



## Comparative Analysis of Gender Differences in Scientific Aptitude: Psychological factors affecting Academic Achievement of Students

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### Abstract

This study aimed to examine gender differences in the academic performance of students. The differential analysis was done with the view to make comparison between the boys and girls to study the difference due to gender on academic achievement and also on the independent variables taken in the study. The descriptive analysis was done to assess the level of academic achievement in academic subjects in respect of both the Government and Private School students of Classes V and VIII. The present study is essentially a descriptive exploratory survey. The study was carried out in Government and Private Schools affiliated to the Punjab School Education Board, selected from 10 districts of the state. The sample in the present study comprised the students studying in Class V and Class of Government and Private Schools of Punjab. The results of the present study reveal that Parents' Educational qualification contributes a lot for the academic output of their wards. The coefficient of correlation between the mother's qualification and the achievement of the students was found to be: 0.209, significant at 0.01 level and the correlation between Father's qualification and students' achievement was 0.140, at .01 level of significance in case of Government Schools only. In Government Schools, the performance of the girls was higher than their counterparts (boys) on all the subjects except in Social Science. Out of all the three psychological variables, the Private School students achieved significantly higher in Achievement Motivation and the Total Aptitude than their counterparts in the Government Schools.

**Keywords:** Academic achievement, Gender differences, psychological variables, Achievement motivation, Scientific Aptitude

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## **Introduction**

Since times immemorial the importance of education has been recognized the world over, as the status of any nation is contingent upon the education of every single individual of the society.

Education is a process that generates knowledge and skills, through educational institutions, that are transmitted to the society. It develops cognitive, affective and psychomotor domains of an individual; reasoning; intrinsic motivation; scientific temper and outlook, and aptitudes. It helps individual to explore; and innovate; to construct knowledge; invent and discuss the proper utilization of the resources. To top it all, it enables the individual to make the maximum use of one's potentialities leading to the attainment of desired goals; subsequently, it helps for the steady functioning and continuous advancement of the society.

In the age of globalization, education is the primary need to acquire knowledge and technical skills required in the local and global markets. Thus, education plays a fundamental role in the development of human capital; economic stabilities; social standard; and the opportunities to live a respectful life and face the challenges of life.

In the present age of competition, everybody needs education but the most important factor is the acquisition of quality education to march ahead in life.

Human development is based on the strong foundation of quality of Education. Recently, Punjab has been ranked 2nd on the Human Resource Development Aspect as reported in the Punjab Economic Survey 2019-20 (P 141). This is evidenced in the improvement of Literacy rate from 75.84% vide Census 2011 to 80% as per the National Sample Survey (2014); and more recently, it has further improved to 82.2% as reported in Periodic Labour Force Survey (PLFS), May 2019.

The endeavour of Punjab has been to provide quality learning environment conducive for all, and is thus, proclaimed to have strong infrastructure. As far as quality of education is concerned, Punjab scored 67 on SDG4 (Sustainable Development Goal 4), according to NITI Aayog's SDG Index 2019-20, which is ahead of the National Average Score of 58 (Ref. Punjab Economic Survey, 2019-20, P 141).

In terms of the parameters of quality education; the pupil-teacher ratio in the schools of Punjab has found to be equal to or less than 30 in 86% of the schools; and the number of trained teachers in Punjab is reported to be 99.14% vide SDG4 India Index and Dashboard Sustainable Goal (2019, P 114).

**Manickavasagan (2018)** in "*A Study on Achievement in Chemistry and Scientific Aptitude of Higher Secondary Students,*" found significant differences between boys and girls in achievement in the subject of Chemistry, where the girls scored higher than the boys, and the difference was significant at .05 level.

**Kundu (2019)** in the study "*Impact of Mother's Education on the Achievement in Mathematics,*" found that the students whose mothers had lower qualification had scored lower marks in comparison to the students whose mothers' qualification was higher ranging from Primary, through High School, and then on to Graduation (P 310). **Khan, et al (2015)** in their study "*The Influence of Parents' Educational Level on Secondary School Students' Academic Achievements in District Rajanpur (P77),*" found significant differences in the achievement in favour of students whose parents had higher level of education. Parents with higher level of education have keen interest and influence on their children to perform better in studies. **Bakar, A., Norsuhaily et al (2017)** found significant influence of "*Parents' Education on Academic Performance of Secondary School Students*" using Regression analysis. They found that with the increase in educational level of parents, there is an increase in the students' academic

performance and vice versa. The reason being that educated parents are more involved, make timetable, assist their children in homework, provide learning material to facilitate their learning (P=30). **Suleiman, et al (2018)** studying “*The Influence of Parental Background on Academic Performance of Children in Secondary Schools in Nigeria,*” established association between parents’ education and students’ academic achievement with Chi Square, significant at .05 level (P=47). **Selvam (2013)** in the “*Study on Relationship Between Parental Education and Student Achievement*” did not find significant differences in the achievement of Higher Secondary boys and girls with respect to the influence of the parents (P=80).

