Effect of Classroom Learning Environment on Students' Academic Achievement in Mathematics at Secondary Level

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Abstract

The aim of the study was to examine the effect of the perceptions of students about classroom learning environment on their academic achievement at secondary level in the Mathematics classrooms. The participants were selected from the secondary and higher secondary schools located in Tehsil Rawalpindi and Islamabad (Federal Area), Pakistan. Twenty four schools were selected randomly. A total of five hundred sixteen students of 10*th* grade studying Mathematics in twenty seven classrooms, were included in the sample. Classroom Environment Instrument (Personal Form) was used to measure the students' perceptions after translating it into Urdu for Urdu medium schools. The pilot testing was carried out before the actual application of this instrument. The reliability of the instrument was determined by the use of Cronbach Alpha which was found as 0.85. The marks obtained by students in the subject of Mathematics in annual examination in 10*th* grade conducted by both BISE Rawalpindi and FBISE Islamabad were taken as achievements in Mathematics. The data was analyzed using multiple regression, Pearson r and ANOVA to find out the effect of perception of students about classroom learning environment on their academic achievement. The results of study revealed that the subscales, `Involvement', `Personal relevance', `Emphasis on understanding', were major predictors contributing towards classroom learning environment and students' academic achievement whereas subscales `Investigation' and `Autonomy' have negative effect on students' academic achievement. The researcher recommends that active involvement of the low achievers may affect their learning more positively.

Keywords: Classroom Learning Environment; Students' Learning; Achievement in Mathematics; Understanding; Students' perception

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Introduction

The teaching-learning process cannot take place in a vacuum. In formal education settings, it occurs as a result of interaction among members of the classroom. In classroom settings, elements of teaching-learning process include: teacher, students, content, learning process and learning situation. The learning situation or learning environment means the conditions in which learning take place. Each classroom has unique teaching - learning conditions. According to Arend (2007), classes may seem similar from the distance but are different in its procedures and the processes.

A classroom setting has two major components, namely, physical component and human component. Physical component comprises all the physical objects present in the classroom e.g. black board, furniture, lightings, projector, books, computers etc., whereas the human component comprises of individuals i.e., teachers and students in the classroom. It generally involves the nature of interaction of teachers with students and student-student as well. This pattern of interaction generates a particular atmosphere which may be called as learning condition/situation/environment. This aspect is also called the psycho-social environment of the classroom. Most scholars agree that students' academic achievement varies with learning conditions. Therefore, this study was designed to investigate the effect of students' perception of classroom learning environment on their academic achievement in mathematics at secondary level.

The importance of Mathematics cannot be denied in this age of science and technology. The mathematics knowledge proved to be an essential vehicle to train the minds of the learners to think logically, objectively and reasonably in solving day to day problems. Mathematics is different from other social science subjects because according to Sharan (2006), Mathematics is the study of abstract system which deals with abstract elements. These elements are not described in concrete fashion. The teaching and learning mathematics requires a proper attitude and deep thinking from the students in terms of their learning styles, as well as teacher's knowledge and behavior in the classroom. It is often said that better environment of a class helps during group work and hence improve the learning of the students.

The importance of environment was derived earlier with the help of concept of `life space' conceived by Randhawa and Lewis (1976). 'Life space' includes the total psychological field with its entire group of forces, which repels as well as attracts persons in the field. It includes unconscious influence as well as conscious influence, past as well as present influences and has a bearing on the person (including the person as self), is encompassed in the life space, including the behavioral and psychobiological environment with all of its influences, such as positive and negative goals and the barriers restricting movement toward objectives (Moos & Trickett 1974).

Murray (1938) introduced the concept of `environmental press'. He says that the learning environment can be seen as interaction of personal needs and environmental press. Personal needs include drives, motives, goals of an individual whereas the term `press' can be labeled as stimulus, treatment or process variables. Both personal needs and environmental press are necessary to be taken into account while assessing the classroom learning environment. The concept of alpha press and beta press were later introduced for further explanation of the concept.

The term classroom learning environment is elaborated by several educationists. Fraser (1986) considered it shared perception of the students and sometimes of the teachers in that environment. Walberg (1974) opined that the classroom psychological or social environment refers to the climate or atmosphere of a class as a social group that potentially influences what students learn.

