomposes the total effect into a direct effect and indirect effect.

We have further added class size \( C \), as second intervening variable between \( S \) and \( Q \). In this model class size is another component which shows number students present in the class can be reasonably assumed that \( R \) (student teacher ratio) is causally prior to \( C \). The time of ordering of the variables, which can be taken as causal ordering, is \( S \), \( R \), \( C \), \( Q \). In the path diagram in model 6.1c, the variables are arrayed from left to right to reflect this time ordering.

The estimated model equations are

\[ \hat{R} = h + i S \]  \hspace{1cm} (6.5)

\[ \hat{C} = j + kR + m S \]  \hspace{1cm} (6.6)
\[ \hat{Q} = n + p C + q R + r S \quad (6.7) \]

The reduced form of the model is obtained by substituting (6.5) and (6.6) into (6.7), the simplified form of the model is as follows

\[ \hat{Q} = (n + jp + hq + hkp) + (r + iq + mp + ikp) S \quad (6.8) \]

The equation has same mathematical form as equation (6.1). Therefore

\[ a = n + jp + hq + hkp \]

and \[ b = r + iq + mp + ikp \]

The total effect of S on Q is b, the same as before. The total effect is decomposed into a direct effect r (corresponding to the direct path S->Q) and indirect effects iq (corresponding to the indirect path S-> R->Q), mp (corresponding to the indirect path S-> C->Q), and ikp (corresponding to the indirect path S-> R-> C -> Q). It is evident that one can obtain the total effect in either two ways: (1) by computing the coefficient of S in the reduced form of the model, \( \hat{Q} = a + b S \), or (2) by tracing out all possible paths from S to Q, computing the product of coefficient along each path, and summing the products over all possible paths.

In the same way, the direct, indirect and total effects of R on Q can be calculated. To derive these effects, we eliminate the intervening variable C by substituting (6.6) into (6.7), yielding the partially reduced form

\[ \hat{Q} = (n +jp) + (q +kp) R + (r + mp) S \quad (6.9) \]

The coefficient q is the direct effect of R on Q via path R -> Q; the product kp is the indirect effect of R on Q via the path R -> C -> Q; and sum q + kp is the total effect of R on Q. In the partially reduced form in (6.9), the direct, indirect, and total effects of R on Q all incorporate a control for the causally prior variable S because S also appears in (6.9). In (6.9), the coefficient of S, r + mp, is not of much interest because it is not the total effect of S on Q, insofar as it omits indirect effects of S on Q via R.
Because equation (6.9) has the same form as equation (6.3), it is evident that the total effect of S on Q in model 6.1c is same as the direct effect of S on Q in model 6.1b. In model 6.1b, the direct effect of S on Q is the same as the total effect of S on Q. Thus the total effect of S on Q is same as models 6.1b and 6.1c.

When equations for models (1a), (1b) and (1c) in model 6.1 are fitted to data the result was

Model (1a)
\[
\hat{Q} = 70.2 + 11.13S
\]

Model (1b)
\[
\hat{R} = 63.29 - 16.48S
\]
\[
\hat{Q} = 80.73-0.166R + 8.39S
\]

Model (1c)
\[
\hat{R} = 63.29 - 16.48S
\]
\[
\hat{C} = -14.2 + 1.15R + 3.34S
\]
\[
\hat{Q} = 74.55-0.43C + 0.33R -0.44S
\]

The following models 6.1a, 6.1b and 6.1c were the fitted path models and Table 6.1 summarises direct, indirect, and total effects of S on Q and R on Q.

Model (6.1a)

\[S \xrightarrow{b=11.13} Q\]

Model (6.1b)
6.3.2 Results

The models 6.1a, 6.1b and 6.1c yield direct and indirect effects and Table 6.1 summarized these effects and the total effects of $S$ (type of school management) on $Q$ (quality of education) and $R$ (student-teacher ratio) on $Q$ (quality of education). As expected the total effect of type of school management on quality of education was the same for all the three models and the total effect of student-teacher ratio on quality of education was the same for models 6.1b and 6.1c, which were the only models which include student-teacher ratio. Table 6.1 furnished that the effect of type of school management on quality of education was almost entirely direct, whereas the effect of student-teacher ratio on quality of education was mostly indirect through class size.

