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IMPACT OF ATTITUDE TOWARDS SCIENCE AND MATHEMATICS ANXIETY ON THE PERFORMANCE IN PHYSICS OF PUPILS FROM SCIENCE STREAM OF GRADE XI

[1]Ms. Navpreet, [2]Mr. Rajib Chakraborty
[1]*Research Student, School of Education, Lovely Professional University, Phagwara, India*
[2]*Assistant Professor, School of Education, Lovely Professional University, Phagwara, India*

Abstract

The current study tries to inspect the impact of Attitude towards Science and Mathematics anxiety on Performance in Physics of pupils from science stream of 11th grade of district Jalandhar, Punjab. The study sample subjects were 220 pupils of non-medical stream of science of 11th grade. The tools used in this study are SAS-GA(Science Attitude Scale) by Dr.Avinash Grewal and MAS-MSKT(Mathematics Anxiety Scale) by Dr.Sadia Mahmood and Dr. Tahira Khatoon. The study adopted descriptive survey method in design. In this study Mean, Standard deviation, Standard Error, Pearson's product moment correlation, point-biserial correlation and simple linear regression, multiple linear regression techniques are used for data analyses. ANOVA was used for testing the significance of the hypotheses under Inferential Statistics. The researcher found that mathematics anxiety negatively and significantly predicts performance of pupils in physics. On the other side, researcher found that attitude towards science predicts the physics performancepositively and significantly. Both independent variable mathematics anxiety and independent variable attitude towards science collectively predict dependent variable physics performance. There is no role of gender on the mathematics anxiety, attitude towards science and performance in physics of pupils.

Keywords *:-Mathematics Anxiety, Attitude towards Science and Physics Performanc*

INTROUCTION

In order to study the physics performance of pupils,subject mathematics and pupils' attitude towards science plays an important role. Understanding of mathematics and attitude towards science is very much required for the good performancein physics for science stream pupils. As to understand the social science strong understanding of English language is required. In the same manner to understand the science subjects understanding of mathematics is required along with the English language. According to a physicist namedGalileo Galilei," *Mathematics is the language in which God has written the Universe*".According to psychotherapist Alfred Adler," *Mathematics is pure language of science. It is unique among languages in its ability to provide precise expression for every thought or concept that can be formulated in its terms.*" Carter and Yackel (1988) wrote that the most of the time teacher has to listen following statements from the pupils in the science classroom:

"I was never any good at math."

"This is probably a stupid question."

"I know that I should know how to do this."

"What's the use, I won't be able to do it anyway."

Generally, Instead of pupils' high motivation and attitude towards science and their teachers' brilliant teaching do not affect their performance in science positively. Student scores less marks in chemistry and physics. Chemistry and physics are such branches of science which requires understanding of mathematics. The reason of this is, the pupils who have phobia of mathematics means mathematics anxiety they do not perform well in chemistry and physics subject of science. Maths anxiety put great influence in a negative manner on science performance. So it becomes very important for a science teacher and mathematics teacher to be such knowledgeable to reduce mathematics anxiety and promote attitude towards science to achieve good performance in science classroom.

Whyte (2012) defined **Mathematics anxiety** as," A fear, or phobia, produce a negative response specific to the learning, or doing, of mathematical activities that interfere with performance".

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According to Sahri.N (2017)mathematics anxiety is a feeling of discomfort and frustration and helplessness when pupils deal with the numbers, numericals, and mathematical concept.

Osborne. et al. (2003) "**Attitude towards Science**is the desire to know and understand, questioning to all statements, search for data and their meaning, search for verification, and consideration of consequences".Ackey.Het al. (2010) "*Attitude towards science* is the feelings, beliefs, and values held about an object that may be the endeavour of science, school science, the impact of science and technology on society, or scientists".

The present study aims to find that how much mathematics anxiety and attitude towards science predicts physics performance of pupils of science stream of 11th grade.

REVIEW OF LITERATURE

Attitude towards Science and Physics Performance

Linda W. Hough (1982) conducted study on 583 pupils of eighth grade and found the result that the value of correlation coefficient between attitude towards science and performance in physics was 0.45 which is magnitude-wise positive. Parker.V and Gerber.B (2000) conducted study on pupils of eighth grade and foundthat attitude towards science has actual significant and strong relation with the performance in science. Chang and Cheng (2008) found that 11th-grade pupils' physics performance was definitely, positively and meaningfully correlated with their interest in science.Adodo and Gbore (2011) found that attitudes and interest towards science predicts the performance in physics. There is positive relation between both variables. If there is unit change in the attitude towards science their will 28.5% change in performance as value of coefficient of determination R square is 0.285.Çapri (2013) found that university pupils' attitude towards science predicted their physics performance in a very weak manner.According to Awoden (2014), performance of pupils in physics can be expected by their attitude towards science, their daily habits of study, their interest towards science and their gender. The coefficient of correlation between attitude towards science and performance in physics is 0.482. It is found that 22.2% performance in physics can be predicted by attitude towards science for unit change in attitude towards science.

