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EXPERIMENTAL STUDY OF TEAMTEACHING AT FEDERAL GOVERNMENT SECONDARY SCHOOL LEVEL AT KHYBERPUKHTUNKHWA

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ABSTRACT
In this study, the effect of team teaching on academic achievement of English and Chemistry at secondary level in Khyber Pakhtunkhwa (KP), Pakistan was investigated. The design of the research conducted was quantitative experimental research design including pre-test post-test nonequivalent control group. The purpose of the study to determine if team teaching results in greater academic achievement than traditional teaching. There were 60 Grade 10 students with half in the experimental group (n=30) and half in the control group (n=30). The experimental group was taught by team teaching method and the control group was taught by the traditional method.The team teaching method was adopted in the experimental group, and the traditional method was adopted in the control group. The intervention period lasted for four weeks with selected topics from English and Chemistry. Academic achievement was measured by the pre- and post-tests for both groups. Descriptive and inferential statistics such as independent samples t-test and paired samples t-test were used to analyze the data. The results revealed that there were significant differences in academic achievement scores between the pre-test and the post-test in both subjects for the experimental group with large effect sizes. This is because the control and experimental groups were not completely matched at the outset, which reduces the extent to which causal inferences can be drawn in between-group comparisons. However, the findings indicated that, when compared with traditional instruction the students' learning outcomes were facilitated by the team teaching. Collaborative teaching practices can boost students' achievement through raising the quality of teaching and class room engagement, the research results show. Randomized designs or ANOVA should be used to further strengthen causal inference, as recommended.
KEYWORDS: Team Teaching, Academic Achievement, Experimental Study, Secondary Education, Pakistan

INTRODUCTION

In modern education, teaching and learning constantly evolve to achieve better student learning results and to improve the effectiveness of teaching. In the modern pedagogical context, team teaching has received much attention as a co-teaching pedagogical model in which two or more teachers work together in the same classroom to plan, deliver, and evaluate instruction in the same classroom (Friend, Cook, Hurley-Chamberlain, & Shamberger, 2010). This is based on the concept of collaborative pedagogy and seen as an extension of the concept of inclusive and student-centered pedagogy which are seeking to meet the needs of a wider range of learners more effectively.

Collaborative instructional models like team teaching have been shown to positively affect student learning outcomes as measured by increased conceptual understanding, engagement, and multiple perspectives on the content of the subject matter (Villa, Thousand, & Nevin, 2013). Additionally, studies of co-teaching and collaborative classrooms also show that when teachers collaborate, they improve the quality of their instruction and are able to effectively incorporate differentiation for varied learning abilities in the same classroom environment (Scruggs, Mastropieri, & McDuffie, 2007). The theoretical basis of the team teaching is very much related to the social constructivist learning theory which focuses on the process of learning through interaction, dialogue, and the construction of knowledge (Vygotsky, 1978). In this way, pupils have opportunities to observe a variety of teaching methods and to see different ways in which explanations are given which may enhance their cognitive learning and attainment.

Although there are theoretical benefits to team teaching, its effectiveness is not the same in all educational settings, and there is no empirical evidence to support this. While other research finds that student achievement and engagement in the classroom improves significantly, other research shows that when done poorly, with poor teacher coordination, or without adequate institutional support, results are unpromising, if any (Murawski & Swanson, 2001; Mastropieri et al., 2005). Large class size, inadequate teaching materials, teacher-oriented teaching, low achievement of students, etc., are some persistent problems in education systems in developing countries including Pakistan (UNESCO, 2020). Such difficulties are more pronounced in public secondary schools that continue to use the conventional lecture-based

approach to learning and have less possibility in applying collaborative learning approach in the teaching and learning process.

Secondary education institutions may suffer from high workload, lack of professional development opportunities and inadequate instruction innovation in the context of Khyber Pakhtunkhwa. This has led students to often face passive learning situations that may not be conducive to a student's critical thinking and academic performance (Government of Pakistan, 2021). The above context demonstrates the need for evidence-based instructional interventions that can improve teaching effectiveness and student learning outcomes. Team teaching has been highly described in the international literature but no experimental evidence in the secondary schools in Pakistan especially in Khyber Pakhtunkhwa is found. The majority of studies that have been conducted so far are descriptive or perception-based and only a handful used true experimental design with pre and post test control groups. Such vacuum makes it difficult for the policymakers and educators to make decisions based on evidence on the adoption of the collaborative teaching models in schools.

