

## Impact of Teachers' Subject Matter Knowledge and Behaviour on Students' Performance

Syed Moeenudin Peerzada\*

Musarrat Jabeen<sup>†</sup>

**Abstract:** *This study investigated the impact of teacher's subject matter knowledge and their behavior on the student's performance. Qualified and well behaved teachers help to boost learner's confidence and involvement in learning activities. In Pakistan, the quality of school level education is continuously deteriorating. It may be because of the reason that most of the private schools, due to their financial constraints, hire less qualified and untrained teachers. The data was collected through a 5 points Likert scale questionnaire. Responses were obtained from the students of secondary and matric classes of three different schools. Data was analyzed using various statistical techniques, (factor analysis, regression analysis, mean comparison). The analysis of data revealed a significant relation between the student performance, teacher subject matter knowledge and teacher's behavior. Besides this, it was found that the achievement level of students of high income area is better than that of low income area. Furthermore, the subject matter knowledge and behavior of the teachers of high income area schools were found to be better than those of low income area. This study suggests that the subject matter knowledge and behavior of the teachers should be given prime consideration while hiring them. In-service teachers' training programs must also be held to keep teachers updated in the subject. Personality development and motivational trainings should also be held to help teachers in improving their behavior. Besides this the perks and privileges should also be raised for the teachers to attract knowledgeable and well behaved people to the teaching profession.*

**Keywords:** Students performance, Teacher Subject Matter Knowledge, Teacher Behavior

## 1 Introduction

It is essential for an efficient, professional and competent teacher to possess a good knowledge of subject matter. The teacher who has command over the subject matter can provide a detailed information and clear explanation of the concepts to the students in the classroom (Piasta, Connor, Fishman, & Morrison, 2009). Awareness of key concepts, examination tools and structures and their implications are also necessary for lesson planning for the class.

The teacher should have sound knowledge about the subject matter to build up reliable connection between curricula of the subjects being taught in the class (Dobbie, 2011). Additionally, through the integrated lesson planning, teachers can convey an

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\* Faculty of Education and Learning Sciences, IQRA University, Karachi-75300, Pakistan

<sup>†</sup> P.E.C.H.S Girls School, Karachi, Pakistan, E-mail: mqazi.ahmed@hotmail.com

authentic knowledge to their students to enhance student's learning and to inculcate creative thinking (Davis & Simmt, 2006).

Besides the subject matter knowledge, the teacher's behavior also plays a pivotal role in student's learning. A teacher having good moral values and behavior, can motivate students to get involved in the learning process with full enthusiasm and passion.

## 2 Review of Literature

### 2.1 Theoretical Background

Review of various studies indicates that the performance of students at all levels is affected by various factors. Along with other factors, two major factors have tremendous impact on student learning i.e. teacher's command over subject matter and teacher's behavior. Most of the studies have suggested that to improve the quality of education, it is essential to improve the teacher's content knowledge, their attitude and their behavior towards students' learning.

Most of the studies reveal that the students' performance is influenced by in-depth knowledge of the teacher and the behavior of the teacher. As the deeper subject matter knowledge makes a teacher capable to teach the subject with full command and the teacher can give more details to explain the subject.

The positive behavior of the teacher also plays a vital role in students' learning. Teachers with a good behavior and a positive attitude can motivate students to willingly take part in the learning process.

### 2.2 Empirical studies

Campbell et al. (2014) conducted a quantitative study to investigate the relationship between teachers' mathematical content and pedagogical knowledge, teachers' perceptions, and student achievement. They found significant statistical relation between teachers' content knowledge of mathematics and students' achievement in both the upper elementary and middle classes. They further found that in upper elementary grades other teacher and students factor were also involved besides teacher content matter knowledge. They also found that with each standard deviation increase in teacher content matter knowledge, the expected mathematics scores of their students increased by 22% of an SD.