Mathematics Anxiety and Physics Performance

Satake and Amato(1995) wrote that pupils know that mathematics is the way to enter in the career of engineering and technology, even then they avoid the mathematics due their phobia towards mathematics i.e mathematics anxiety. They feel troubled while doing mathematics which affects their performance negatively.Arem(2009) wrote that pupils with mathematics anxiety, they have afraid of doing calculations and manipulation with equations and numbers. They feel worried while solving problems of mathematics and understanding mathematical concepts. These things are required for understanding of physics. Therefore the pupils with mathematics anxiety cannot perform well in physics.Khatoon and Mahmood(2010) declared that there is inverse relationship between mathematics anxiety and performance. Awodun et.al(2014) conducted study on senior school pupils and found that who has good mathematics skill to understand the concepts of graphs, shapes, geometry, computational and algebra that can perform good in physics. The pupils those have anxiety in mathematics they cannot perform well in physics.

BODY OF ARTICLE

STATEMENT OF THE PROBLEM

"Impact of Mathematics Anxiety and Attitude towards Science on the Physics Performance of pupils of Science Stream of 11th grade."

RESEARCH OBJECTIVE

- To examine the association between mathematics anxiety and physics performance in pupils of science stream of 11th grade.
- To examine the association between attitudes towards science and physics performancein pupilsof science stream of 11th grade.

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- To examine the predictive association of mathematics anxiety on physics performance in pupilsof science stream of 11th grade.
- To examine the predictive association of attitude towards science on physics performance in pupils of science stream of 11th grade.
- To examine the predictive association of attitude towards science and mathematics anxiety on physics performancein pupils of science stream of 11th grade.
- To examine the role of gender on mathematics anxiety in pupilsof science stream of 11th grade.
- To examine the role of gender on attitude towards science in pupilsof science stream of 11th grade.
- To examine the role of gender on performance in physics in pupilsof science stream of 11th grade.

RESEARCH HYPOTHESES

- **H_0:** Themathematics anxiety and physics performancein pupilsof science stream of 11th gradehas no significant difference.
- **H_0:**The attitude towards science and physics performance in pupilsof science stream of 11th grade.
- **H_0:**There is no predictive association of mathematics anxiety on physics performance in pupilsof science stream of 11th grade.
- **H_0:** Thereis no predictive association of attitude towards science on physics performance in pupilsof science stream of 11th grade.
- **H_0:** There isno predictive association of attitude towards science and mathematics anxiety on physics performancein pupilsof science stream of 11th grade.
- **H_0:** The gender and mathematics anxiety of pupilsof science stream of 11th gradehas no significant association.
- **H_0:**The gender and attitude towards scienceof pupilsof science stream of 11th gradehas no significant association.
- **H_0:**The gender and physics performanceof pupilsof science stream of 11th gradehas no significant association.

Population for the study

The population of the study is the pupils of science stream of 11thgrade of district Jalandhar,Punjab.

Sample for the study

In the present study, total 220 pupils of science stream(non-medical) of 11th grade of government and private schoolsof district Jalandhar, Punjab, selected randomly. There were 111 girlspupils and 109 boys pupils.

TOOLS USED IN STUDY

Measuring Attitude towards Science

The Science Attitude Scale (SAS-GA) is used by researcher to measure the attitude towards science, which was developed by Dr.AvinashGrewal in 2012. It has total 20 statements, from which 10 are negative and 10 are positive. It is five-point likert scale questionnaire means each statement has 5replies that are strongly agree, agree, undecided, disagree, and strongly agree. The tool has 0.86 reliability estimated by split half method and 0.75 reliability estimated by test-retest method. It has content validity.

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Mesuring Mathematics Anxiety

The Mathematics Anxiety Scale (MAS-MSKT) is used by researcher to measure the mathematics anxiety, which was developed by Dr.SadiaMahmood and Dr.TahiraKhatoon in 2012. It has 14 statements from which 7 are positive and 7 are negative. It is a questionnaire with five-point likert scale means each statement has 5 replies that are strongly agree, agree, undecided, disagree, disagree. The tool has split half reliability 0.89 and cronbach alpha reliability of 0.87. It has concurrent validity.

SAMPLING

In the present study, the technique used for data collection is simple random sampling.By using this technique the data is collected from 220 pupils of science stream (non-medical) of 11th grade ofdifferent government and private schools of district Jalandhar, Punjab.