Moss and Trickit (1974) said that the classroom learning environment is a dynamical social system which includes not only teachers' behaviour and teacher - student interaction but student - student as well". Fraser (1991) explained the concept of classroom environment as: "Classroom learning environment carries a variety of meanings; it generally refers to the total climate, structures, processes, ethos within class-rooms which are integral elements affecting student's learning" (P231). Adediwura and Tayo (2007) considered perception as psychological and physiological perspective and elaborated their effect on learning. The perception is described as, the way we judge or evaluate others with whom we are familiar in everyday life. It is important that background knowledge of the students in the form of schemas affects their perception and subsequent learning. This is called the cognitive dimension of the perception that is why, in this study, the researcher was interested in perception of students about the classroom learning environment.

The conceptualization, assessment and investigation of various aspects of classroom learning environment are an important area of research since 1960s around the world. At present, there are two main approaches being used for the assessment of classroom learning environment. One approach is based on observation of classrooms or general kinds of activities by external observers. This approach was used in many studies like Amidon (1961) and Lindzey, and Elliot (1977). The other approach is the assessment of classroom learning environment variables based on students' perceptions about their classrooms.

The latter approach considered to be better than the previous one because it directly involves the students in the classroom activities who are the permanent members of a class rather than outside observers. It is also found that outside observers change the behavior pattern of the classrooms by their sudden appearance which minimize the possibility of measuring the actual learning environment of classrooms, however, there is

a major shortcoming of perceptual approach, which is the pooling of all students' ratings, without considering their individual differences, socio-economic status of their families, sex and other variables such as the liking or disliking of the teachers etc., however, this approach is more economical, less time consuming than using the coding sheets in observational studies. Students' responses in questionnaires and inventories proved to be valid instruments for measuring students' achievements. During the past, several studies around the world used the questionnaires to assess the classroom learning environment (Anderson &Walberg, 2003).

Fraser (1986) divides the classroom learning environment into four major components which includes: physical things, the social interaction among its members, the characteristics of its members and systems, values, cognitive structures etc., so, a classroom learning environment can be explained with reference to either physical or social aspects. This study considers only the social aspects of the classroom learning environment which includes teacher's behavior and students' behavior (both verbal and non-verbal communications), teaching and learning methodologies, teachers' classroom management practices, teaching and learning styles, attitudes, personality traits, beliefs, group dynamics, socio-economic status of the students, cultural diversity of the classroom called its social component of the classroom environment.

According to Lewin (2009), behavior exists in a totality of interacting facts which comprise a dynamic field. The circumstances or conditions in any part of the field are influenced by and depend on every other part of the field. This psychological field is otherwise known as the life space which comprises the individual and his psychological or behavioral environment also known as facts that effect the behavior or thoughts of the individual at a certain point in time.

Life space is most frequently determined by the physical and social environment that the individual finds himself in. It may include places where he goes, events that occur around him, feelings about places and people encountered, what he sees on TV or reads in books, his imagination, thoughts and goals. Encompassed by a child's life space are forces which the child may be aware of or not, in addition to forces which are accepted by the child as true though they may not be so (Lindzey & Elliot, 1977).

Ranchelor (1992) is of the view that an effective school and classroom can be described as a place that naturally motivates students to learn. Students and teachers work well in a school culture where academic success and the motivation to learn, is expected, respected and rewarded. Such an atmosphere where students learn to love learning for learning's sake, results in better academic achievement, is a chief characteristics of an effective school.

There are many factors that may be considered part from psycho-social environment in classroom environment

1. *Review acoustics and room temperature:* The sound levels in your classroom greatly impact learning. You may need to minimize background noise or amplify the teacher's voice to create the right sound. You can adjust sound levels through flooring, baffle boards, notice boards or by adding in soft seating.

2. *Focus on effective lighting:* There's no substitute for natural daylight in a classroom, but if sunlight is limited make sure that there's enough artificial light. Correct lighting prevents eye-strain and helps to keep students alert. When choosing lighting, think about how you may need to alter the lighting for each learning experience - for example in a science classroom, black-out blinds may be needed for some experiments.

3. *Choose classroom furniture carefully:* The furniture in classroom is hugely important to the overall learning experience. Students must be comfortable, and making sure that chairs are the right size will help to keep them focused. Classroom furniture should comply with the British and European Standards for "chairs and tables for educational institutions"..

4. *Innovative storage for effective learning:* Storage can make all the difference in classroom design. Clever use of storage helps to keep the classroom free from clutter and helps students to take pride in their classroom. There are a lot of evidences to say that while students should be able to see their work on the walls, at least 20% of wall space should be kept clear.

According to Steve and Richard (2013), when a student first steps into a room they will make a judgment about the type of class they are going to be taking. They will look to see how desks are arranged. They will notice what is hanging on the walls. The way in which a teacher sets up their class allows them to communicate with their students non-verbally. By adding various learning centers or activity centers the students will know that this is a classroom that likes to do hands on experiments. It also conveys that they will not just sit and take notes, but they will act out what ever subject they are learning.