Subject matter knowledge is an essential factor of student learning. For an effective teacher it is important that they should be knowledgeable about the ideas they teach. It is evident that students, taught by the teachers with the proper subject matter knowledge on a given concept, performed well than those students whose teachers were lacking subject matter knowledge. A teacher without expertise, may teach the concept erroneously, and students may develop the same malicious information as their teacher has. Efficacy of middle school science teachers may so depend on command over all the concepts they teach than with the extent of their understanding in any particular topic. (Sadler, Sonnert, Coyle, Cook-Smith, & Miller, 2013)

Baumert et al. (2010) conducted one year study in Germany with a representative sample of Grade 10 classes and their mathematics teachers and reported that the content knowledge was not the only prerequisite, yet, researches showed that content knowledge rests inert in the classroom without a rich stock of mathematical knowledge

and skills relating directly to the curriculum, instruction, and student learning. Their multilevel structural equation models showed a significant positive effect of pedagogical content knowledge on students' learning achievements with the support of cognitive activation and individual learning support.

A mixed method sequential nested study was conducted to examine the relation between teacher's cognitive content knowledge and student achievement by [Tchoshanov \(2011\)](#). Result of the study suggested a tendency were the teacher's knowledge of studies and links make a successful teachers and such teachers could affect students' mathematics achievement positively.

According to [Mullens, Murnane, and Willett \(1996\)](#) children learn from particular teachers and not from every other teacher. Therefore, teacher's effectiveness depends on four factors, as identified in the researches, which were: their educational achievement, in service teacher training programs, their subject matter knowledge and teaching styles.

[Metzler and Woessmann \(2012\)](#) studied the impact of the teacher's subject knowledge on student's achievement, using data of primary school from Peru, containing test scores in two subjects not only for each student, but also for each teacher, data from a total of over 12,000 students, in nearly 900 randomly sampled primary schools, was obtained. The study revealed a significant effect of teacher's subject knowledge on student achievement. It was observed that a one-standard-deviation increase in teacher subject knowledge resulted 10 percent of a standard deviation increase in student's achievement. It was suggested that at the time of the teacher recruitment, subject knowledge should essentially be kept in consideration. Attention to teacher subject knowledge must also be considered for teacher training courses, and teacher's reward schemes.

A quantitative study was made by [Mullens et al. \(1996\)](#) about the effect of training and subject matter knowledge on teaching effectiveness. They examined the four types of variables for teaching effectiveness: educational achievement of a teacher, participation in training programs, teacher's subject matter knowledge and teacher's instructional approaches. For students' achievement, the data was collected by the difference of pretest and post test of 1043 third-grade students was analyzed. The study showed that a student learn more when their teacher has full command over the subject. The academic training of teachers and years of teaching experience were not directly linked with the student's learning. It was proposed that teacher's subject matter knowledge should highly be considered while hiring them. It was also stated that to make the training programs more effective, the contents and the structure of the training programs may also be re-designed.

[Hill, Rowan, and Ball \(2005\)](#) studied the effects of teacher's mathematical knowledge on student's achievement. A three-level hierarchical model in which mathematical gains of 1190 first graders and 1773 third graders over a year with the data of 334 and 365 teachers respectively of 115 schools were collected. It was revealed that the teacher's mathematical knowledge had a high effect on students' gain in both grades. It was recommended that for the increase in students' performance in mathematics the upgrading in teachers content matter knowledge in the subject was vital.

[Rotgans and Schmidt \(2011\)](#) conducted a study to investigate the relation between a teachers' interpersonal characteristics such as social interactions, subject matter proficiency, cognitive equivalence and rise in student's interest in learning. They reported that their results suggested that it was very essential for a compatible teacher to be friendly, and to be emotionally and socially attached with the students. For maximum student involvement into the learning process, teacher's should also be cognitively

compatible i.e. a teacher must be capable of helping students to understand the topic by scaffolding.

Durlak, Weissberg, Dymnicki, Taylor, and Schellinger (2011) stated that schools and teachers have to play a vital role in bringing up vigorous children by nurturing the cognitive growth as well as their social and emotional development. Educators should prioritize and implement effective approaches to acquire multiple benefits.