RESULTS

After the data collection, data analysis is done using SPSS software. The interpretation of theresult and data analysis is given below:

Analysis of descriptive statistics

The mean, standard deviation (S.D.), standard error, skewness and kurtosis of the variables mathematics anxiety, attitude towards science and performance in physics has been given below:

TABLE I: "A summary of descriptive statistics of different variables"

Variables	N	Mean	Standard Deviation(S.D.)	Standard error	Skewness(Sk)	Kurtosis(Ku)
Mathematics anxiety	220	2.00	0.64	0.043	0.747	0.712
Attitude towards Science	220	2.58	0.36	0.24	-0.144	0.560
Physics Performance	220	61.73	16.21	1.09	0.080	-0.652

MTHEMATICS ANXIETY

Above result indicates that mean and S.D. of mathematics anxiety among pupilsof science stream of 11th grade is 2.00 and 0.64 respectively. Skewness is found to be 0.747 which reveals that data is positively skewed. Kurtosis is 0.712 which is greater than 0.263 (Ku for normal curve), which shows that the curve is leptokurtic.

ATTITUDE TOWARDS SCIENCE

Above result indicates that mean and S.D. of attitude towards science among pupilsof science stream of 11th grade is 2.58 and 0.36 respectively. Skewness is found to be -0.144 which reveals that data is negatively skewed. Kurtosis is 0.560 which is greater than 0.263(Ku for normal curve), which shows that the curve is leptokurtic.

PERFORMANCE IN PHYSICS

Above result indicates that mean and S.D. of performance in physics among pupilsof science stream of 11th grade is 61.73 and 16.21 respectively. Skewness is found to be 0.080 which reveals that data is positively skewed. Kurtosis is -0.652 which is less than 0.263 (Ku for normal curve), which shows that the curve is platykurtic.

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TABLE II: TESTING HYPOTHESIS ONE
"Correlation between physics performance and mathematics anxiety"

N	Pearson Coefficient of Correlation	Sig.(2-tailed)	Result
220	-0.245**	0.000	H_0:Rjected

The** means correlation is significant at the 0.01 level

Interpretation: The value of coefficient of correlation between Physics Performance and mathematics anxiety is -0.245 that is significant at the level of significance 0.01. It is interpreted that Physics Performance is negatively, weakly and significantly correlated with the MathematicsAnxiety.This implies that more the mathematics anxiety leads to less in physics performance and less in mathematics anxiety leads to more in physics performance.

TABLE III:TESTING HYPOTHESIS TWO
"Correlation between physics performance and attitude towards science"

N	Pearson Coefficient of Correlation	Sig.(2-tailed)	Result
220	0.207**	0.002	H_0:Rjected

The ** means correlation is significant at the 0.01 level

Interpretation: The value of coefficient of correlation between physics performance and attitude towards science is 0.207 which is significant at the level of significance 0.01. It is interpreted that physics performance is positively, weakly and significantly correlated with the attitude towards science. It implies that higher the attitude towards science leads to higher in physics performance and lesser the attitude towards science leads to lesser in physics performance.

TABLE IV: TESTING HYPOTHESIS THREE
"Predictive association of mathematics anxiety on physics performance ofpupils of science stream of 11th grade"

"Model Summary"

Model	R	R Square	Adjusted R square	Std.Error of Estimate
1	0.245[a]	0.060	0.056	15.75688

a.Predictors:(constant), Mathematics Anxiety

ANOVA[a]

Model	Sum of Squares	Df	Mean Square	F	Sig.
1Regressin	3455.005	1	3455.005	13.916	0.000[b]
Residual	54124.913	218	248.279		H_0:
Total	57579.918	219			Rejected

a. Dependent Variable: Physics Performance
b. Predictors: (constant), Mathematics Anxiety

Interpretation: It is clear that the independent variable mathematics anxiety of pupils of science stream predicts performance in physics, with a coefficient of regression (R) of 0.245 and the coefficient of determination R square 0.060. This indicates that 6% variation in performance in physics is explained by the predictor variable mathematics anxiety for a unit change in it. The simple linear regression coefficient R is significant at 0.01 level, as shown in the table for a F value of 13.916. Therefore the null hypothesis is rejected.

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TABLE V: TESTING HYPOTHESIS FOUR
"Predictive association of attitude towards science on physics performance of pupils of science stream of 11th grade"

"Model Summary"

Model	R	R Square	Adjusted R square	Std.Error of Estimate
1	0.207[a]	0.043	0.038	15.90130

a.Predictors:(constant), Attitude towards Science

ANOVA[a]

Model	Sum of Squares	Df	Mean Square	F	Sig.
1Regressin	2458.328	1	2458.32	9.722	0.002[b]
Residual	54121.590	218	252.851		H_0:
Total	57579.918	219			Rejected

a. Dependent Variable: Physics Performance
b. Predictors: (constant), Attitude towards Science

Interpretation: It is clear that the independent variable attitude towards science of science stream pupils of science stream predicts performance in physics with the simple linear coefficient of regression (R) of 0.207 and coefficient of determination R square 0.043.This indicates that 4.3% variation in performance in physics is explained by predictor variable attitude towards science for a unit change in it. The simple linear regression coefficient R 0.207 is significant at 0.01 level, as per the table with the F value is 9.722. Therefore null hypothesis is rejected.