The wall art will demonstrate to the student that the teacher cares about their work enough to show it off. Students will also gain an understanding of the social expectations of the teacher in the classroom based on how the desks are organized. Each of these tools can be used in any classroom regardless of the content. This indicates that classroom environment helps in motivating people and have effect on their thought processes, how he/she perceive himself/herself and what are his/her thoughts about present environment and situations. 'Self' is influenced by how other persons behave to him/her especially with whom he/she is in close contact. In a classroom, the teacher's role

is much important to enhance the morale, self-concept, self-confidence of a learner because he/she may be tool of inspiration or torture. He/she can humiliate or humor, hurt or heal a student in a class. A person with a positive self-concept will try to respond to a task invest the time and energy necessary to accomplish it. Mathematics needs consistency, logical and abstract thinking in carrying out complex tasks, activities which demands self-determination and self-confidence. It is often observed that students with low achievement score, attribute their failure to luck or chance whereas students with high self-confidence attribute their success with hard work. Therefore, the researcher conducted the study aimed to examine the effect of students' perception about classroom learning environment and its effect on academic achievements in Mathematics at secondary level.

Methodology

The study was exploratory in nature to investigate the classroom learning environment as perceived by students on individual basis and its effect on their academic achievement in Mathematics at secondary level. The students studying Mathematics at secondary level (10th grade) in Rawalpindi (Tehsil) and Islamabad (Federal area) were included in the study. Twenty four schools were randomly selected from rural and urban areas. Out of these schools, 516 students from 27 Mathematics classrooms were selected randomly from sample schools. These were from both English and Urdu Medium schools located in rural and urban areas. It was decided that maximum twenty students from each classroom will be taken as sample. The students taken from these classes as sample were categorized into three levels (`fail', `average' and `high achiever') according to their academic achievement scores obtained during year 2004-05 in internal examination taken by their concerned teachers. After thorough study of the related literature, the researcher found three questionnaires used by George Rawnslay, in his Ph.D. research in Curtin University of technology (Australia) in 1997 which were found relevant to topic of the study, one of them CEI (Personal Form) was used in this study.

The instrument, namely, Classroom Environment Instrument (Personal Form) was translated in Urdu (original questionnaire was in English Language) and validated in Pakistani context by experts according to objectives of the study.

The Classroom Environment Instrument (CEI) consisted of 9 sub-scales, each with 8 items. Students were asked to respond to each item using five point Likert scale by indicating if the statements or the items represented a situation is `Almost Never Happens', `Seldom Happens', `Sometimes Happens', `Often Happens' or `Almost Always Happens'. The researcher relied on detail of the Boards of Intermediate and Secondary Education (BISE) Rawalpindi and (FBISE) Islamabad results of students of 10th grade for the academic achievement of the sample students.

Data Collection

The researcher personally administered the questionnaire to assure the acceptable response rate. The responses were analyzed by using mean scores and their corresponding marks in the annual examination of 10*th* grade in the subject of Mathematics. Students were categorized into three ways: fail, average and high achiever. Students who obtained marks ranges from 0-32 were considered as `fail', students who obtained marks ranges from 33-59 were considered as `average' students, students who obtained marks higher than 60 were considered as `High achiever'. The data related to performance of students in annual examination was collected through result gazette issued by examination boards and by the schools.

Findings of the Study

The aim of the study was to inform the policy makers of education, curriculum developers, teacher trainers, administrators, examining bodies and especially teachers about the importance of this aspect and also the factors which affects the quality of learning environment in the classroom. The study is entirely quantitative and relies on perceptions of the students about classroom learning environments. An effort has been made to explore links between classroom learning environment and students' academic achievement. Table 1 provides an overview of the results.

Table 1

Perceptions of students about Classroom Learning Environment using CEI (Personal Form) and their level of academic achievements (N = 516).

Scale Variables	Level of academic achievements of students	Mean	Standard Deviation	F-value
Student Cohesiveness	Fail	28:90	4:003	
	Average	29:52	4:179	4:42
	High Achiever	30:22	4:54	
Teacher Support	Fail	26:03	6:59	
	Average	28:87	5:38	12:05
	High Achiever	29:22	5:93	
Involvement or Negotiation	Fail	24:78	4:86	
	Average	27:11	4:71	16:72
	High Achiever	28:31	5:2	
Investigation	Fail	27:56	4:26	
	Average	27:75	4:71	3:47
	High Achiever	26:52	5:20	
Autonomy	Fail	30:27	5:21	
	Average	30:65	5:89	2:40
	High Achiever	30:7	6:14	
Cooperation	Fail	26:82	4:1	
	Average	27:44	3:6	5:65
	High Achiever	28:42	4:8	

