Impact of Classroom Environment on High School Students' Mathematics Anxiety

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Abstract

This study is aimed at identifying the relationship between classroom environment and mathematics anxiety of students. Adopting a quantitative data analysis procedure, it has been revealed that there exists a significant negative correlation for the scales for teacher's support and learning mathematics anxiety and mathematics evaluation anxiety. It has also been identified that learning environment scales and learning mathematics anxiety include significant, negative and independent relationships in relation to teacher's support, investigation, task orientation and equity. Acknowledging teachers as catalysts in pedagogical practice, the study shows that they can play a pivotal role in easing mathematics learning byreducing mathematics anxiety.
Keywords: *Mathematics anxiety, learning anxiety, evaluation anxiety, classroom environment*

Introduction

The learning environment of the classroom is a prime factor in effective academic practices. It focuses on the importance of providing the social, psychological, and physical environment to the heterogeneity of the classroom. An effective classroom environment plays a pivotal role in harmonizing all diversities and facilitating the learning process. Failure to create an effective learning environment may invite hindrances to achieving academic objectives. One of the burning problems that the educational community comes across is that of mathematics anxiety.

Mathematics anxiety is a real problem faced by many students these days. It is an intense feeling of frustration or helplessness about one's ability to understand and do mathematical functions. Students who suffer from mathematical anxiety feel that they are incapable of doing activities that involve mathematics. It is an emotional rather than intellectual problem that might have a detrimental effect on a learner. However, this problem interferes with a person's ability to learn mathematics and results into an intellectual problem. It can cause one to forget and lose one's self-confidence. Hence, it is a problem to deal with sensitively and tactfully to stimulate a learner to study.

Mathematics anxiety has been defined as feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations. Tobias (1993) characterized mathematics anxious individuals as "those who mistrust in their problem-solving abilities and experience a high level of stress when called upon to use those abilities, particularly in public". Furthermore, these persons apologize for their lack of skills and avoid associated activities. Mathematics anxiety is "an attitude combining many factors to affectmathematics performance and an uneasiness, nervousness or apprehension regarding mathematics" (Cavez & Widmer, 1982).

Students' mathematics anxiety is negatively correlated with performance in mathematics. People who suffer from

mathematics anxiety tend to avoid courses, fear careers and promotions that involve quantitative or computational skills (Tobias, 1993). However, it is not yet determined what factors make learners feel anxious when confronting mathematics. Learners with higher mathematics anxiety show a strong tendency to avoid learning mathematics, to hold a negative attitude towards mathematics, to have weak self-confidence in doing mathematics, and to receive lower grades in mathematics-related courses in general

(Ashcraft, 2002). Therefore, math anxiety has become an issue to tackle with sensitivity to facilitate mathematics learning with ease.

As shown in Figure 1, my study would take variables like student cohesiveness, teachers' support, students' involvement,task orientation, investigation, cooperation, and equity inclassroom environment factors; and learning mathematics anxiety and evaluation mathematics anxiety as the factors for mathematics anxiety.

Figure 1
Conceptual Frameworkof the Study
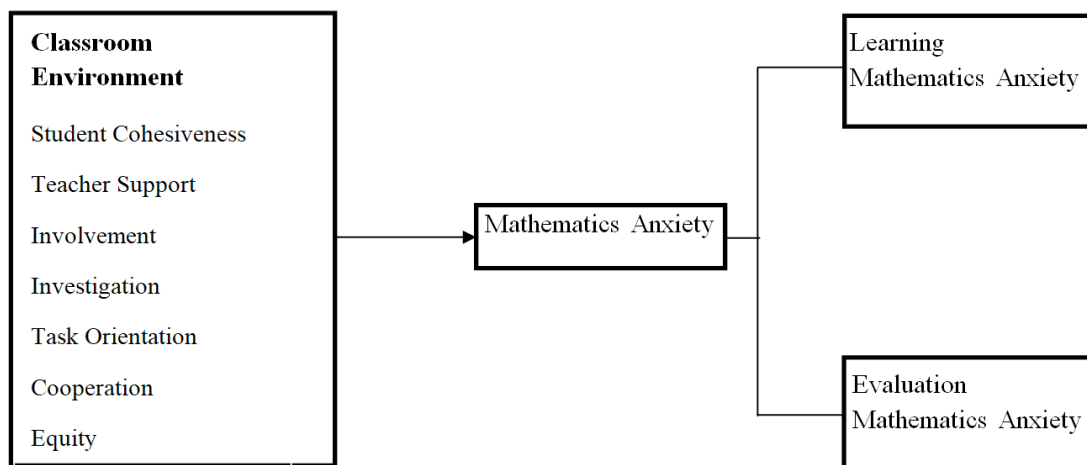
Rationale of Study

Most of the present researches have focused on the cognitive components of mathematics classroom and their relation to achievement; only a few are concerned with the learning environment of mathematics classroom and affected areas of learning. From my own teaching experience, some students do well during mathematics lessons and assignments, yet they fail to perform well in the examination. Although there are diverse reasons for poor performance in mathematics, one prevalent variable worth considering is

mathematics anxiety. At this background, this study undertakes to add some insightful ideas to that body of knowledge.

