The Relationship between Student-Teacher Ratio and Academic Achievements at Secondary Level in the Subject of Physics

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Abstract
The research study was conducted to explore the relationship between the student teacher ratio and academic achievements at the secondary level in the subject of physics. The study was experimental research by nature so pre-test, post-test control group design was adopted and the sample of 127 students of 10th grade from Govt. High School Warburton out of the population of 287 students was divided into control and experimental groups with 40 students (control group) and 87 students (experimental group). Units (1-5) from the physics book 10th grade published by Punjab Text Book Board Punjab were selected as contents of study and two achievements tests (Pre & Post) in Physics were developed having 20 multiple choice items. The validity of the instruments was assured by the expert opinions of three experts and the reliability of the instruments was assured using test-retest techniques having 0.837 Pearson's product moment. Pre and post tests were administered to the Experimental and Control groups by the researcher along with the two other teachers and data was collected. The data collected were tabulated, mean score and standard deviation statistics were used to explore the answers of the research questions while the t- test statistics were employed to test the hypothesis for the analysis and interpretation of data. It was concluded from the analysis and interpretation of data that there exists an inverse relationship between academic achievements and student teacher ratio and was recommended that Government may ensure the implementation of the law of student teacher ratio at the secondary level.
Key Words: Student- teacher ratio, Academic achievements, Secondary level, Physics

Introduction

Teachers are the fundamental components of any educational system of any country as they are responsible for the quality of education, for this, they play their vital, impressive and decisive role for the improvement of the quality of education. A child has the right of moral principle; matter of self-interest and to have a good quality of education constitutionally. A nation depends upon its educational system as education is needed to be reinforced throughout the life for a competitive workforce and effective citizenship (Hettleman, 2007). Education affects human life positively, and the attainment level of education helps the people of a nation to earn recognition and self-respect.

The Government of Pakistan developed National Professional Standards for Teachers for its educational reforms agenda with the financial support of USAID. The intention was the improvement of the quality of teachers and the quality of education for students. The National Professional Standards for Teachers (2009) include Proficient knowledge of subject, development & growth of HR, knowledge, and skills of Islamic ethical values and social life, teaching strategies and Planning, the environment of learning, use of ICT, Cooperation and organization, CPD and code of conduct.

Government of the Punjab (2016) viewed that the ministry of School Education Department formulated and implemented approximately six Recruitment Policies for school Educators during the last ten years (2005-2016) having the these main and common features / objectives: The availability of teachers in every school, Provision of better qualified Educators in public schools, Increase of enrolment in public schools, Elimination of the teacher absenteeism, Recruitment of best talented teachers with relevant qualification on merit, Improvement of quality of education in public level schools, guarantee of an internationally competitive quality education,

supply of subject teachers, re-allocation of vacant posts, appointments of subject specific teachers, Satisfying vacancy positions in all public schools, Decreasing overloading and multi-grade teaching public schools, Surety of high quality teaching and learning, Improvement of leadership and liability at all levels.

Student teacher ratio is a tool used for measuring the quality of education of any educational system. It significantly plays its prominent role for the measurement of quality in education because a competent teacher will not be able to focus his / her considerable attention to students in the class having a high number of students (Nkinyangi, 2003; Katunzi & Ndalichako, 2004, Muijs and Reynolds, 2003). Student teacher ratio is responsible for the achievement of better performance and major objectives of any educational system. It is considered that better academic performance and results are achieved through lower student teacher ratio than those of higher student teacher ratio

The student teacher ratio represents an estimation of personal attention provided from the teachers to students. National Center for Education Statistics pointed that the academic performance of students can be enhanced in the result of low student teacher ratio and it improves the test scores of a student and grant permanent academic benefits. Student teacher ratio means the number of students admitted to an institution in a particular academic programme divided by the number of working teachers in that system (Blatchford, 2011).Student teacher ratio is one of the important indicators of quality of education. Reduction of very large class sizes helps teachers to make their performance better and pupils to learn more and more (UNESCO, 2009).

Bayo (2005) opined that low student teacher ratio is beneficial for all students because of personal attention from the concerned teachers, but weak students are of the more advantage in the schools at the secondary level. Finn (2003) presented the results that the students academically and socially remained to engage in the classes having a low number of students that result the improvement of their academic achievements. Lindahl (2005) found the significant effects of low student teacher ratio on the academic achievements of the students. The study examined the effect of student teacher ratio in natural variation by using longitudinal approach. In the developing countries, the teaching and learning process is substandard, and this is the key and real issue. The teaching and learning process can be made better by increasing the capacity of teachers for the identification of ways for students for their success (Benbow, Mizrachi, Oliver & Said-Moshiro (2007). Ayodo (2015) concluded that low student teacher ratio was one of the factors that enhanced the academic performance of the students in secondary schools.