The $F$ value of regression models from equations 6.1a, 6.1b, and 6.1c were found highly significant at $p < 0.001$. 
Table 6.1: Direct, Indirect and Total Effects of Type of School Management, Student-Teacher Ratio and Class Size on Quality of Education of Primary Schools

<table>
<thead>
<tr>
<th>Variable</th>
<th>Type of School Management</th>
<th>Model (6.1a)</th>
<th>Model (6.1b)</th>
<th>Model (6.1c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Effect</td>
<td>Formula</td>
<td>Numerical Value</td>
<td>Formula</td>
<td>Numerical Value</td>
</tr>
<tr>
<td>Direct</td>
<td>b</td>
<td>11.13</td>
<td>g</td>
<td>8.39</td>
</tr>
<tr>
<td>Indirect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-&gt;R-&gt;Q</td>
<td>df</td>
<td>2.74</td>
<td>Iq</td>
<td>-5.44</td>
</tr>
<tr>
<td>S-&gt; C-&gt; Q</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-&gt; R-&gt;C-&gt; Q</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>11.13</td>
<td>11.13</td>
<td>11.13</td>
</tr>
<tr>
<td>Student Teacher Ratio</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>f</td>
<td>-0.17</td>
<td>Q</td>
<td>0.33</td>
</tr>
<tr>
<td>Indirect</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-&gt; C-&gt;Q</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>-0.17</td>
<td>-0.17</td>
<td>-0.17</td>
</tr>
</tbody>
</table>

6.3.3.1 Direct effect of type of school management on quality of education:

The total effect of type of school management on quality of school education is the path coefficient ‘b’ (11.13) equals sum of the direct and the indirect effects. The result was positive and explained direct effect of type of school management on quality of education. The schools managed by ZP have better academic achievements as compared to other two schools.

Table 6.1 portrayed the information given in the path diagrams in Figures 6.1a, 6.1b and 6.1c. To minimize rounding errors, the numbers in the table were calculated from the values of the coefficients specified to two decimal places, rather than zero decimal places as shown in figure6.1a to 6.1c. Because R was endogenous in the models 6.1b and 6.1c,
the direct, indirect and total effect of $R$ (student–teacher ratio) all incorporated a control for $S$ (type of school management). It can be noticed that $b = g + df = r + iq + mp + ikp$ and $f = q + kp$.

6.3.3.2 Direct, indirect and total effects of type of school management, student–teacher ratio on quality of education:

In Table 6.1, the coefficient ‘$g$’ (8.39) was the direct effect of type of school management on quality of school education and the product of coefficient ‘$df$’ (2.74) is indirect effect. The indirect effect ‘$df$’ was the product of coefficient ‘$d$’ (-16.48) over the arrow from type of school management to student–teacher ratio and coefficient ‘$f$’ (-0.166) over the arrow from student–teacher ratio to quality of school education. The negative sign of ‘$d$’ indicated inverse relationship between student–teacher ratio and quality of education. The coefficient $f$ (-0.166) student–teacher ratio to quality of school education implied that student–teacher ratio was a casual factor for quality of primary school education. The negative sign indicates that lower was the student–teacher ratio higher was the academic achievement score of the students. This path, because it involved an intervening variable $R$–student teacher ratio, was called the indirect path from School management to Quality of education. The direct path was denoted as $S -> Q$ and the indirect path as $S -> R -> Q$. The F value was significant at $p<0.001$.