Objectives of the Study

The primary objective of the study was to investigate the influence of classroom environment on secondary school students' mathematics anxiety. Based on this objective, further research has been conducted to explore the components of the effective classroom environment and their impacts on teaching teaching-learningprocess. Along with this, the research also focused on the impact

of the classroom learning environment on mathematics learning and evaluation anxiety.

Research Methods

Adopting the quantitative method, this study involved 405 randomly selected students of grade 9 from 12 different classes of schools of Kathmandu Valley consisting of heterogeneity. The students voluntarily became participants in the study but could not participate without parental/guardian and consent of school authorities. All ethical guidelines were followed as directed by the school authorities to ensure participants' confidentiality and obtain informed consent. Two instruments were used to obtain the data:

a) 'What is happening in this Class?' (WIHIC) (Fraser et al., 1996) learning environment instrument measured students' perceptions of seven psychosocial learning environment areas: Student Cohesiveness, Teacher's Support, Involvement, Investigation, Task Orientation, Cooperation, and Equity. There are 56 total items in the WIHIC with each scale having 8 questions. The instrument uses a Likert Scale with a range of "almost-never to almost-always".

b) The Revised Mathematics Anxiety Ratings Scale (RMARS) (Plake & Parker, 1982) instrument measures perceptions of mathematics anxiety in two areas: Learning Mathematics Anxiety and Mathematics Evaluation Anxiety. There are 24 questions altogether in the RMARS, with 16 of them assessing the Learning Mathematics Anxiety scale and 8 for Mathematics Evaluation Anxiety.

The data from the two instruments were first analyzed for factor structure, reliability, and discriminant validity. Factor analysis was carried out using the principal component method with Kaiser varimax rotation. Internal consistency reliability was determined by using the Cronbach alpha correlation between scales. Factor analysis in this study for the RMARS shows that out of 24 items 22 items have factor loadings greater than 0.4. Two items of the learning mathematics anxiety scale did not have a factor loading greater than 0.4 but approached to 0.4 i.e., 0.392 and 0.395, so with the consultation of mathematics subject experts, all 24 items were included for the final study. The mean correlation with other scale was found to be 0.4, which showed that each of the scale measuring concepts was different from the other scale. The alpha reliability coefficient of learning mathematics anxiety and evaluation mathematics anxiety were found 0.848 and 0.842 respectively, which showed highly reliable instrument provided confidence in using an instrument in the Nepalese context. The results of factor reliability and validity analysis were consistent with previous research (Plake & Parker, 1982; Taylor, 2004).

It was found that each item of WIHIC had factor loading greater than 0.4 on their own scale showed that the WIHIC's factor structure was clear and repeatable. The alpha reliability coefficient of WIHIC sub-scaleswasfound 0.7 to 0.877. These results reflected a reliable instrument with a strong level of internal consistency. The eta[2] statistic from MANOVA was used to examine whether the classroom learning environment instrument WIHIC could differentiate between various classrooms. Each value had a significant difference ($p < 0.05$) except the subscale 'cooperation' but also significant result was consistent with other earlier studies that conducted factor and reliability analysis of WIHIC (Taylor, 2004; Moss & Fraser, 2001).

Result and Discussion

Associations between the classroom learning environment factors and anxiety factors were explored by using simple correlation techniques and multiple regression models. Using the learning environment scales as the independent variables, investigated whether these scales had significant statistical relationships with the various anxiety scales when all the learning environment scales were mutually controlled. The learning environment scale and the mathematics anxiety scale were investigated and examined through simple correlations and regression analysis. While so doing, learning environment scales were considered as independent variables. The correlation analysis involved simple Pearson product moment correlations that identified the relationship between anxiety and learning environment scale.

A multiple regression analysis was conducted for anxiety scales. This analysis identified the relationships of anxiety scale as the dependent variable and learning environment scale as the independent variable. The regression indicated the unique contribution made by a specific learning environment dimension in explaining the variance in the dependent variable when all the learning environment scales were mutually controlled.

Table 1 shows the result of the correlation and regression analysis between each of the two mathematics anxiety scales and the learning environment scales. The correlation coefficient (r) and the regression coefficients (β) are shown for each of the learning environment scales. Multiple correlation is also computed for analysis.

Table 1

Simple Correlation and Multiple Regression Analysis for Associations between Anxiety and Classroom Environment Using the Individual as the Unit of Analysis

Environment Scale	Learning Mathematics Anxiety		Mathematics Evaluation Anxiety	
	R	β	R	β
Student Cohesiveness	-0.023	0.28	0.057	0.237
Teacher Support	-.287**	-0.444	-.298**	-0.387
Involvement	-0.157	-0.024	-0.163	-0.63
Investigation	-.221*	-0.249	-0.169	-0.10|4
Task Orientation	-.210*	-0.309	-0.11	-0.064
Cooperation	0.104	-0.111	-0.006	0
Equity	-223*	0.125	-0.141	0.016
Multiple Correlation, R		0.358*		0.348*

*. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed)

Mathematics evaluation anxiety showed no significant relationship with classroom environment for either the simple correlation or multiple regression analysis, besides teacher's support. There was a significant negative relationship for the scales of teacher's support (P<0.01) and mathematics evaluation anxiety. It appeared that specific emphasis on the learning environment in these classes did not contribute to anxiety

associated with the evaluation process. Only teacher's support was the strongest correlation with mathematics evaluation anxiety. The evaluation process for testing mathematics knowledge is probably not dependent on classroom situation and environment, but the teacher's support plays a vital role in reducing mathematics evaluation anxiety.