### Objective of the Study

To make a comparison between the boys and the girls on academic achievement, along with the other independent variables of intelligence, motivation, and aptitude in Science and Maths separately in Government and the Private Schools.

### Design of the Study

The present study is essentially a descriptive exploratory survey. It is descriptive study in the sense that it seeks to find answers to the questions through the analysis of variable relationship i.e. what factors seem to be associated with certain outcomes or types of behaviour.

### Field of Investigation

The study was carried out in Government and Private Schools affiliated to the Punjab School Education Board, selected from 10 districts of the state. The details of the districts selected region-wise are given below in table 1.

**Table 1**  
**Region by Sampled Districts**

<b>Majha Region</b>	<b>Doaba Region</b>	<b>Malwa Region</b>	
Amritsar	Jalandhar	Mohali	Barnala
Gurdaspur		Faridkot	Sangrur
		Ferozepur	Bathinda
		Fazilka	

### The Scope of the Study

The study was delimited to Government and Private, Primary/Elementary, and High/Higher Secondary Schools affiliated to PSEB, Mohali.

### Sample

The sample in the present study comprised **the students** studying in Class V and Class VIII; For the **selection of schools, random method** was used i.e. selecting required number of schools randomly from the lists provided by the District Education Officers comprising both Government and Private Schools affiliated to PSEB

### Sampling Framework

**Number of Schools:** In all, there were 30 schools, out of which there were 10 Government Primary Schools, 10 Government High, Middle, Elementary Schools, and 10 Private Schools. The data were taken from Class V and Class VIII students from these schools.

### Sample size of Class V and Class VIII students

In all there were 1,047 students in the sample, out of which there were 474 Class V, and 573 Class VIII students.

### Data collected from the students

The entire data were collected from the students with the help of administering achievement tests and other psychological tests to the students:

**The Achievement tests:** The tests were administered on each subject being taught in Class V and Class VIII.

### Gender Differences: Comparison between Boys and Girls on the Variables under Study

**Objective:** One of the objectives of the study was to make a comparison between the boys and the girls on academic achievement, along with the other independent variables of intelligence, motivation, and aptitude in Science and Maths.

### Hypothesis:

- i) There are no differences in academic achievement of the boys and the girls.
- ii) There is no difference in boys and girls due to intelligence; achievement motivation, aptitude in Maths and Science.

The results were analysed separately for the boys and the girls students in Government and the Private Schools. The comparative data of the boys and girls have been presented separately in the tables to follow:

**Table:2**  
**Comparison of Boys (105) and Girls (160) on Academic Achievement and Psychological Variables in Government Schools**

Sr. No.	Subject	c2 Gender	Mean	Std. Deviation	Std. Error Mean	SE <sub>D</sub>	M <sub>1</sub> -M <sub>2</sub>	t-ratio
1.	Punjabi	1Boys	5.47	2.189	0.214	.261	.596	2.28*
		2Girls	6.06	1.906	0.151			
2.	Hindi	1 Boys	7.33	3.421	0.334	.393	1.467	3.73**
		2 Girls	8.8	2.632	0.208			
3.	English	1 Boys	2.36	1.582	0.154	.186	.388	2.08*
		2 Girls	2.75	1.318	0.104			
4.	Maths	1 Boys	0.69	1.163	0.113	.171	106	6.24*
		2 Girls	1.75	1.61	0.127			
5.	Social Science	1 Boys	6.75	3.671	0.358	.424	.648	1.53
		2 Girls	7.4	2.869	0.227			
6.	Science	1 Boys	6.04	4.057	0.396	.485	1.36	2.81**
		2 Girls	7.4	3.547	0.28			
7.	Subject Total	1 Boys	28.64	12.124	1.183	1.44	5.524	3.82**
		2 Girls	34.16	10.485	0.829			
8.	Intelligence	1 Boys	6.88	2.934	0.286	.364	1.01	2.78**
		2 Girls	7.89	2.833	0.224			
9.	Achievement Motivation	1 Boys	34.49	3.297	0.322	.401	.442	1.10
		2 Girls	34.04	3.029	0.239			
10.	Reasoning	1 Boys	2.9	1.278	0.125	.152	0.26	.175
		2 Girls	2.87	1.094	0.086			
11.	Numerical Ability	1 Boys	2.5	1.429	0.139	.219	1.14	5.24**
		2 Girls	3.65	2.132	0.169			