6.3.3.3 Direct, indirect and total effects of type of school management, student–teacher ratio, class size on quality of education:

Another important variable class size $C$ when introduced as second intervening variable between type of school management and quality of school education, because class size was another component reasonably assumed as a factor that was causally related to student–teacher ratio through type of school management to quality of education. Class size was the number of students present in the class, though the enrolment figure of students in a school may be high but attendance of students is same or lower than the student teacher ratio, student-teacher ratio can be used as the measure of class size (Graue and Rauscher, 2009). Thus class size was another intervening variable affecting the
quality of education. The causal ordering was \( S \rightarrow R \rightarrow C \rightarrow Q \) in the path diagram of model 6.1c. The total effect of \( S \) on \( Q \) was the same as before. The total effect was decomposed into a direct effect ‘r’ (corresponding to the direct path \( S \rightarrow Q \)) and indirect effects ‘iq’ (corresponding to the indirect path \( S \rightarrow R \rightarrow Q \)), ‘mp’ (corresponding to the indirect path \( S \rightarrow C \rightarrow Q \)), and ‘ikp’ (corresponding to the indirect path \( S \rightarrow R \rightarrow C \rightarrow Q \)) as given in Table 6.1. The indirect effect ‘mp’ (-1.44) was the product of coefficient ‘m’ (3.34) over the direction from type of school management to class size and coefficient ‘p’ (-0.43) was from class size to quality of education. This revealed effect of indirect path \( S \rightarrow C \rightarrow Q \). Likewise ‘ikp’ was the product of indirect path coefficient ‘i’ (-16.48) is from type of school management to student - teacher ratio, path coefficient ‘k’ (1.15) was from student - teacher ratio to class size and path coefficient ‘p’ (-0.43) was from class size to quality of education. The ‘ikp’ (8.17) was the path coefficient corresponding to the indirect path \( S \rightarrow R \rightarrow C \rightarrow Q \). The findings revealed that type of school, student - teacher ratio and class size were affecting quality of education. The result shows that ZP schools had smaller class size, lower student - teacher ratio and higher score of academic achievement. Contrary to this the NMMC schools have large class size and higher student - teacher ratio and lower scores in final result as compared to ZP. Private schools had moderate class size and medium student- teacher ratio and stood better than NMMC but lower than ZP schools in academic performance. Thus class size was another intervening variable affecting the quality of education.

The findings revealed that there was the direct, indirect and total effect of type of school management on quality of school education. There was indirect effect of type of school management via student - teacher ratio and via class size on quality of school education. There was the direct, indirect and total effect of student - teacher ratio on quality of school education.

6.3.3 Discussion

6.3.3.1 Direct effect of type of school management on quality of education:

From the results of the study, it was evident that the direct impact of the type of school management on academic performance of students was dominant. The result showed that
the direct effect of type of school management on quality of education was quite high. The performance of ZP schools was better than that of private and NMMC schools. In India, as in most developing countries, there is little empirical research on the determinants of educational quality (Kingdon 1996). Various reasons have been postulated for private schools’ superior efficiency. However, across the Atlantic, several studies have investigated the relative effectiveness and quality of private and public schools, with mixed results.

The results of the present study about direct effect of type of school management on quality of primary education did not support the research findings reported in other countries. (see Mahmood and Khatoon, 2011; De Fraja, 2004; Juneja, 2001; Neal, 1997; Evans and Schwab, 1995 ;). Furthermore, the findings of the study support Vandenberghe and Robin (2004), who have used the data of OECD 2000, and found that public schools can perform better than private schools in France, Austria. Brunello and Rocco (2008) found that public schools have higher quality of education in Italy as compared to US schools. The above debate divulges that type of school management is a vital factor affecting the quality of education.

6.3.3.2 Effect of student - teacher ratio on quality of education:

The findings revealed that there was the direct and indirect effect of type of school management on quality of school education. The indirect effect of type of school management through student - teacher ratio on quality of school education showed inverse relationship between students’ achievement and student - teacher ratio, i.e. lower was the student - teacher ratio, higher was the quality of education measured in terms of results of final examination and vice versa. The results clearly brought out that ZP schools had lower student- teacher ratio and higher quality of education in terms of academic performance of students as compared to other two types of school managements. , NMMC schools had high student - teacher ratio and private schools had moderate (in between ZP and NMMC) student - teacher ratio. Therefore student- teacher ratio was an intervening variable (but casual factor for quality of education) between ‘Type of Management of School and ‘Quality of Education and therefore provided the indirect effect of school management on Quality of education through student - teacher
ratio. It may be noticed from Table 6.1 that a large portion of the Type of Management on Quality of primary education had been taken away by the student - teacher ratio. As has rightly been observed in other studies as well that student teacher ratio is one of the most important variables in the teaching learning process (Dahar et al 2009).