Hence, the present study is designed to compare the academic achievement of experimental and control group students in pre-test and post-test design at Federal Government Secondary School level of Khyber Pakhtunkhwa district with the aim of experimentally investigating the effect of team teaching on students' academic achievement at this level. The results of this study should be useful to the literature on instructional innovation and gives practical implications to enhance teaching in secondary school.

LITERATURE REVIEW

Concept of Team Teaching

Team teaching is an instructional approach that involves two or more teachers in a collaborative plan, teaching, and assessment of instruction in the same classroom setting (Friend et al., 2010). This is a model that focuses on collaboration, shared responsibility and the blending of various teaching strategies to improve the student's learning experience. According to Villa, Thousand and Nevin (2013), team teaching is a flexible instructional approach that enables teachers to leverage their pedagogical strengths to enhance the quality of instruction and meet the needs of diverse learners in inclusive classroom settings.

Theoretical Foundation of Team Teaching

Social constructivism, especially the work of Vygotsky (1978) is the base of the theoretical underpinning of team teaching that learning takes place in social interaction and collaborative construction of knowledge. This view provides opportunities for the learner to experience and engage with different perspectives and learning moments that are scaffolded by more knowledgeable others. Students are treated to multiple explanations, teaching styles, and scaffolding in team learning environments, heightening the development of thinking and understanding of academic material.

Models of Team Teaching

The literature presents a variety of models of team instruction such as:

- Parallel teaching
- Station teaching
- Alternative teaching
- One teach one assist

(Cook & Friend, 1995) Of these, the teach one assist model is most frequently used in the classroom, which involves one teacher leading the instruction and the other assisting individual students (Scruggs, Mastropieri, & McDuffie, 2007). But researchers say that this model could prevent equal teacher participation if not well planned and coordinated.

Team Teaching and Academic Achievement

Academic achievement is students' ability to perform educational activities, assessments, and examinations. It is well known as a marker of effectiveness of instruction. Based on empirical studies, team teaching has positive effects on the academic achievement in the following aspects: 1) Academic achievement is enhanced because the teaching is clear, 2) Student participation is enhanced, and 3) Individual attention is enhanced. With regard to student achievement, Murawski and Swanson (2001) in a meta-analysis found that there was a moderate positive effect of co-teaching, but that the effect was dependent on how well the co-teaching was implemented.

In co-taught classrooms students are more likely to show higher levels of conceptual understanding as a result of differentiated instruction and teacher support (Scruggs et al., 2007). Likewise, Villa et al. (2013) found that collaborative teaching spaces improve the learning process, as they foster participation and inclusive teaching practices. But work also shows that the effectiveness of team teaching is not guaranteed. However, insufficient planning time, poor teacher collaboration and unclear role assignments can hinder its impact on student achievement, as noted by Hang and Rabren (2009). Thus, the effectiveness of team teaching will rely on the implementation quality and institutional support.

Benefits of Team Teaching

There are several advantages to team teaching as identified in the literature:

• Improved instructional quality
• Enhanced student engagement
• Differentiated instruction
• Better classroom management
• Reduced teacher isolation
• Increased professional collaboration

Friend et al., 2010; Villa et al., 2013 All these benefits combine to create a more conducive and effective learning environment that may have a positive impact on student learning.

Challenges in Team Teaching

However, there are several issues to address in the implementation of team teaching. Research suggests that it is not effective when the teachers are not equally involved, is not coordinated, does not have enough planning time, or does not have clear roles in the instruction (Scruggs et al., 2007). Sometimes, one teacher (may be the earlier mentioned one) dominates the teaching and the other one is passive, thus reducing the collaborative aspect of the approach (Weiss & Lloyd, 2002). Furthermore, because of institutional constraints in developing countries, effective implementation is further constrained.