TABLE VI: TESTING HYPOTHESIS FIVE
"Predictive association of attitude towards science and mathematics anxiety on physics performance of pupils of science stream of 11th grade"

"Model Summary"

Model	R	R Square	Adjusted R square	Std.Error of Estimate
1	0.278[a]	0.077	0.069	15.64680

a.Predictors:(constant), Mathematics Anxiety

ANOVA[a]

Model	Sum of Squares	Df	Mean Square	F	Sig.
1Regressin	4453.437	2	2226.718	9.095	0.000[b]
Residual	53126.481	217	244.822		H_0:
Total	57579.918	219			Rejected

a. Dependent Variable: Physics Performance
b. Predictors: (constant), Mathematics Anxiety, Attitude towards Science

Interpretation: It is clear that the independent variables mathematics anxiety and attitude towards science of pupils of science stream collectively predict the performance in physics with the multiple linear regression coefficient of regression (R) 0.278 and coefficient of determination R square 0.077. This indicates that 7.7% variation in performance in physics is explained by predictor variables mathematics anxiety and attitude towards science for a unit change in them collectively. The multiple linear regression coefficient R 0.278 is significant at 0.05 level for the F-value 9.095. Therefore null hypothesis isrejected.

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TABELE VII: TESTING HYPOTHESIS SIX
"Point Bi-serial correlation between Mathematics anxiety and Gender"

N	Pearson Coefficient of Correlation	Sig.(2-tailed)	Result
220	0.069	0.307	H_0: Accepted

Interpretation: The correlation between gender and mathematics anxiety is found to be non-significant at 0.05 level for the point-biserial coefficient 0.069. This results that,null hypothesis is accepted. So, the gender and mathematics anxietyofpupils of science stream are not associated significantly. It implies gender does not play any role in mathematics anxiety amongpupilsof science stream.

TABELE VIII: TESTING HYPOTHESIS SEVEN
"Point Bi-serial correlation between Attitude towards Science and Gender"

N	Pearson Coefficient of Correlation	Sig.(2-tailed)	Result
220	-0.051	0.451	H_0: Accepted

Interpretation: The correlation between gender and attitude towards science is found to be non-significant at 0.05 level for the point-biserial coefficient -0.051. Therefore the null hypothesis is accepted. So, The gender and attitude towards science of pupils of science stream are not associated significantly. Gender does not play any role in attitude towards science among pupilsof science stream.

TABELE IX: TESTING HYPOTHESIS EIGHT
"Point Bi-serial correlation between Physics Performance and Gender"

N	Pearson Coefficient of Correlation	Sig.(2-tailed)	Result
220	-0.038	0.577	H_0: Accepted

Interpretation : The coefficient of correlation between gender and performance in physicsis found to be non-significant at 0.05 level for the point-biserial coefficient -0.038. That is why the null hypothesis is accepted. So, the gender and performance in physicsof pupils of science stream are not associated significantly.Gender does not play any role on physics performance ofpupilsof science stream.

DISCUSSION

- The major finding of the study reveals that both mathematics anxiety and attitude towards science among pupils of science stream at secondary level predicts their performance in physics significantly. There is 7.7% variation in performance in physics is explained by variables mathematics anxiety and attitude towards science for a unit change in them collectively.
- The study also reveals that gender does not play any role in the mathematics anxiety, attitude towards science and physics performanceof pupils of science stream of 11^{th} grade.
- If there is more the mathematics anxiety in pupils, there will be less in performance in physics and if there is less mathematics anxiety among pupils, there will be more achievement inphysics performance.
- If there is high attitude towards science among pupils, there will be increase in their performance in physics and if there is low attitude towards science among pupils, there will be low achievement in performance of physics.

CONCLUSION

The importance of Mathematics understandingin expressing scientific concept is known to everybody. Ifthe mathematics anxiety among pupils is high, they cannot understand and express some science concepts which affect their performance in science subjects. But attitude towards

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science among pupils has positive impact on the performance of science subjects. The study concluded that both variables mathematics anxiety and attitude towards science collectively predict the performance of physics. So educational experts, curriculum makers, teachers and school management should make such strategies, curriculum, co-curricular and curricular activities, projects for pupils so that mathematics anxiety gets reduced and attitude towards science gets promoted.

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