

Exploring Curriculum Integration: A Comparative Study of Reading and Writing Comprehension through Science Subjects at SSC Level

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ABSTRACT: Developing reading and writing skills is fundamental to academic achievement. The study aimed to explore the influence of integrating the curriculum through the science subject on the comprehension of both reading and writing at the Secondary School Certificate (SSC) level. A quantitative quasi-experimental design involving pretesting and post-testing with a control group was utilized in this research. Fifty students from the 9th grade at Government Girls High Schools in Peshawar (Pakistan) participated in the study, with half randomly assigned to the experimental group and half assigned to the control group. The data were analyzed using descriptive statistics, an independent t-test, and ANCOVA. The experimental group had a higher mean post-test reading ($M = 45.36$, $SD = 2.57$) than the control group ($M = 28.93$, $SD = 10.75$). The results of the t-test revealed a statistically significant difference between the two groups ($p = 0.001$), similar results were observed using ANCOVA to confirm that there were significant differences between teaching methods ($F(1, 47) = 47.68$, $p < 0.001$), with a large effect size; $\eta^2p = 0.499$). Thus, the results of this study support the claim that the integration of the curriculum considerably increases student comprehension of both reading and writing. Consequently, it is recommended that schools and policymakers encourage teachers to use integrated methods of instruction and provide them with the proper resources and training.

KEYWORDS: Curriculum Integration, Reading and Writing Comprehension, Science Education, SSC Level, Academic Achievement

Introduction

In the present day, the global education system has experienced a shift from traditional methods of teaching to an interconnected and student-centered approach. In this approach, subjects are integrated into one lesson as opposed to being taught separately. In order to achieve academic success in high school, students need to have strong abilities in reading comprehension and writing. Both of these skills are assumed by all students at the Secondary School Certificate (SSC) level, where students must be able to interpret and analyze scientific information, as well as demonstrate their understanding of this information through written expression. In addition to their importance in supporting academic success, reading and writing abilities are also essential for developing skills that last a lifetime (Adora et al., 2024).

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One of the characteristics that set science education apart from other subjects is that there are many different ways for students to learn to read and write well because reading and writing in science involve the ability to decode, process and communicate scientific information. Thus, science provides an excellent context to integrate literacy instruction with content instruction (Khan et al., 2023). As an example, the integration of literacy with science education often occurs at the SSC level through the integration of language skills such as reading and writing into science teaching. In this context, students will read many science-related materials (textbooks, trade journals) in order to learn about the various concepts of biology, chemistry, and physics, thereby becoming good readers while simultaneously learning more about science.

Curriculum integration is the practice of linking different subject areas for the purpose of facilitating learning and ensuring better revisions. An example would be the integration of academic literacy with science, as this has been proven to support both the acquisition of content and the communication of that content (Siraj et al., 2025). Integrated literacy deviates from the traditional model of isolated instruction and allows students to apply their literacy skills (that is, reading and writing) in an academic context. Many schools worldwide teach science and language arts separately; this separation has created an environment where many students have difficulty comprehending science texts and demonstrating their understanding through writing. Consequently, even though students can perform well on tests and assessments where they need to recall previously learned information, they still do not have the ability to comprehend texts at a deeper level (UNESCO, 2020).

Problem Statement

The development of students' literacy skills has become extremely important in education, particularly in secondary schools, where students need to show that they have good reading and writing abilities. However, a large number of high school SSC students struggle to understand scientific materials and be able to demonstrate their understanding of these materials. Teachers in many science classes tend to focus on memorization of course content rather than the students' ability to comprehend it and express their understanding through writing; therefore, it can be extremely challenging for SSC students to use their reading and writing abilities to enhance their overall understanding of the subject matter. By incorporating literacy into all subject areas (including science) through discipline-specific literacy activities, Siraj (2025) states that students will develop their ability to read and write in a way that helps them develop a better understanding of the course content.

Empirical investigations of the effects of integrated curriculum on reading and writing skills in secondary school students have been infrequently conducted in Peshawar, although, both in general and specifically for Empirical Studies of Education, there have been several studies conducted within the field of curriculum integration. Based on studies that used an "integrative approach" to science instruction, using it as a means to assist students in learning and becoming better writers; however, there is a need to conduct more extensive studies to test the effectiveness of the integrated approach in developing literacy skills in secondary school students. Conducting further empirical studies on this area will enable teachers to develop methods for instructional design that would support the enhancement of literacy skills amongst these students.

Literature Review

Recent studies indicate that researchers are now emphasizing curriculum integration, particularly between literacy and specific content areas such as science. When literacy skills are incorporated into science instruction, research has indicated that students are able to gain a deeper understanding, knowledge, and ability to express their understanding of concepts studied in science. The term disciplinary literacy has been coined to refer to the use of literacy skills to

teach science. Yet, numerous academic investigations demonstrate that an interdisciplinary curriculum linking science and literacy benefits learners as they develop both language skills and acquire knowledge relating to the field of science. A recent design-based research investigation showed that incorporating text structure instruction into instruction on science improves students' comprehension of reading material, builds vocabulary, and furthers their understanding of scientific concepts (Kooiker-den Boer et al., 2024).