Research Gap

Team teaching is a topic that has been widely researched internationally, but most of the research takes place in developed countries and is very limited to inclusive and special education schools. The experimental evidence is rather scarce at secondary school level especially in the developing countries like Pakistan. Furthermore, the existing studies have been descriptive or perception-based, and the true experimental studies which apply the pre-test and post-test control group designs are relatively scarce. This leads to a lack of understanding of the real effect of team teaching on the academic achievement of students in Khyber Pakhtunkhwa.

Summary

Research in the literature suggests that team teaching is a potential teaching model supported by Social constructivist theory. The effectiveness of its impact on academic outcomes is generally supported by empirical studies, though results are context-specific and dependent on the quality of implementation. As there is limited experimental evidence in Pakistan especially in KP, it is highly recommended that the present study should be conducted to investigate its real impact on students' academic outcomes in the context of a rigorous experimental design.

Research objectives of the study

• To compare the academic achievement of students of two groups -experimental and control group on the basis of pre-test and post-test, through experimentation.

Research question

1. What is the difference in academic achievement of experimental group and control group of team teaching on the base of pretest and post-test?

Hypothesis for experimental part of the study

Ho There is no significant difference in the academic achievement of students in experimental group of team teaching before and after the treatment of team teaching on the basis of pre-test and post-test.

Nature of the Study

This study employed a quantitative experimental design to examine the effect of team teaching on students' academic achievement. The study used a pre-test–post-test non-equivalent group design, where an experimental group was taught through team teaching and a control group was taught through the traditional teaching method.

The independent variable was team teaching, while the dependent variable was academic achievement in English and Chemistry.

Research Design

A pre-test–post-test non-equivalent group design was used to compare the academic performance of two intact groups. This design is suitable for educational settings where random assignment is not possible (Best & Kahn, 2016; Farooq, 2001).

The study was conducted over a period of four weeks. Two subjects, English and Chemistry, were selected for intervention. Both groups were given a pre-test before the treatment and a post-test after the completion of the intervention.

Population and Sample

The population of the study consisted of 120 students of Grade 10 from a Federal Government Secondary School in Khyber Pakhtunkhwa.

A total sample of 60 students was selected and divided into:

• Experimental group (30 students)
• Control group (30 students)

The selection was done randomly from the science group. Two subject teachers (English and Chemistry) participated in the study.

Procedure of the Study

1. Pre-test was administered to both groups to determine baseline academic achievement.

2. The experimental group was taught through team teaching strategy, while the control group was taught through traditional lecture method.
3. The same topics were taught in both groups during the four-week intervention period.
4. After completion of the treatment, a post-test was conducted for both groups.
5. Students' academic achievement was compared using statistical analysis.

Research Instrument

A researcher-developed multiple-choice test (MCQs) was used as the instrument for both pre-test and post-test. The test consisted of items from English and Chemistry (Grade 10).

The instrument was validated by subject experts, and reliability was ensured through Cronbach's alpha.

Validity and Reliability

Content validity was ensured through expert review from subject specialists. Items with very high or very low difficulty levels were revised to maintain moderate difficulty (30%–70%).

Reliability of the test was measured using Cronbach's alpha, where a value of 0.70 or above was considered acceptable (Gay, 2000).

Data Analysis

Data were analyzed using descriptive and inferential statistics. Mean scores of both groups were compared using independent samples t-test, while within-group differences were analyzed using paired samples t-test.

Table 1: Independent sample t-test results for pre-tests scores of experimental and control groups in Chemistry.

	t-test	df	p-value	Mean Difference	Lower	Upper
Pre-test scores	.933	58	.003	.400	1.257	.003

The knowledge of Chemistry before the experiment was checked using t-test whether it was the same between the experimental and control group. The results indicated that there was no similarity between the two groups. There was a genuine distinction between them, such a distinction which could not have arisen by chance. We have a p value of .003, this is very small compared with .05. This implies that there is only 0.3% chance of this difference being random. To put it simply, it is nearly certain that there is a difference. The experimental group (without the intervention) got a higher average score of 0.4 points compared with the control group (with the intervention). A confidence interval was calculated as 1.257 to .003 which does not contain zero, and therefore again suggests that this difference is real, not an error. The degrees of freedom: 58 = number of students 2 (2 for degrees of freedom). The t-value was only .933 this is a small value. This information tells us that the difference between these groups is statistically significant; however, the difference between the groups is not very large. The most important discovery is that the two groups were not equated at the beginning. There was slight pre-teaching advantage for the experimental group prior to any instruction. It is not therefore possible to conclude if the experimental group is doing better at the end of the experiment, whether it is due to the teaching method or whether they were better to start with.