Dobbie (2011) conducted a study to explore the impact of teachers characteristics on students achievements. He used data from Teach for America admissions records. The study found that a teacher's academic accomplishment, leadership skills and determination are very much related with students' achievements in math. These characteristics are also associated with a decrease in behavioral problems of the students.

Akbari and Allvar (2010) studied relation of teaching style, teachers' sense of efficacy, and teacher's reflectivity to students' achievement gains in an English-language teaching (ELT) context. The results of the study showed a high correlation between teacher reflectivity and student achievement outcomes, as the reflective teachers focused on student learning and were committed to help students to succeed. These teachers intended to discover and draft strategies to help children learn. Their reflection was stimulated by their zealous commitment to help children to learn. Actually, this was a enthusiastic want of reflective teachers to convert problematic classroom environment into opportunities for students to learn and grow.

### 3 Methodology

The model to estimate the effect of teacher's subject matter knowledge and teacher's behavior on student's performance in parametric form is defined as follows:

$$SP = \alpha_o + \beta_1(TK) + \beta_2(TB) + \epsilon$$

where  $SP$  represents students performance,  $TK$  represents the teachers subject matter knowledge and  $TB$  represents the teachers' behaviour while  $\alpha_o$  is constant,  $\beta_1$  and  $\beta_2$  coefficient and  $\epsilon$  is error term.

The model is estimated by the data collected through a 5 point likert scale questionnaire designed specifically for the purpose. Responses were individually obtained from 161 students of class X, IX, VIII and VII of three different schools of Karachi.

Questions from 1 to 3 are to comprehend the students' performance, from 4 to 8 to know about their teacher's subject matter knowledge and from 9 to 13 to know about the behavior of their teacher.

### 4 Data Analysis

In this section the data had been presented in a certain order. The data was analyzed by the use of different statistical tests in SPSS software.

#### Reliability

Data reliability had been demonstrated by applying statistical tests of reliability. The questionnaire for the study was based on 13 questions including both dependent and independent variables. Reliability test was applied in SPSS and according to the

limitations; the value of Cronbach’s Alpha should be more than 0.5 (i.e. 50%). The Cronbach’s Alpha value of this study came out to be 0.784 (i.e. 78.4%) which shows that the reliability of data is acceptable.

Table 1: Reliability Statistics

Variable	No. of Items	Cronbach’s Alpha
Students performance	3	0.563
Teachers content knowledge	5	0.737
Teachers behavior	5	0.731
Over all	13	0.784

Source: Author’s Estimation

The first variable “Students performance” was dependent variable. It had 3 items and the value of Alpha of these items is 0.563. The second variable “Teachers Subject matter knowledge” was independent variable and it has 5 items and its value of Alpha is 0.737. The third variable “Teachers Behavior” was another independent variable, it also has 5 items and its value of Alpha is 0.731. The overall reliability of the instrument is 0.784 (i.e. 78.4%).

### Factor Analysis

The value of KMO was 0.799 which statistically determine adequate sample size for factor analysis. After the application of factor analysis the following rotation component matrix was obtained:

Table 2: Rotated Component Matrix

ITEMS	SP	TK	TB
The course was intellectually stimulating.	0.557		
The course was well structured	0.748		
I sit in the front of the class	0.605		
My Teacher effectively explains the subject matter in multiple perspectives		0.712	
Subject matter is made applicable to the real world,situation		0.509	
My Teacher Exhibit good knowledge of the subject		0.709	
Use different ways/ methods to develop students understanding of the subject		0.692	
Possess an in-depth knowledge of how to represent the subject matter to learners		0.664	
My Teacher talks with students affectionately			0.685
My Teacher forgives students for naughtiness			0.567
My Teacher behaves with students sympathetically			0.755
My Teacher cares of students emotions			0.739
My Teacher is punctual			0.566

Source: Author’s Estimation

In the above table rotated component matrix defines the correlation in the variables. The highest value of correlation shows the highest level of relationship between the variables. It makes group of each variable.