The simple correlations between the learning mathematics anxiety and the classroom environment scales were not strong, and there were significant negative relationships for the scales of teacher's support (p<0.01), Investigation (P<0.05), task orientation (p<0.05), and equity (p<0.05). This suggested that there was a moderate level of relationship between anxiety with the process of learning mathematics and these four learning environment areas.

The multiple regression analysis using learning mathematics anxiety and mathematics evaluation anxiety as the dependent variable and the WIHIC scales as the independent variables yielded a statistically significant correlation of 0.358 has (p<0.01); and 0.348 has (p<0.01) respectively. Teacher's support had the strongest negative correlation with mathematics anxiety scales. This suggested that the less teacher supportexists in the classroom, the more anxiety is likely to bein the process of learning as well as evaluation mathematics when all other WIHIC scales are mutually controlled.

The low multiple correlations in Table 1arose partly because of multicollinearity, which existed when the independent variableshad a high level of correlation with each other. However, these correlations were large enough to give rise to a degree of multicollinearity. Low multiple correlations reflected a weak underlying relationship between dependent variable and independent

variables (Taylor, 2004).

If students get continuous teacher support, they will be able to create quality shared relationships. The benefits of a positive perception of teacher support are reflected in increased student school engagement, student dedication to academic activities and a decrease in problematic school behaviour (Garcia-Reid et al., 2015).

The study revealed no statistically significant relationship between the learning environment scales and mathematics evaluation anxiety in either the correlation or multiple regression analysis, besides teachers' support. There was a significant negative relationship as well as the strongest correlation between the scales of teachers' support and Mathematics Evaluation Anxiety. This revealed that teachers play a vital role in evaluation anxiety.

The associations found between the learning environment scales and Learning Mathematics Anxiety included significant, negative, and independent relationships with Teacher's Support, Investigation, Task Orientation, and Equity. These findings suggested that the teacher's support could affect the way they learn subject area and about the examination as well. It also showed the need for students' own investigation habits, task orientation, and encouragement and opportunity.

This study showed that teacher support had the strongest negative correlation with mathematics anxiety scales. It revealed that a teacher had the greatest influence in the reduction of students' mathematics anxiety. This result was supported by some prior research(e.g., Oxford & Vordick, 2006).

Teachers can play a significant role in lessening the math anxiety of their students and helping them approach math with

confidence. Students' interests and attitudes about mathematics might be influenced by the opinions and interests those teachers and parents have for the subject matter (Budhathoki et al., 2022). In my opinion, the best remedy to math anxiety is mastery over math. The more the students understand math concepts, the less anxiety they tend to experience. So, the teachers should counsel and prepare the students to face mathematics learning and testing with ease and comfort. The better prepared the learners are for tests, the less they are likely to get mathematics anxious. A teacher, hence, can help disfigure away at this block by providing individualized academic support and strengthening the student's confidence.

Implication of the Study

The correlation between mathematics anxiety and classroom environment indicates that students would learn mathematics with ease and comfort when the classroom environment could be made student friendly. This research would surely help the instructors to guide the students in such a way that the students' mathematics anxiety would be reduced. This study revealed that the ability of the instructors and parents/ guardians to share their recognition and instruct the value of mathematics and make the learners/wards realize it in their practical life, would be one of the most effective therapies for mathematics anxiety. Teachers can change their attitude to contribute to creating learner-friendly classroom environments after pursuing this research, as they are the primary agents for change. They can feel their responsibility to identify each student's personal level of mathematics anxiety and take remedial procedures to address it. Moreover, this study provides an improved understanding thereby showing

a way to find a reformative diagnosis for students suffering from mathematics anxiety through identification of associations between their anxiety levels and classroom settings. However, this analysis gives a better view of the dimension of the learning environment and their relationship with math anxiety likely to emerge, qualitative data still requires evaluation to corroborate and expand possible relationships.

Conclusion

The study has revealed that mathematics anxiety among the students and classroom environment have a relational connection having a significant negative correlation for the scales of teacher's support and learning mathematics anxiety and mathematics evaluation anxiety. The data have exposed that learning environment scales and learning mathematics anxiety include significant, negative, and independent relationships in relation to teacher's support, investigation, task orientation, and equity. Hence, the instructors should learn how to react when students' behavior changes because their math anxiety is at a higher level. Recognition of such problems in instructional procedure would compel an instructor to adopt various techniques like cooperative learning, peer learning, group work, project assignments, remedial teaching, etc. to reduce the level of mathematics anxiety among students. So, it is essential to promote effective and engaging mathematics instruction to create a positive mathematics culture in the classroom and to endorse positive attitudes about mathematics and mathematics achievement for students.

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