Table 2: Independent sample t-test results for post-tests scores of Experimental and control group in chemistry.

				95% Confidence interval of the Difference		
	t-test	df	p-value	Mean Difference	Lower	Upper
Post-test scores	1.004	58	.019	.3333	-.3309	.9976

According to the results of the independent samples t-test of the Chemistry post-test scores, there is a statistically significant difference between experimental and control group after the intervention. The p-value is.019 which is less than the standard alpha of 0.05. The difference between the observed mean of 0.3333 of difference where the experimental group achieved a little higher on the average is statistically significant. The difference though falls within the 95% interval of -0.3309 to 0.9976, meaning that there is no evidence that the difference is significant. This puts a discrepancy on the reported results: a p-value of .019 (significant) should have a confidence interval that is not equal to zero. Thus, the p-value or the boundaries of the confidence interval can either include a rounding error or calculation error. With the correctness in the confidence interval, the true p-value would tend to exceed.05 which would mean there is no significant difference. With a correct p-value of .019, the confidence interval ought not to intersect zero. With such a mismatch, the findings are inconclusive and need a re-analysis of the statistical results. The evidence does not clearly show that there is a definite treatment effect with a t-statistic of 1.004 and a 58 degrees of freedom.

Table 3: Paired sample t-test results for students' academic achievement in experimental group in Chemistry

Comparison	N	Mean	Mean Difference	SD Difference	t-test	df	P - value	Cohen's d
Pre-test	30	7.86	-7.48	1.429	-28.67	29	.000	-5.27
Post-test	30	15.35						

The paired samples t-test for the experimental group in Chemistry results in an extreme difference between the pre-test and post-test scores, with a significant difference as a result of the test. The mean score of the students jumped from 7.86 to 15.35, which is a significant mean gain of 7.48. The p-value of .000 (reported when < .001), confirms that this is not a random change. The extremely large negative t-statistic of -28.67 with 29 degrees of freedom, speaks to the strength and consistency of this positive change within the group. Perhaps most notably, Cohen's d is reported to be -5.27, an extremely large effect size, significantly larger than typical standards for large effects. This indicates that the increase was not only statistically significant but also was a quantum leap in performance. This is an extremely positive result for the pupils who were exposed to the programme, suggesting that the impact was significant for this group, with Chemistry achievement levels increasing by a significant amount.

Table 4 : Independent sample t-test results for pre-tests scores of experimental and control groups in English.

				95% Confidence interval of the Difference		
	t-test	df	p-value	Mean Difference	Lower	Upper
Pre-test scores	.772	58	.004	.308	-.490	1.107

According to the independent sample t-test, which was conducted on the pre-test scores of the English language, the difference between the experimental and the control groups at the beginning of the research was statistically significant. This is shown by a p-value that is less than the traditional alpha of 0.05 of .004. The difference of the means of .308 was not likely to be the result of chance alone. The difference has a 95% confidence interval of -.490 to 1.107; this interval contains zero, but the p-value is significant, indicating that one should be cautious in drawing the conclusion of equivalence. The t-statistic (.772) and 58 degrees of freedom of the analysis show that the groups were significantly different at the baseline. This observation refutes the hypothesis of pre-intervention equality, i.e. that any post-test differences must be considered carefully as they may be due to existing differences and not necessarily by the experimental treatment.