The findings of the study about student- teacher ratio on quality of education were in line with those of other quantitative studies undertaken elsewhere (See: Sharp and Mark, 2009; Levacic et al., 2005; Graddy & Stevens, 2003; Paterno,2001; Grissmer, 2000; Lee and Barro,1998).

Muralidharan and Kremer (2007) found that though private schools had low student - teacher ratio as compared to other types of schools but the quality of education, as assessed through students’ result in final examination, was relatively poor in private schools. Nonetheless, the majority of studies world over showed inverse relationship between student-teacher ratio and quality of education in primary schools.

6.3.3.3 Effect of class size on quality of education

The result shows that ZP schools had smaller class size, lower student - teacher ratio and higher score of academic achievement. Contrary to this the NMMC schools had large class size and higher student - teacher ratio and student’s lower scores in final examination as compare to ZP. Private schools had moderate class size and medium student - teacher ratio and stood better than NMMC but lower than ZP schools in academic achievements. In present study, the average class size for NMMC schools was higher (58) as compared to the average class sizes in Private (44) and ZP (27) schools. It revealed that if student - teacher ratio was high than average class size of that school is also high.

This result supports the findings that smaller class size improves student achievement. (see Bressoux Kramarz and Prost, 2008; Woessman and West, 2006; Crosnoe, Johnson and Elder 2004; Nye, Hedges, & Konstantopoulos, 1999).

Although the class size in the Asian countries is quite large, the students in these countries consistently get highest scores (Biggs, 1999; Jin & Cortazzi; 1999). However,
some studies found very small or no effect of class size (Rivkin et al, 2000; Hanushek, 2006). Likewise, class size effects in upper grades were not evident (Fuller & Clarke, 1994; Ehrenberg, et al., 2001). Many studies have discussed the influence of student-teacher ratio and class size on the performance of schools. (Duflo, Dupas and Kremer, 2012).

It was concluded that there was direct and indirect effects of the type of school management on quality of education through student - teacher ratio. However, a large chunk of its direct effect has been taken away by the intervening variable student-teacher ratio. There was an also direct and indirect effect of student - teacher ratio on quality of education through the intervening variable class size.

Model 2

6.3.2 Analyzing the Effect of Type of Management of School on Quality of Education through Intervening Variables – Percentages of Trained Teachers and Permanent Teachers in the School:

The rationale of proposing Model 2 was to study some additional intervening variables through which the type of school management predictor affects the quality of education. Since India has regional differences, the need of studying some other possible factors which may affect the quality of education in primary schools cannot be undermined. According to Benbow, Mizrachi, Oliver & Moshiro, 2007, the teaching and learning process in the developing countries is substandard. This is the key issue, however, this process can be improved by enhancing the capability of teachers and school leaders to identify the factors responsible for poor quality of education in order to overcome the shortcomings. Therefore an attempt was made here to examine the effects of the factors related to teachers that may be closely associated with quality of education. A second model (Model 2) of path analysis hypothesizing the direct and indirect causal relationships was given as follows.
In this model the variables related to teachers are considered as causal factors that were more closely associated with quality of education. The path model proposed to analyse direct and indirect effects of the variables of interest on the response variable – quality of education measured as the percentage of students securing 60 or more percentage of marks in their final examination.

Figure 6.2 presents the hypothesised path model showing the direct and indirect effects of the selected predictors on the response variable along with the direction and causation of the effects.

**Figure 6.2: Path Model Portraying the Direct and Indirect Effects of Type of School Management, through Percentage of Trained Teachers and Percentage of Permanent Teachers Employed in the School on the Quality of Education**

6.3.2.1 Rationale of Selection of Predictors
The list of predictors hypothesised to influence dependent/response variable i.e. the quality of primary school education and rationale of their selection was given below.