In most developing countries, student teacher ratio is in a stressful condition. UNESCO (2006) projected that more than 84% of classrooms had more than forty students per teacher.
An important indicator of quality education is student teacher ratio is an important indicator of the quality of education, and low student teacher ratio helps teachers to perform better and students to learn more (UNESCO, 2009).High student teacher ratio is the cause of low quality education in many developing countries. According to Benbow et al. (2007), forty students per teacher (40:1) are considered an ideal and the best student teacher ratio for the effective teaching learning process. Alderman (2001) concluded that higher student-teacher ratio negatively affected the performance and achievements of the student in language skills. Robert Kennedy (2015) discussed the student teacher ratio as it is beneficial for the students and teachers and it helps the students and teachers to make the teaching and learning more and more effective.

In, India, our neighboring and developing country, the Act of the Right of Children to Free and Compulsory Education suggests a student teacher ratio of forty students per teacher (40:1) for one to five (1-5)grades, and thirty five students per teacher(35:1) for six to eight(6-8) grades while in Finland, the Ministry for Education and Culture suggested twenty to twenty five(20-25)students per teacher for grades 1 – 6; the student teacher ratio is twenty five (25)students per teacher maximum in Serbia. The Republic of Korea aims to bring its

student teacher ratio down to the OECD average by 2020, and in Qatar, the goal is to reach a student teacher ratio of 13 to 15 students per teacher (UNESCO, 2009).

According to Idowu and Oluwole (2014), academic achievement is the knowledge and skills gained by a student as measured through formal examination. Academic achievement of students is a yardstick for testing the educational quality of a nation (Nwokocha and Anadike, 2014). Huebler (2008) was of the point of view that the quality of education suffers in the classroom with high student teacher ratio as teachers find it difficult to meet the needs of each student, and it is also difficult for the students to follow the subject and understand its contents. The academic achievements of the students in both the internal and external examinations had been used to determine excellence in teachers and teaching (Ajao, 2001).

Physics is the branch of science concerned with the nature and properties of matter and energy. The subject matter of physics includes mechanics, heat, light and other radiation, sound, electricity, magnetism, and the structure of atoms. Physics is basic for understanding the complexities of modern technology and essential for technological advancement of a nation. According to Rudolph, J.L. (2002), Physics teaching learning provides more possibilities of involving children in such activities as are liked by the students. Physics, which has been found to be the bedrock of scientific and technological development worldwide in both developed and developed countries alike, has some features which are generally accepted and believed to widen the knowledge and increase the horizon of understanding of physics by the learners (Sunday A. Adeyemo, 2010).

Statement of the Problem

The statement of the problem was "The Relationship between Student-Teacher Ratio and Academic Achievements at Secondary Level in the Subject of Physics."

Objectives of the Study

The present research study intended to achieve the following objectives:

1. To examine the extent of the difference in the pretest mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio.

2. To ascertain the difference in the post test mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio.

3. To establish a relationship between student-teacher ratio and academic achievements at the secondary level in the subject of physics.

Research Questions

1. To what extent does the difference in the pretest mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio?

2. To what extent the post test mean achievements scores of students in classes with high student teacher ratio differ from those in classes with low student teacher ratio?

3. What is the relationship between student teacher ratio and academic achievements at the secondary level in the subject of physics?

Hypotheses

The following hypotheses were formulated to conduct the present research study:

1. There is no significant difference in the pretest mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio (H_{o1})

2. There is no significant difference in the post test mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio (H_{o2})

3. There is no significant relationship between student-teacher ratio and academic achievements at the secondary level in the subject of physics (H_{o3})

Delimitations of the Study

The study was delimited to:

- District Nankana Sahib
- Government Boys High school Warburton (city)
- Only the students of 10th grade

Research Methodology

Research Design

The research study was experimental by nature so pre-test, post-test control group design was adopted to conduct the research study. The study considered a class with high student teacher ratio as the experimental group while the one with low student teacher ratio constituted the control group.

Population

All the students (Two hundred and Eighty Seven 287) of 10th class (Science Group) enrolled in the subject of Physics as an elective subject from Government High School, Warburton (city), District Nankana Sahib (Punjab), Pakistan were the population of this research study.

Sample

The sample of this research study was eighty seven (87) students of one class with high student teacher ratio (Experimental Group) and Forty (40) students of one other class with low student teacher ratio (Control Group). Purposive and convenient sample techniques were employed to select the sample. A total of one hundred and twenty seven (127) students constituted the sample.

Contents of the Study

Units (1-5) named as Simple Harmonic motion and waves(unit#1),Sound(Unit#2),Geometrical Optics(Unit#3), Electro statistics(Unit#4) and Current Electricity(Unit#5)from the book of physics grade 10 published by Punjab Text Book Board Punjab were selected as contents of study to conduct this research study.