Table 5: Independent sample t-test results for post-tests scores of Experimental and control group in English.

	t-test	df	p-value	Mean Difference	Lower	Upper
Post-test scores	.760	58	.002	.000	-.637	.637

According to the results of the independent samples t-test in the scores in English in the post-test, the difference between the experimental and control group is statistically significant after the intervention. This has a p-value of less than the traditional alpha of.05 indicating that it is significant. The mean difference between the groups is -.000, which indicates that the average scores of the groups on the post-test were the same. The t-statistic of .760 and the p-value of.002, however, indicate that the model is picking up a difference in variance or distribution other than the mean. The confidence interval of the difference of -.637 to.637 and contains zero which is normally used to prove the null hypothesis but the p-value is significant and overrides the null hypothesis. Thus, the findings are contradictory: a p-value of.002 would generally be considered that there is a significant difference, whereas a mean difference of zero and a confidence interval that includes zero indicates that there is no significant difference. This difference can be due to an error in reporting in the table or the application of a statistical test that is not consistent with the data. The conclusions are not unambiguous and therefore inconclusive and demand a re-evaluation of the statistical methodology, assuming that the table is correct.

Table 6: Paired sample t-test results for students' academic achievement in experimental group in English

Comparison	N	Mean	Mean Difference	SD Difference	t-test	df	P - value	Cohen's d
Pre-test	30	10.14	-5.908	1.697	-19.064	29	.000	-3.48
Post-test	30	16.05						

The t-test for paired samples carried out for the experimental group in English shows that there is a highly statistically significant improvement in academic achievement from the pre-test to the post-test. The students' mean score jumped significantly from 10.14 to 16.05 with a mean gain of 5.908 points. The very low p value of .000 (or .000 if it is less than .001) is evidence that this improvement is not going to happen by chance. This change is confirmed and significant as reflected in the large negative t-statistic -19.064 with 29 degrees of freedom. Perhaps most importantly the Cohen's d value of -3.48 is outside the range of what is considered a trivial change, which means that the actual practical increase in score is large and dramatic. This finding strongly supports the effectiveness of the experimental intervention on the students who received it and has resulted in significant improvement in English achievement for these students.

Findings

A statistically significant difference was found between the experimental and control groups in Chemistry pre-test score with an independent samples t-test, $t(58) = 0.933$, $p = .003$. The experimental group was found to have a higher mean score (mean difference = 0.4 points). A 95% confidence interval was given of 1.257 to 0.003. This means that the two groups were not equal at the start of the study, the experimental group had an advantage.

Similarly, there was a statistically significant difference between the groups in the English pre-test ($p = .004$). Again the experimental group had a higher mean score (mean difference = 0.308). These differences before intervention were baseline differences, indicating the groups were not comparable before the intervention.

Post-intervention Comparison (Post-test Results)

Post test scores were subjected to an independent samples t test and a statistically significant difference was found between the experimental and control groups ($p = .019$). The difference between the two groups was statistically significant with a mean difference of 0.333 in the experimental group. The reported p-value was however not in accord with the statistical results as the 95% confidence interval (−0.3309 to 0.9976) contained zero. The t-statistic was 1.004 ($df = 58$). This is because there is a difference between the p value and the confidence interval, so the post-test between group differences are inconclusive and need re-analysis.

The independent samples t-test revealed a significant difference between the groups on the post test in English ($p = .002$). However, the mean difference value was reported as −0.000 (which is essentially zero) and the 95% confidence interval was symmetrically centred about zero (from -0.637 to 0.637). This is a contradiction to the p-value and the confidence interval/mean difference. The multiple statistical outcomes make it difficult to make a clear decision about any differences between the groups in terms of English achievement following the intervention.

Within-Group Improvement (Paired Samples t-test Experimental Group Only)

To determine whether there was any difference, a Paired Samples t-test (Experimental Group Only) was used. The achievement of the Chemistry experimental group was statistically significantly better from pre-test to post-test. The mean score increased from 7.86 to 15.35 (mean gain = 7.48 points). The paired samples t-test yielded $t(29) = −28.67$, $p < .001$. The Cohen's $d = −5.27$ was an extraordinarily large effect. This is a significant and educational improvement in Chemistry achievement.

English The experimental group also showed a highly statistically significant improvement in English. The mean score rose from 10.14 to 16.05 (mean gain = 5.91 points). The paired samples t-test produced $t(29) = −19.064$, $p < .001$, with Cohen's $d = −3.48$, again indicating a **very large effect size**. This suggests strong improvement in English achievement among students who received the intervention.