12.	Scientific Information	1 Boys	0.64	0.761	0.074	.102	.093	.911
		2 Girls	0.73	0.888	0.07			
13.	Scientific Vocabulary	1 Boys	3.61	1.458	0.142	.183	.697	3.80**
		2 Girls	2.91	1.464	0.116			
14.	Aptitude Total	1 Boys	16.52	4.744	0.463	.621	1.526	2.46*
		2 Girls	18.05	5.23	0.413			
15.	Total Number of family members	1 Boys	5.27	1.625	0.159	.192	.077	.401
		2 Girls	5.34	1.378	0.109			
16.	Language Total	1 Boys	17.18	5.839	0.57	.715	.312	.437
		2 Girls	16.87	5.459	0.432			

### Academics: Learning Outcomes

**Languages:** In all the three languages of Punjabi, Hindi, and English, the girls scored higher than the boys. The differences in the Mean score were statistically significant at .01 level in case of Hindi, and at .05 level in case of Punjabi and English. The Means of boys and girls in the Punjabi language was 5.47, and 6.06. In Hindi the mean scores were 7.33, and 8.8; and in English, the Means were 2.36, and 2.75 in respective order.

**Maths and Science:** In both these subjects the girls performed better than their counterparts (boys) as revealed by the significant t-ratio at .01 level. The Means in Maths were 0.69, and 1.75; and in Science, the means were 6.04, and 7.4 in respect of the boys and the girls. In **Social Science** also, the mean of the girls was 7.4, and that of boys it was 6.75. But the difference in performance was not significant.

**On Aggregate (Total Score):** On all the subjects, the girls scored higher than the boys. The difference in favour of the girls was significant at .01 level indicated by the t-ratios as the scores were 34.16 and 28.64 in case of girls and boys respectively.

**The results reject the hypothesis of no difference in the academic achievement of the boys and the girls in Government Schools.**

**Comparison of Boys (105) and Girls (160) on Academic Achievement and Psychological Variables in the Government Schools**

#### Hypothesis:

- i) There are no differences in academic achievement of the boys and the girls.
- ii) There is no difference in boys and girls due to intelligence; achievement motivation, aptitude in Maths and Science.

### Academics: Learning Outcomes

**Languages:** In all the three languages of Punjabi, Hindi, and English, the girls scored higher than the boys. The differences in the Mean score were statistically significant at .01 level in case of Hindi, and at .05 level in case of Punjabi and English. The Means of boys and girls in the Punjabi language was 5.47, and 6.06. In Hindi the mean scores were 7.33, and 8.8; and in English, the Means were 2.36, and 2.75 in respective order.

**Maths and Science:** In both these subjects the girls performed better than their counterparts (boys) as revealed by the significant t-ratio at .01 level. The Means in Maths were 0.69, and 1.75; and in Science, the means were 6.04, and 7.4 in respect of the boys and the girls. In **Social**

**Science** also the Mean of the girls was 7.4, and that of boys it was 6.75. But the difference in performance was not significant.

**On Aggregate (Total Score):** On all the subjects, the girls scored higher than the boys. The difference in favour of the girls was significant at .01 level indicated by the t-ratios as the scores were 34.16 and 28.64 in case of girls and boys respectively.

**The results reject the hypothesis of no difference in the academic achievement of the boys and the girls in Government Schools.**

#### Psychological Variables

**Intelligence, and Achievement Motivation:** In these two variables also the girls scored higher than the boys on Intelligence and Achievement Motivation, although the t-ratio was significant at 0.01 level in case of Intelligence only. The scores on intelligence were 6.88 and 7.89 and in Achievement motivation, the scores were 34.49 and 34.04 in case of boys and girls respectively. *The null hypothesis of no gender differences was confirmed in case of intelligence but not in case of achievement motivation.*

*Significant difference between male and female students were also not found by Tamilselevi and Devi (2017) on achievement motivation.*

**Numerical Ability, Scientific Vocabulary and Total Aptitude Score:** The girls excelled over the boys in all the three variables. The differences were significant at .01 level. The Means of the boys and girls were 2.5 and 3.65; 3.61 and 2.91; 16.52 and 18.05 in case of Numerical Ability, Scientific Vocabulary and Total aptitude for boys and girls respectively.