Table 3: Regression Co-efficient (Students Performance)

Variables	Coefficient	t-stats	Prob.	V.I.F
Constant	2.742	8.117	0.000	
Teachers Content Knowledge	0.184	2.090	0.038	1.320
Teachers Behavior	0.133	1.517	0.131	1.320
Adj. $R^2$		0.064		
F-stats		6.461		
(Prob.)		(0.000)		

Source: Author's Estimation

## Regression Analysis

The table 3 describes the statistics of all the variables with their beta value, co-linearity value, and significance value. The value of  $\beta$  shows the nature of relationship between dependent and independent variables. From the table it is seen that the beta value of both the variables is positive it means that both the independent variables have positive effect on the dependent variable. The F-stats value is 0.002 it means that the combined effect of the independent variable also exists. The Sig. value of teachers' content knowledge is 0.038 (i.e.  $< 0.1$ ) it means that it has significant effect on students performance while the Sig. value of teachers behavior is 0.131 (i.e.  $> 0.1$ ) it means that it has not a significant effect on the dependent variable.

The VIF value of both the independent variables is 1.320 (i.e.  $> 1$ ) it indicates that multiple co-linearity also exists in the model and hence the independent variables are correlated with each other.

The  $\beta$  value of teachers' subject matter knowledge is more than that of teachers' behavior it means that teachers' subject matter knowledge is more effective than the teachers' behavior.

By using  $\beta$  values from the above table we can write our equation as :

$$SP = 2.742 + 0.184(TK) + 0.133(TB) + \epsilon$$

## Mean Comparison

### One Sample T-Test

As the respondents of the survey were best students of their schools it was expected that the mean value of their responses may lie near 4. To confirm this, a one Sample T-Test on students' performance (SP) variable against the expected value of 4 was conducted.

The table shows the result of the test.

Table 4: T-Test One Sample

	Claim	Actual	t-Stats	Sig. (2 tailed)
SP	4	3.937	- 1.191	0.235

The Sig. value (0.235) indicates that our hypothesis is accepted and the means are not different.

### Independent Sample T-Test

The respondents of the survey were from both the genders. To analyze the performance difference, between Boys and Girls, an Independent Sample T-test was conducted on the students' performance variable.

The table shows the result:

Table 5: T-Test Independent Sample (Boys / Girls)

Boys mean 3.9958 Girls Mean 3.8807				
Levens Test for equality of variance				
	F- Stats	Sig.	T-stat	Sig.(2 tailed)
SP	4.550	0.034	1.106	0.270

The Sig. value of Levens Test for equality of variance (0.034) which is less than 0.1 it means that the variability in the performance of boys and girls are significantly different. The Sig. value of T-stat indicates that the means for boys and girls are not significantly different. It means that the students' performance is not based on the gender difference.

### Paired Sample T-Test

As the survey was conducted in the different income level areas of Karachi, a pair sampled T-Test was conducted to study the effect of parents' income factor on the performance of students.

The table shows the Result:

Table 6: T-Test Paired Sample for Students Performance, Teachers Knowledge and Teachers Behavior (Locality based)

	Low Income Area	High Income area	T-stat	Sig.(2 tailed)
SP	3.543	4.129	- 4.816	0.000
TK	4.026	4.396	- 3.021	0.000
TB	3.683	4.290	- 5.224	0.000

The table shows that the mean values for students of low income area and high income area are significantly different. It indicates that the performance of the students of high income area is significantly better than that of low income area. One sample T-Tests were also conducted on independent variables to study the teachers' subject matter knowledge and their behavior on the basis of their area of work.

The table 6 shows that the means of subject matter knowledge for the low income area (4.0264) and high income are (4.3962) significantly different (Sig. value < 0.1). It means that the subject matter knowledge of teachers from high income area is better than that of low income area. Similarly from the table 6 it is evident that the means of the teachers' behavior of low income area (3.6830) and high income area (4.2906) are significantly different. It indicates that the behavior of teachers with their students in high income area is far better than that of low income area.