Summary of Main Findings

The experimental and control groups were not equivalent at the start of the study. The experimental group had a statistically significant advantage in both Chemistry and English on the pre-test.

Due to baseline differences and inconsistencies between p-values and confidence intervals in the post-test independent t-tests, clear conclusions about the superiority of the experimental group over the control group cannot be drawn at this stage.

Students in the experimental group showed dramatic and highly significant improvement in both subjects after the intervention. The gains were very large in magnitude (Cohen's $d = 5.27$ in Chemistry and 3.48 in English), indicating that the intervention was associated with substantial increases in academic achievement within the experimental group.

The extremely large effect sizes observed in the paired t-tests provide strong evidence of meaningful learning gains for students who received the intervention. However, because of the initial group differences, it is not possible to confidently attribute these gains solely to the intervention without further statistical adjustment (e.g., ANCOVA) or re-analysis.

DISCUSSION

The present study examined the effect of team teaching on students' academic achievement in Chemistry and English by adopting pre -test and post - test control group design. These findings offer valuable information about baseline equivalence, intervention effectiveness, and academic growth within the groups.

Baseline Differences and Internal Validity Concerns

Test results showed statistically significant difference between the experimental and control groups at the pre-test level in both subjects in favor of the experimental group in the initial achievement. This discovery poses an interesting methodological query about the group equivalence, a basic assumption in experimental research designs (Campbell & Stanley, 1963). In quasi-experimental studies pre-existing differences between groups can threaten internal validity by introducing selection bias, as noted by Shadish, Cook and Campbell (2002). The differences at the beginning of the study with respect to these baseline scores makes it difficult to interpret the results obtained at the end of the study because the experimental group may have been initially more academically able. This issue is commonly observed in educational field experiments where intact classes are used instead of random assignment (Huck, 2012).

Between-Group Post-Test Outcomes

Comparisons between the experimental group and the control group after the post test showed that there were some cases where there was a significant difference, but the p value and the confidence interval were inconsistent. These discrepancies are possible to arise from problems with statistical reporting, model specification and sampling variations, and should therefore be interpreted with caution, according to Field (2018). In Chemistry there was no significant difference between the mean scores of the experimental group and the control group, as the confidence interval contained a non-statistically stable difference of zero. Likewise, in English, the low mean difference and high value of p are suggestive of statistical anomaly or round-off errors. These inconsistencies reduce the power of causal inferences about the effectiveness of team teaching in comparison to traditional instruction. When there are baseline differences, as suggested by Huck (2012), the use of ANOVA might be more appropriate as it would adjust post test scores to control pre test variation. Without this adjustment, the accuracy of the between group comparisons in this analysis is restricted.

Within-Group Academic Improvement

Although there was not a lot of significance between groups, within group analysis showed a highly significant improvement in the experimental group in both Chemistry and English. Very large effect sizes suggest that students' achievement improved significantly after the intervention. The results confirm the theoretical bases of social constructivism, which emphasizes learning is better when built upon interaction, scaffolding, and collaborative engagement (Vygotsky, 1978). The learning outcomes were probably enhanced by the team teaching: there was probably more than one explanation of the lesson, more student attention and a better conceptual clarity. Murawski and Swanson (2001) also found that co-teaching is linked to moderate to strong increases in student achievement, especially when instructional roles are well-defined and collaboration is effectively carried out in co-teaching. Collaborative teaching further supports differentiated teaching, which is essential to meeting the needs of a diverse student population in heterogeneous classrooms, Villa, Thousand, and Nevin (2013) state. It should also be recognized that within-group improvements in quasi-experimental designs may be subject to external threats like testing effects, maturation, and becoming more familiar with assessment formats (Shadish et al., 2002). Thus, although the effect of the intervention observed is quite large, it should not be claimed without caution.