Instrumentation

The researcher developed two achievements tests (Pre & Post) having two sections. Section I contained students personal information such as class and name of the school while section II had twenty (20) multiple choice items from the units (1-5) of the book of physics 10th grade. Only four (04) items from each unit were included in both tests keeping in view that they covered all the levels (knowledge, understanding, application, analysis, and synthesis). Each item has four options (a, b, c &d) where the respondents were expected to pick the right option. The achievements tests were also translated into national language (Urdu) for the students so that they don't feel any trouble to answer the statements/ items.

Validity and Reliability of Instruments

Content and face validity technique was used to assess the validity of the research instruments. In this study, the expert opinions from three experts (Two in physics and one in measurement & evaluation) regarding the field were obtained, and the validity of the instrument was assured that all aspects of the research problem were captured in the achievement tests. A test-retest reliability technique was used to determine the reliability of the research instrument. The achievements tests were first personally administered to ten students of 10th class (science group) from the population not included in the sample for pilot testing. The achievements tests were personally administered, the data was collected, and scores were recorded. After two weeks, the same questionnaires were again administered personally to the same respondents, and the scores were recorded again. Pearson's product moment formula was used to calculate the coefficient of correlation between the first and second scores. The calculated Pearson's product moment was 0.837, and the reliability of the instruments was thus assured. After being assured of the reliability of the instrument, achievements tests were administered.

Data Collection

A structured achievements test in physics (Pre-test) was administered to the students of both the groups (Experimental and Control) at the same time by the researcher along with the two other teachers before the start of the experiment and data was collected. The selected units were taught by the same physics teacher in different periods and the time for teaching was forty (40) minutes per day to each group. The units described above were taught to both groups for the time of ten weeks. A post test was administered to the students of both the groups (Experimental and Control) at the same time by the researcher along with the two other teachers and data was collected. Students were guided by the researcher as for how to response the achievements tests while administering the instruments in both pre and posttests.

Analysis and Interpretation of Data

The data collected were tabulated, mean score and standard deviation statistics were used to explore the answers of the research questions while the t- test statistics were employed to test the hypothesis having table value 1.645 at the level of significance 0.05 with a degree of freedom 125for the analysis and interpretation of data. The values of t-test mean and standard deviations were calculated using SPSS (special package for social sciences) software updated version.

Research Question#1

To what extent does the difference in the pretest mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio?

Table No.1: Analysis of pre-test mean achievements scores

Groups	N	Mean	Std. Dev.
Control(low student teacher ratio)	40	11.30	2.65
Experimental(High student teacher ratio)	87	8.64	4.21

Table No.1reveals that the mean score of the academic achievements of the control group is11.30 that is higher than the mean score of the academic achievements of the experimental group (8.64) which results that academic achievements are higher in the class with low student teacher ratio while academic achievements is lower in the class with high student teacher ratio. The standard deviation value of the pre-test mean achievements scores for the control group (low student teacher ratio) is 2.65 and the standard deviation value of the pre-test mean achievements scores for the experimental group (High student teacher ratio) is 4.21 which concludes that academic achievements are higher in the class with low student teacher ratio while academic achievements is

lower in the class with high student teacher ratio. The result is that academic achievements are inversely related to the student teacher ratio.

Research Question#2

To what extent the posttest mean achievements scores of students in classes with high student teacher ratio differ from those in classes with low student teacher ratio?

Table No.2: Analysis of post-test mean achievements scores

Groups	N	Mean	Std. Dev.
Control(low student teacher ratio)	40	13.35	2.79
Experimental(High student teacher ratio)	87	6.91	3.50

It is clear from the table No.2 that the mean score of the academic achievements of the control group is higher than the experimental group. The standard deviation of the experimental group is higher than that of the control group. It is concluded that academic achievements are higher in the class with low student teacher ratio while academic achievements are lower in the class with high student teacher ratio.

Research Question#3

What is the relationship between student teacher ratio and academic achievements at the secondary level in the subject of physics?

Table No.3: Analysis of the relationship between student teacher ratio and academic achievements

Groups	Tests	N	Mean	Std. Dev.
Control(low student teacher ratio)	Pre test	40	11.30	2.65
	Post test	40	13.35	2.79
Experimental(High student teacher ratio)	Pre test	87	8.64	4.21
	Post test	87	6.91	3.50

Table No.3 shows that the mean scores of the academic achievements of the control group increase in the post test while the mean score of the academic achievements of the experimental decreases in the post test. It means that the academic achievements of the students is higher in the class with low student teacher ratio and the academic achievements of the students is lower in the class with high student teacher ratio which concludes that academic achievements of the students at the secondary level in the subject of Physics are inversely related with the student teacher ratio, means lower is the student teacher ratio, higher will be the academic achievements and higher is the student teacher ratio, lower will be the academic achievements at secondary level in the subject of Physics.