The differences between the boys and the girls were not found significant in Reasoning and Scientific information but the differences were significant in Numerical ability and Scientific vocabulary. **So, the hypothesis of no differences between boys and girls in Aptitude in Science and Maths of Government School students got partial support only.**

*Manickavasagan (2018) and Kalaivani (2018) also found gender differences in favour of girls on Scientific Aptitude.*

**Scientific Vocabulary:** This was the only variable in which boys scored significantly higher than the girls as the Mean of the boys was 3.61 and that of girls it was 2.91.

**Table 3**

**Comparison of Boys (141) and Girls (168) on Academic Achievement and Psychological Variables in Private Schools**

Sr. No.	Subject	c2 Gender	Mean	Std. Deviation	Std. Error Mean	SE <sub>D</sub>	M <sub>1</sub> -M <sub>2</sub>	t-ratio
1.	Punjabi	1 Boys	7.58	1.564	0.132	.194	.492	2.53*
		2 Girls	7.09	1.853	0.143			
2.	Hindi	1 Boys	9.93	2.546	0.214	.305	.739	2.42*
		2 Girls	9.19	2.813	0.217			
3.	English	1 Boys	4.74	1.654	0.139	.198	.578	2.92**
		2 Girls	4.17	1.82	0.14			
4.	Maths	1 Boys	1.85	1.414	0.119	.179	.113	.632
		2 Girls	1.96	1.733	0.134			
5.	Social Science	1 Boys	7.7	2.549	0.215	.327	.363	1.11
		2 Girls	7.34	3.2	0.247			
6.	Science	1 Boys	6.17	3.406	0.287	.385	.093	.241

		2 Girls	6.08	3.328	0.257			
7.	Subject Total	1 Boys	37.98	8.862	0.746	1.133	2.15	1.89
		2 Girls	35.83	11.045	0.852			
8.	Intelligence	1 Boys	9.06	2.592	0.218	.298	.201	.673
		2 Girls	8.86	2.638	0.203			
9.	Achievement Motivation score	1 Boys	34.45	3.583	0.302	.393	1.17	2.99**
		2 Girls	35.63	3.268	0.252			
10.	Reasoning Ability	1 Boys	3.16	1.35	0.114	.154	.235	1.52
		2 Girls	2.93	1.347	0.104			
11.	Numerical Ability	1 Boys	3.21	1.558	0.131	.184	.326	1.77
		2 Girls	2.89	1.676	0.129			
12.	Scientific Information	1 Boys	1.15	0.985	0.083	.107	1.07	1.00
		2 Girls	1.04	0.878	0.068			
13.	Scientific Vocabulary	1 Boys	4.02	2.079	0.175	.218	.271	1.24
		2 Girls	3.75	1.694	0.131			
14.	Aptitude Total	1 Boys	20.61	5.096	0.429	.564	1.14	2.02*
		2 Girls	19.47	4.745	0.366			
15.	Total Number of family members	1 Boys	4.45	1.045	0.088	.127	.278	2.19
		2 Girls	4.73	1.181	0.091			
16.	Language Total	1 Boys	19.99	4.897	0.412	.555	1.79	3.24**
		2 Girls	21.79	4.807	0.371			

### Correlation between the Parents' Educational Qualification and Academic Achievement of the Students

In addition to the correlation between achievement and independent variables, an attempt was also made to establish the relationship between parents' qualification and occupation with the achievement of their wards. The coefficient of **correlation between the mother's qualification and the achievement** of the students was found to be:  $r = .209$ , significant at .01 level and the correlation between **Father's qualification and students' achievement** was  $r = .140$ , at .01 level of significance in case of Government Schools only.

- **The relationship between Parents' Qualification and Achievements' Motivation of the students** was **not found** to be significant in any of the samples of Government and Private School students.
- The results of the present study reveal that Parents' Educational qualification contributes a lot for the academic output of their wards *which is confirmed by the research studies of Khan et al (2015); Shoukat et al (2013); Baker et al 2017; Kundu (2019); and Selvam (2013); Oginni (2018)*. Non-significant relationship between Parents' education and students' motivation was not confirmed by the research studies

**In the sample of Class V** boys and girls, the significant differences were observed **in favour of the girls** in all the three languages and Maths. The overall score of the girls was higher in comparison to that of the boys, **thus refuting the hypothesis of no difference in the academic achievement of the boys and the girls**. **In Class VIII**, significant differences were found only in Maths and Science **in favour of the girls**, though the score of the boys was higher in Punjabi

and English but **the differences were not significant**. In order to seek the cooperation of the parents to enhance learning competencies of their wards, to create awareness among the parents regarding the importance of education in general, and more so for their wards what is required is to involve:

- Social media to connect with the parents.
- Make use of NSS teachers and student volunteers to organize awareness camps for the parents in villages, suburbs and urban slums.

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