### Discussion about the data analysis

The results of paired sample T-Test show that the subject matter knowledge of the teacher from high income area is found to be better than that of low income area

similarly the behaviour of teachers from high income area with their students is found to be better than teachers from low income area. The possible reason for this, may be the academic qualification and background of the teachers they belong from, as in high income areas the teachers are normally more qualified and belong to more educated family background while the schools of low income areas can not hire more qualified teachers due to their financial constraints.

## **5 Conclusion and Policy Implications**

From the results, on the basis of various statistical analysis of the data, it is evident that the student's performance is highly dependent on the teachers' subject matter knowledge and teachers' behavior besides other factors. The performance of students from both gender is found to be same. It means that the performance and learning levels of boys and girl are significantly the same. The teacher's subject matter knowledge and their behavior are also found to be correlated. It means that the behavior of the teachers in turns depends on their knowledge and academic qualifications.

From the paired sample T-Test analysis, it is found that teachers working in low income areas are having less subject matter knowledge and their behavior is also poor as compared to the teachers working in high income areas. The main reason of this difference in teacher's subject matter knowledge and behavior of teachers from different localities could be because of the perks and privileges they are entitled to.

It is suggested that for the better performance students', the subject matter knowledge and behavior of the teachers should be given prime consideration while hiring them. Continual in-service teacher's training programs must also be given importance to keep them updated with the latest trends and changes in the subject. Character building, moral and personality development and motivational trainings should also be arranged for the teachers to help them improving their behavior. Besides this, the concerned authorities should also consider to raise the salary structure and other monetary benefits for the teachers, to attract knowledgeable, qualified and well behaved people to the teaching profession.

## References

- Akbari, R., & Allvar, N. K. (2010). L2 teacher characteristics as predictors of students' academic achievement. *Test-Ej*, 13(4), n4.
- Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., . . . Tsai, Y.-M. (2010). Teachers' mathematical knowledge, cognitive activation in the classroom, and student progress. *American Educational Research Journal*, 47(1), 133–180.
- Campbell, P. F., Nishio, M., Smith, T. M., Clark, L. M., Conant, D. L., Rust, A. H., . . . Choi, Y. (2014). The relationship between teachers' mathematical content and pedagogical knowledge, teachers' perceptions, and student achievement. *Journal for Research in Mathematics Education*, 45(4), 419–459.
- Davis, B., & Simmt, E. (2006). Mathematics-for-teaching: An ongoing investigation of the mathematics that teachers (need to) know. *Educational Studies in Mathematics*, 61(3), 293–319.
- Dobbie, W. (2011). Teacher characteristics and student achievement: Evidence from teach for america. *Harvard University*, July.
- Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child development*, 82(1), 405–432.
- Hill, H. C., Rowan, B., & Ball, D. L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American educational research journal*, 42(2), 371–406.
- Metzler, J., & Woessmann, L. (2012). The impact of teacher subject knowledge on student achievement: Evidence from within-teacher within-student variation. *Journal of Development Economics*, 99(2), 486–496.
- Mullens, J. E., Murnane, R. J., & Willett, J. B. (1996). The contribution of training and subject matter knowledge to teaching effectiveness: A multi-level analysis of longitudinal evidence from belize. *Comparative Education Review*, 139–157.
- Piasta, S. B., Connor, C. M., Fishman, B. J., & Morrison, F. J. (2009). Teachers' knowledge of literacy concepts, classroom practices, and student reading growth. *Scientific Studies of Reading*, 13(3), 224–248.
- Rotgans, J. I., & Schmidt, H. G. (2011). The role of teachers in facilitating situational interest in an active-learning classroom. *Teaching and Teacher Education*, 27(1), 37–42.
- Sadler, P. M., Sonnert, G., Coyle, H. P., Cook-Smith, N., & Miller, J. L. (2013). The influence of teachers' knowledge on student learning in middle school physical science classrooms. *American Educational Research Journal*, 50(5), 1020–1049.
- Tchoshanov, M. A. (2011). Relationship between teacher knowledge of concepts and connections, teaching practice, and student achievement in middle grades mathematics. *Educational Studies in Mathematics*, 76(2), 141–164.