Hypothesis Testing

The collected data was tabulated; t- test statistics were employed to test the hypothesis having table value 1.645 at the level of significance 0.05 with a degree of freedom 125 for the analysis and interpretation of data. The values for t-test were calculated using SPSS (special package for social sciences) software updated version.

Hypothesis 1 (H01)

There is no significant difference in the pretest mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio (H01).

Table No.4 Summary of the t-test statistics for pre test

Groups	N	Mean	Std. Dev	Df	t-cal	t-value	α	Decision
Control(low student teacher ratio)	40	11.30	2.65	125	3.48	1.645	0.05	H0 rejected
Experimental(High student teacher ratio)	87	8.64	4.21					

Table No.4 makes it clear that the value of t-calculated 3.48 is higher than the table value 1.645 at the significance level 0.05 that results that null hypotheses are rejected. It is concluded that there is a significant difference in the pretest mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio while the difference in the mean and standard deviation values make it clear that an inverse relationship exists between student teacher ratio and academic achievements of the students at the secondary level in the subject of Physics.

Hypothesis 2 (H02)

There is no significant difference in the post test mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio (Ho2).

Table No.5 Summary of the t-test statistics for post test

Groups	N	Mean	Std. Dev	Df	t-cal	t-value	α	Decision
Control(low student teacher ratio)	40	13.35	3.79	125	4.02	1.645	0.05	H0 rejected
Experimental(High student teacher ratio)	87	6.91	3.50					

Table No.5 shows that the value of t-calculated 4.02 is higher than the table value 1.645 at the significance level 0.05 that results that null hypotheses are rejected. It is concluded that there is a significant difference in the post test mean achievements scores of students in classes with high student- teacher ratio and those with a low student teacher ratio

Hypothesis 3 (H03)

There is no significant relationship between student-teacher ratio and academic achievements at the secondary level in the subject of physics (Ho3).

Table No.6: Summary of the t-test statistics for pre-test and post-test to ascertain the relationship between student teacher ratio and academic achievements

Groups	Tests	N	Mean	Std. Dev.	Df	t-cal	t-value	α	Decision
Control(low student teacher ratio)	Pre test	40	11.30	2.65	78	3.21	1.645	0.05	H0 rejected
	Post test	40	13.35	2.79					
Experimental(High student teacher ratio)	Pre test	87	8.64	4.21	172	0.003	1.645	0.05	H0 accepted
	Post test	87	6.91	3.50					

It is represented from the table No.6 that t-calculated is 3.21 which is higher than the table value 1.645 for the control group while t-calculated is lower than table value, so null hypothesis is rejected for the control group and is accepted for the experimental group which results that there is a significant relationship between student-teacher ratio and academic achievements. It is concluded from the analysis of data that there exists an inverse relationship between the academic achievements of the students and student teacher ratio. Lower is the student teacher ratio; higher will be the academic achievements and vice versa.

Conclusions and Discussions

The answer of the research question one was that the mean score of the academic achievements of the control group is11.30 that is higher than the mean score of the academic achievements of the experimental group (8.64) which results that academic achievements are higher in the class with low student teacher ratio while academic achievements is lower in the class with high student teacher ratio. This result collaborates with the findings of the research studies of Bayo (2005) and Ayodo (2015). It was concluded from the analysis and interpretation of data that academic achievements are higher in the class with low student teacher ratio while academic achievements are lower in the class with high student teacher ratio, this result was favored and accepted by Finn (2003). Table No.3 showed that the mean scores of the academic achievements of the control group increase in the post test while the mean score of the academic achievements of the experimental decreases in the post test. It means that academic achievements of the students are higher in the class with low student teacher ratio and academic achievements of the students are lower in the class with high student teacher ratio which concludes that academic achievements are inversely related with the student teacher ratio. Alderman (2001) supported this result that that academic achievement is negatively related with the student teacher ratio. It was concluded that there is a significant difference in the pretest mean achievements scores of students in classes with high student-teacher ratio and those with low student teacher ratio which was also acknowledged by Lindahl (2005). Furthermore, it was concluded that there is a significant difference in the post test mean achievements scores of students in classes with high student- teacher ratio and those with low student teacher ratio. It is concluded from the analysis of data that there exists an inverse relationship between the academic achievements of the students and student teacher ratio. Lower is the student teacher ratio; higher will be the academic achievements and vice versa.

Recommendations

The researcher, after the analysis and interpretation of data, recommended the following recommendations:

1. The government may ensure the implementation of the law of student teacher ratio at the secondary level.
2. The government may provide infrastructures and instructional material for the accommodation of growing enrollment of the students in high schools.
3. The government may increase the supply of teachers to lower down the student teacher ratio in the classes
4. Administrative authorities of the schools may take strict actions to control high student teacher ratio in classes.

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