Equity	Fail	30:61	5:96	
	Average	30:65	5:89	0:008
	High Achiever	30:7	6:14	
Emphasis on Understanding	Fail	27:12	4:59	
	Average	28:14	4:22	8:325
	High Achiever	29:29	4:84	
Personal Relevance	Fail	26:03	6:69	
	Average	28:44	6:30	4:75
	High Achiever	30:17	6:26	

($p <:05$)

The data were collected on nine subscales in the Classroom environment Instrument (CEI Personal Form). Six of them (Teacher Support, Cooperation, Student Cohesiveness, Involvement, Personal relevance and Emphasis on understanding) were positively and significantly correlated with academic achievement of students with Pearson 'r' value varying from 0.142 to 0.244 indicating that these subscales have positive effect on the students' academic achievement. The remaining two subscales (Equity and Investigation) were negatively correlated with the academic achievement of the students and subscale `Autonomy' has not any significant impact on students' academic achievement. These Findings are also supported by researches conducted by Rawnslay (1997) in Australia in which CEI (Personal Form) was used and the subscale `Investigation' was negatively correlated with students' academic achievement in Mathematics at secondary level whereas subscale `autonomy' has low correlation with students' academic achievement. This shows that students involved in investigation may not be able to allocate enough time to grasp the content fully or our examination system does not encourage this attitude due to traditional examination system.

To investigate the cause-effect relationship between the perceptions of the students about the classroom learning environment and academic achievement, the regression analysis was employed. It indicated that three subscales (`Involvement', `Personal relevance', `Emphasis on understanding'), have the positive significant effect on the overall academic achievement of the students, i.e. the students' involvement, emphasis on understanding and personal relevance play positive effective role towards their academic achievement, however, three subscales `investigation', `equity' and `student cohesiveness' were negatively correlated with the students' academic achievements whereas remaining three subscales `Teacher support', `Autonomy' and `Cooperation' were not playing any significant role towards the academic achievement of the students. The value of R^2 (variance) is 0.15 which shows that 15 percent variance in students' academic achievements is explained by the classroom learning environment and variance explained for each subscales having significant effect on student's academic achievements ranges from 9 percent to 22 percent.

The results of ANOVA statistics revealed that F (9; 516) = 9:884 is statistically significant (at Alpha = 0:05 level of significance). It shows that there is no significant effect of classroom learning environment perceived by the student as an individual on his/her academic achievements at secondary level in the subject of Mathematics because at least one factor was contributing towards students' academic achievement.

The researcher formulated another hypothesis regarding the difference of perceptions of students of their classroom learning environments according to their level of academic achievements. In order to test this hypothesis the three levels of students' academic achievement (fail, average and high achiever) were established.

The results revealed that high achievers have greater mean value score for the sub-scales `Student cohesiveness', `Teacher support', `Cooperation', `Equity', `Emphasis on understanding' and `Personal relevance' than other categories of students according to their level of achievement i.e. mean value of Fail and Average student was higher except for the sub-scales `Investigation' and `Involvement'. The sub-scales `Involvement', `Teacher support' have the highest F-value among all subscales which shows that these two subscales causes highest variation of academic achievement scores among students. The subscales `Autonomy' and Equity' causes the least value of variation among all subscales.

In order to find whether the variation among all subscales is significant or not, ANOVA was used, it is revealed that there exists significant variation among all levels of academic achievements of students of subscale of CEI (Personal Form) except for subscales Autonomy' and `Equity'. The table 1 highlights this aspect.

Discussion

To achieve the objectives, the perception of students about their classroom learning environment was obtained using the Classroom Environment Instrument in personal form because literature reveals the importance of measuring the nature of interaction or behavior in class. It was revealed that out of nine subscales of CEI (Personal Form), the subscales "Teacher Support', 'Cooperation', Students Cohesiveness', 'Involvement', Personal relevance' and 'Emphasis on understanding', were positively correlated with students' academic achievement whereas subscales of 'Investigation' and 'Equity' were negatively correlated. The Pearson correlation coefficient was highest for subscale Involvement (0.244) and least for 'students' cohesiveness' (0.142).