(i) Dependent/Response Variable *Quality of Education*

Quality of education was measured in this study from the final results of 11,078 students studying in 24 primary schools. This variable was already discussed above at 6.3.1A, therefore the same is not discussed again.

(ii) *Type of school management*
How school management is related to educational quality is a crucial issue in current educational reforms. The three types of school management in the current study were explained earlier at 6.3.1 (i), therefore the same details were not debated once more.

(iii) Proportion of Trained Teachers:

There is an impact of teacher’s training on academic achievements of students. Several studies have found large variability in the extent to which teachers promote students’ learning. (Rivkin, Hanushek and Kain, 2005 and Rockoff, 2004). In France, Bressoux (1996) studied the effect of teachers’ training on third-grade pupils’ achievement, comparing certified and uncertified teachers and found that training substantially improves students’ scores in mathematics. Angrist and Lavy (2001), evaluated the effect of in-service teacher training program in Jerusalem schools and found a significantly positive causal effect of this program on pupils’ test scores. Bressoux, Kramarz and Prost (2008) found that teachers’ training substantially improves students’ test score in mathematics. It can be said that teachers’ training have considerable and lasting effects on students performance. Therefore proportion of trained teachers in this model is taken as a causal factor in assessing its effect on the quality of education.

(iv) Proportion of Permanent Teachers:

Majority of research concentrated on the impact of teacher’s experience, salaries of teacher’s pre-service or in-service training and qualifications. The effect of teacher’s appointment on permanent or temporary basis has received little attention. The pattern of growth of schooling in India has boomed particularly during last two decades due to government schemes like Mid Day Meal Scheme (2001), SSA (2001-02) and Right to Education Bill (2009), and to achieve hundred percent literacy rates. There is a sharp increase in primary schools. Keeping the growth of schools in view, there is high demand of teachers. The main factors behind teachers’ demand namely increase in students’ numbers due to population growth and increased access to education. The lack of qualified teachers in schools, particularly trained teachers has been an impediment in promoting the quality of primary education in India. In view of acute shortage of qualified therefore school management appoints teachers on temporary basis. Majority of private schools and some government schools appoint the teachers on temporary or on short-term contractual basis. In many cases
teachers do not have proper training as per requirement of primary schools. Appointment of teachers on temporary basis is the cause of concern for the quality of education in the country.

Model 6.2: The equations for the three models showing direct, and indirect effects of above mentioned variables are given below

$$\hat{Q} = a + b \cdot S$$

Model (6.2a)

Model (6.2b)

Model (6.2c)

Where, $S$ (type of school management) was the cause of variation in $Q$ (Quality of primary school education). To view (6.2) in the context of path analysis, was to draw it into path diagrams, shown in model 6.2a. The third variable $T$ (proportion of trained teachers), where, theoretically three variables were causally related as in model 6.1b.
Because S has no arrow coming towards it, it was not determined by other variables in the model and was therefore called an exogenous variable. In contrast, T and Q were endogenous variables, because they have arrows coming towards them and were determined, at least in part, by other variables in the model.

As explained in model 6.1, similar kind of regression analysis was done for model 6.2. The models 6.2a, 6.2b and 6.2c and table 6.2 summarized direct and indirect, and total effects of type of school management on quality of education and proportion of trained teachers on quality of education. As expected the total effect of type of school management on quality of education was the same for all the three models and the total effect of trained teachers on quality of education were the same for model 6.2b and 6.2c, which are the only models which include proportion of trained teachers (T). Table 6.2 illustrated that; the effect of type of school management on quality of education was almost entirely direct, whereas the effect of trained teachers on quality of education was mostly indirect through proportion of permanent teachers (P).