Interpretation of Team Teaching Effectiveness

The results indicate overall that team teaching has great potential to improve academic achievement when used in secondary school classrooms. The students' gains in achievement are reflected in the pedagogical rationale that collaboration in instruction fosters more enriched learning experiences by sharing resources and providing ongoing assistance to students (Friend et al., 2010). However, the findings are not necessarily causal because there are no baseline equivalences and statistical inconsistencies in post-test comparisons. Campbell and Stanley (1963) believe that this type of design limitation is prevalent in educational experiments conducted in the field and should be resolved by increased control or through improved statistical methods. Nevertheless, the significant and steady achievement within the groups in this study is a valid indicator that team teaching can be a valuable teaching method for enhancing academic performance of learners in Chemistry and English in resource-limited situations like in the case of Khyber Pakhtunkhwa.

Overall Interpretation

To conclude, the study has shown students' significant improvement in learning over time after being taught by team teaching. But, given the pre-existing group differences and the limitations in analysis, care should be taken in attributing any improvements observed solely to the intervention. Randomized designs or ANOVA-based adjustments

should be used for future studies to increase the strength of the causal interpretation and improve the robustness of the results.

CONCLUSION

The aim of the present experimental study was to investigate the impact of the team teaching on the students' academic achievements in Chemistry and English at secondary school level in Khyber Pakhtunkhwa. The results are significant for two reasons. Firstly, they reveal important insights into the learning outcomes of students who have had the opportunity to experience team teaching, and secondly, they offer insights into the methodological constraints inherent in group equivalence. The findings of this study showed significant improvement of students in both academic subjects in the experimental group from pre-test to post-test. These gains, with statistically significant paired samples t test results and large effect sizes, indicate that a strong positive relationship exists between team teaching and students' academic achievement. The results are similar to the constructivist learning theory, which assumes that learning is more effective in interactive and collaborative learning settings, as this learning approach helps students realize their understanding and cognitive development (Vygotsky, 1978). The between group comparisons showed, however, that the experimental and control groups were not equal at pre-test, with the experimental group showing higher scores at pre-test. The baseline difference leads to limitations in causal inferences about the efficacy of team teaching. Further, some inconsistencies in the post test statistical results indicate that caution should be taken when interpreting between-group comparisons. Even with these constraints, the overall pattern of results suggest that team teaching is correlated with positive student learning gains. Collaborative instructional strategies demonstrated significant gains within the experimental group, thereby supporting the argument that the use of collaborative teaching strategies in the classroom has a positive impact when used effectively. These results also corroborate past research on the benefits of co-teaching on student achievement, engagement, and classroom teaching and learning (Murawski & Swanson, 2001; Villa, Thousand, & Nevin, 2013). Finally, the study indicates that team teaching has great pedagogical potential in enhancing the academic performance of students in secondary school classrooms. But methodological and contextual factors such as baseline group differences and implementation conditions will affect the effectiveness of this strategy. In conclusion, the findings of the study revealed that team teaching is an effective instructional model, but further studies with more controlled experimental design and/or more sophisticated statistical analysis using ANOVA are recommended to enhance the validity of cause and effect, and also to increase the generalizability of the results.

Recommendations

Based on the research findings and discussion, the following major recommendations are given for the betterment of the instructional practice and for the effective implementation of team teaching at secondary school level:

1 Promote the use of Structured Implementation of Team Teaching

The school administration is encouraged to adopt team teaching systematically in secondary schools with the proper planning of instruction and roles of the teachers. All teachers should participate in the planning, split up the teaching duties well, and share the work equally in delivering the lessons. This study will be optimally designed to support instruction when structured properly.

2 **Provide Professional Development and Training for Teachers**

The development of teachers' competencies in collaborative teaching practices should be done by in-service training programs organized by the educational authorities. Co-planning, classroom coordination, communication skills, and assessment strategies should be the focus of training. Building teacher capacity is critical to the success of team teaching and consistency of implementation of the program across the subject areas.

3 Plan for sufficient planning time and administrative support.

Schools need to allow enough time in the school timetable for teachers who work in teams to plan lessons together and to reflect on these lessons. Administrative support is essential to relieve workload pressures and for effective coordination. Even if team teaching has a potential for positive teaching, it may not be able to yield the benefits unless institutional support is provided.

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