It is revealed during present study that the students who believe in investigation or use inquiry approach for grasping the content is not attaining good marks in Pakistani Context, this may be due to lack of priority by our agencies responsible for curriculum development and assessment to this aspect. This is supported with a study conducted in Mauritius in 2005 by Hemat Bessondyal. Moreover, using Pearson correlation formula, out of nine subscales of CIE (Class form), subscales 'Teacher support', 'Involvement' , 'Emphasis on understanding' and 'personal relevance' are significantly Correlated with students' academic achievement and subscale 'Investigation' , 'autonomy' and 'equity' have negatively correlation value. This is supported by the research conducted by Rawnsly (1997). The findings of the study are also supported by researches conducted by Shugufta bibi (2009), Ayaz and Ummara (2009), Farooq (2011), Khaliq (2012) in Pakistan.

Conclusion

From the findings of the study, following conclusions were drawn:

The sub-scales "Investigation" and "Equity" are negatively correlated with students' academic achievement in Mathematics. This was also supported by research conducted by George (1997) in Australia. The sub-scale `autonomy' has insignificant role towards students' academic achievement in Mathematics. The Sub-scale `Involvement' has the highest value of correlation between classroom learning environment and students' academic achievement. The sub-scales `Involvement', `Emphasis on understanding' and `Personal relevance' are major factors effecting students' academic achievement. High achiever in the subject of Mathematics students perceive their classroom learning environment better than fail and average students except at the subscale `Investigation', however, the average students perceive their classroom learning environment better than the fail students.

Recommendations

On the basis of conclusions, the researcher recommends as follows

The pillars of education system like curriculum development, assessment system and teacher training should take practical and meaningful steps to inculcate/promote the habits of self-learning, reflection, understanding, inquiry and investigation among students. The induction of committed, skilled teachers as well as the training of in-service teachers is required to improve teacher's behavior in classroom. The focus of change needs to be at three levels: Conceptual level, pedagogical level and attitudinal level that may affect the learning of low achievers in mathematics positively. The managers should frequently visit classrooms in order to assess participation, involvement, and

understanding of the students and offer support to those teachers also who lack competencies required to improve the learning situation and environment in mathematics classrooms. Low achievers in the subject of Mathematics are need to be involved more through increased interaction with teachers in the form of makeup classes, tutorial classes or special coaching. The concerned teacher should give special attention in order to bring them at par with others at least with average students. Personal involvement of low achievers should be enhanced through questioning, better inter-personal relationship and teacher's special attention.

Further studies can be conducted to investigate the classroom environment of elementary classes and for other subjects and grades as well.

References

Adediwura, A. A. & Tayo, B. (2007). Perception of teacher's knowledge, attitude and teaching skills as predictor of academic performance in *Nigerian secondary schools. Educational Research and Review, 2*(7),165-171. Retrieved form http://www.academic journals.org/ERR.291.

Amidon, E., & Flanders, N. (1961). The effects of direct and indirect teacher influences on dependent - prone students learning geometry. *Journal of Educational Psychology*, *52*, 286 - 291.

Anderson, G. & Walberg, H. (2003). *Learning environments*. In Walberg (Ed.) Evaluating educational performance: A sourcebook of methods, instruments and examples.

Arends, R. I. (2007). *Learning to teach*. Boston: McGraw Hill.

Fraser, B. (1986). *Classroom environment*. New York: Croom Helm, 51 Washington Street.

Fraser, B. J., & Hebert, H. J. (1991). *Educational environments: evaluation, antecedents and consequences.* Britain: Per Gamon Press Oxford (UK).

Kurt Lewin's Psychological Field Theory. (n.d.). Retrieved from https://www. psychologynoteshq.com/psychological-field-theory

Lewin, K. (2009). *Principles of topological psychology*. New York: McGraw-Hill.

Lindzey, G., & Elliot, A. (1977). *The handbook of social psychology* (2nd Edition). USA: Published by Addison-Wesley Publishing Company.

Moos, R. H., & Trickett, E. J. (1974). *Manual classroom environment scale*, California: Con-sulting Psychologist Press, Palo Alto

Murray, H. (1938). Exploration in personality. New York: Oxford University Press

Randhawa, S., & Lewis (1976). Assessment and effect of some classroom environment variables. *Journal of Review of Educational Research*, *43*(3).

Renchlor, R. (1992). Student motivation, school culture and academic achievement. USA: ERIC Clearing House on Educational Management.

Sahakian, S. W. (1976). Introduction to psychology of learning. Chicago: Rand McNally College Press.

Sharan, R. (2006). *Teaching of mathematics.* New Delhi: A.P.H. Publishing Corporation, Darya Ganj.

Steve, G., & Richard, H. (1990). Establishing a classroom environment that promotes interaction and improved student behavior, *The Clearing House*, *63*(8), 375-378.

Walberg, H. (1974). *Evaluating educational environments.* Beralay, CA, McCutcha.