Model (6.2a)

\[
\hat{Q} = a + b S \\
= 70.2 + 11.13 S
\]
Model (b)

\[ \hat{Q} = c + dS \]
\[ = 95.64 - 0.29 S \]
\[ \hat{Q} = e + fT + gS \]
\[ = 49.39 + 0.22T + 11.19 S \]

Model (c)

\[ \hat{Q} = h + iS \]
\[ = 95.64 - 0.29 S \]
\[ \hat{Q} = j + kT + mS \]
\[ = -92.56 + 1.77T + 7.55 S \]
\[ \hat{Q} = n + pP + qT + rS \]
Table 6.2 explained the results of the analysis carried out through the path diagrams in Figures 6.2a to 6.2c. To minimize rounding errors, the numbers in the table were calculated from the values of the coefficients specified to two decimal places, rather than zero decimal places as shown in figures 6.2a to 6.2c. Because $T$ is endogenous in the models 6.1b and 6.1c, the direct, indirect and total effect of $T$ (proportion of trained teachers) all incorporate a control for $S$ (type of school management). It can be noticed that $b=g+df = r + iq + mp + ikp$ and $f = q + kp$.

Table 6.2: Direct, Indirect and Total Effects of Type of School Management, Percentages of Trained Teachers and of Permanent Teachers on Quality of Education of Primary Schools

<table>
<thead>
<tr>
<th>Variable Type of school Management</th>
<th>Model (a)</th>
<th>Model (b)</th>
<th>Model (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type of Effect</td>
<td>Formula</td>
<td>Numerical Value</td>
</tr>
<tr>
<td>Direct</td>
<td>$b$</td>
<td>11.13</td>
<td>$g$</td>
</tr>
<tr>
<td>Indirect</td>
<td>$S-&gt;T-&gt;Q$</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>$S-&gt;P-&gt;Q$</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>$S-&gt;T-&gt;P-&gt;Q$</td>
<td>___</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td>Total</td>
<td>11.13</td>
<td>11.13</td>
<td>11.13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proportion of Permanent Teachers</th>
<th>Model (a)</th>
<th>Model (b)</th>
<th>Model (c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>$f$</td>
<td>0.21</td>
<td>$q$</td>
</tr>
<tr>
<td>Indirect</td>
<td>$T-&gt;P-&gt;Q$</td>
<td>___</td>
<td>___</td>
</tr>
<tr>
<td></td>
<td>0.21</td>
<td>0.21</td>
<td></td>
</tr>
</tbody>
</table>
6.3.2.2 Results

The findings of the analysis carried out through Path Model 6.2 are as under:

6.3.2.2.1 Direct effect of type of school management on quality of education:

From the results of the study, the total effect of type of school management on quality of school education was the path coefficient ‘b’ (11.13) equals sum of the direct and the indirect effects, which was same as explained in model 1. The similar result revealed that there was direct and significant effect of type of school management on quality of education. This was already discussed in detail at 6.3.3.1, therefore the same findings and interpretation was not repeated here.

6.3.2.2.2 Direct and indirect effect of type of school management on proportion of trained teachers on quality of education:

In table 6.2, the coefficient ‘g’ (11.19) was the direct effect of type of school management on quality of school education and the product of coefficient ‘df’ (-0.06) was indirect effect. The indirect effect ‘df’ is the product of coefficient ‘d’ (-0.29) over the arrow from type of school management to proportion of trained teachers and coefficient ‘f’ (0.22) over the arrow from proportion of trained teachers to quality of school education. The ‘d’ (-0.29) was negative which indicated that private schools had high proportion of untrained teachers or low proportion of trained teachers. ZP schools had high proportion of trained teachers. The coefficient f (0.22) proportion of trained teachers to quality of school education implies that proportion of trained teachers was a casual factor for quality of primary school education. The positive sign indicated that higher was the proportion of trained teachers, higher was the academic achievement score of the students. The direct path was denoted as S -> Q and the indirect path as S-> T-> Q. The F value was significant at p<0.001.
6.3.2.2.3 *Direct and indirect and total effects of type of school management on the quality of education through intervening variables -- proportion of trained teachers and proportion of permanent teachers employed in the school:*

The variable employment status of the teachers (temporary or permanent), has also been assumed to have effect on the quality of primary education. The percentage of permanent teachers was another intervening variable added in the model, to know the effect on the quality of primary education.

The percentage of permanent teachers was indirectly related to the percentage of trained teacher in the sense that teacher were eligible for permanent post only after getting appropriate training like diploma or degree in education. In the current study, the ZP and NMMC school management facilitate the temporary teacher to acquire the appropriate degree in education during their service period. Temporary teachers were facilitated with the facility of study leave for completing the degree in education. After getting the degree they were entitled for applying for permanent post through Competitive Entrance Test (CET).

The causal ordering in Path Model 6.2 c was S-> T-> P-> Q. The total effect of S on Q was decomposed into direct effect ‘r’ (corresponding to the direct path S->Q) and indirect effects ‘iq’ (corresponding to the indirect path S-> T->Q), ‘mp’ (corresponding to the indirect path S-> P->Q), and ‘ikp’ (corresponding to the indirect path S-> T-> P -> Q) as given in Table 6.2. The indirect effect ‘mp’ (9.44) was the product of coefficient ‘m’ (7.5) over the direction from type of school management to percentage of permanent teachers and coefficient ‘p’ (1.25) was from percentage of permanent teachers on quality of education. This shows the effect of indirect path S-> P->Q. Likewise ‘ikp’ was the product of indirect path coefficient ‘i’ (24.6) is from type of school management to percentage of trained teachers, path coefficient ‘k’ (1.02) was from percentage of trained teachers to percentage of permanent teachers and path coefficient ‘p’ (0.33) was from percentage of permanent teachers on quality of education. The ‘ikp’ (-0.66) was the path coefficient corresponding to the indirect path S-> T-> P -> Q. The findings revealed that type of school, percentages of trained teachers and permanent teachers were significantly affecting quality of education. The result shows that ZP schools had high percentages of trained
and permanent teachers and also had higher score of academic achievement. Whereas, private schools had low percentages of trained and permanent teachers. The private schools had also lower students’ scores in final examination as compared to ZP. Though, the NMMC schools had comparatively (as compared to private schools) little higher percentages of trained and permanent teachers but students’ scores in the final examination were low. Thus employment status of teacher was another intervening variable affecting the quality of education.

6.3.2.3 Discussion

6.3.2.3.1 Direct effect of type of school management on quality of education:

The findings revealed that there was direct effect of type of school management on quality of education like that was found in Model 6.2. This was discussed in detail at 6.3.3.1 therefore the same was not discussed again.

6.3.2.3.2 Direct and indirect effects of type of school management on quality of education through the intervening variables percentages of trained teachers and permanent teachers employed in the school:

The findings revealed that ZP schools had high percentage of trained teachers and better quality of education which implied that percentage of trained teachers was a casual factor in effecting the quality of primary school education. The percentage of trained teachers was an important factor affecting the quality of education. Schleicher (2012) found that teacher training was positively related to effective teaching and suggested that teachers need to be in continuously learning and growing, and repositioning themselves in a fast changing world to better prepare children for higher educational demands of life and work in the 21st century. The above discussion proved that training of teachers directly and indirectly related to quality of education. The study concluded that there was effect of trained teachers on students’ achievement which was in line with the findings of Rahman, Jumani, Akhter, Chisti and Ajmal (2011), Harris and Sass (2008).
6.3.2.3.3 Direct and indirect and total effects of type of school management on quality of education through percentages of trained teachers and permanent teachers employed in the school:

It has been observed that many schools particularly private schools had large percentage of temporary teachers. According to the report of UNESCO (2006), there is a massive teacher shortage over countries in sub-Saharan Africa, the Arab States and South Asia. But it is not only the imperative of translating a target into sufficient numbers of teachers, but the support for teachers and teaching quality which will finally lead to the attainment of universal primary education. Temporary teachers are not able to have the benefit of regular pay scale, yearly salary increment and job security which may indirectly affect the teaching. The results of the present study support the findings of Kremer, Muralidharan, Chaudhury, Hammer and (2005). However, Muralidharan and Kremer (2007) found that in India, salaries paid by unaided fee-charging schools are only about one-fifth of those paid by public schools, but these schools had many more such teachers relative to the public school.

From the above Path Model 2 it had been established that ZP schools outperformed in quality of education as compared to other two types of school management, namely, NMMC and Private, mainly due to relatively higher percentages of trained teachers and permanent teachers.