Consequently, the meta-analysis also demonstrates that the synergistic approach of integrated instruction in science and reading is typically more effective than instruction in isolation from one another. The findings of various studies on integrated modes of instruction demonstrate a medium to a high level of proficiency regarding the effect of using integrated modes of instruction on improving student science learning and reading proficiency at both lower and upper secondary levels (Krismonika & Asrizal, 2021). From this body of research, it can be concluded that integrated curriculum can be beneficial to secondary education students as they are typically required to integrate complex texts and/or constructs while reading. In addition, through research, reading and writing are now considered popular areas of study within the fields of linguistics and curriculum development. Research has also established that there is an interdependent relationship between reading and writing, whereby reading has a direct influence on writing and directly assists with the understanding of the material read (Sun & Liang, 2024). Also, reading and writing in music and science will have contextual values within the discipline of reading and writing. Therefore, according to the reading and writing disciplines (Nugrahani et al., 2025), the process of learning to read and write as a scientist is through interpreting information, mastering the scientific language and formulating evidence-based arguments. In turn, more modern research confirms this idea, indicating that incorporating the writing of scientific explanations and laboratory reports boosts academic engagement.

Hypotheses of the Study

Hypothesis 1

H₀₁: There is no significant difference in mean reading - writing comprehension test scores of students who receive instruction through an integrated curriculum compared to those who receive instruction using traditional teaching methods at the SSC level.

H₁: There are significant differences in mean reading - writing comprehension test scores of students who receive instruction through an integrated curriculum compared to those who receive instruction using traditional teaching methods at the SSC level.

Hypothesis 2

H₀: Curriculum integration has no significant effect on mean reading comprehension test scores.

H₁: Curriculum integration has a significant effect on mean reading comprehension test scores.

Methodology

Research Design

The present study used the quantitative research methodological approach, which used the quasi-experimental research design to explore the effect of integrated curriculum (integration of reading, writing and science) on secondary school students' comprehension of reading and writing through science content at the SSC level. The pre-test post-test control group design was used to compare the mean score differences between one group of students that used the integrated curriculum and another that was taught using the conventional method (Creswell & Creswell, 2018). The use of the quasi-experimental design was necessary since randomization of the participants could not be achieved because of the nature of the school environment. Thus, the intact classes were assigned to

either the experimental or control group. This is a common practice in educational research studies (Cohen et al., 2018).

Population of the Study

The population of this research was composed of students studying in the ninth grade in Government Girls High Schools located in Peshawar, Khyber Pakhtunkhwa province, Pakistan. Students studying science as a compulsory subject from their syllabus constituted the subject population for this research since scientific literacy and critical thinking are essential for the development of scientists through secondary science education. Reading and writing are fundamental for acquiring knowledge about science (Kelp et al., 2023; Shanahan & Shanahan, 2008).

Sample and Sampling Technique

This study adopted the method of simple random sampling, where there was equal probability that the selected 50 students would be picked from the population as samples (Fraenkel et al., 2021). According to Roscoe (1975), the required sample size for most behavioral and educational studies should be between 30 and 500. This assertion is reiterated by Sekaran and Bougie (2016). Recent use of Roscoe's standards in determining sample sizes can also be witnessed in recent literature (Sultana, 2020).

Procedure of the Study

The process involved in this study has been modified from the method used by Mumtaz et al. (2025). With the permission of the chosen school, the teacher from the experimental group underwent training for a week. An interdisciplinary teaching approach combining science and literacy was conducted for six weeks to improve the learning experience of the learners (Barry, 2001). Both the teachers in the two groups had the same level of qualification and experience in teaching. At the conclusion of the intervention, a post-test was carried out to determine the learning achievements of the learners.

Data Analysis Techniques

The analysis of data was carried out using the Statistical Package for Social Sciences (SPSS, v-28). Descriptive statistics were computed for the mean and standard deviation of students' reading-writing comprehension test scores. An independent samples t-test was conducted to find out whether there was a significant difference in the post-test mean scores of students who were taught using the integrated curriculum approach compared to those who were taught using the conventional approach at the SSC level. In order to investigate the effect of curriculum integration on students' reading comprehension scores, Analysis of Covariance (ANCOVA) was used, where post-test scores were considered as the dependent variable, teaching method (integrated or conventional) as an independent variable, and pre-test scores as a covariate. All the statistical analyses were tested at a 0.05 level of significance.

Findings and Discussions

Descriptive Statistics (Post-test Marks)

From the descriptive statistics, there are significant differences in post-test performance between the two groups. The experimental group (N = 25) scored higher in terms of mean (M = 45.36, SD = 2.57) with a small score range (39 to 47). This shows consistency and better performance by the students in this group. On the other hand, the control group (N = 25) had lower mean scores (M = 28.93, SD = 10.75) with a larger score range (12 to 40), indicating inconsistency in their performance. A smaller standard error in the experimental group is another sign of a more consistent mean score.

Table 1

Descriptive Statistics (Post-test Marks)

Group	N	Min	Max	Mean	Std. Error	Std. Deviation
Experimental Group	25	39.00	47.00	45.36	0.47	2.57
Control Group	25	12.00	40.00	28.93	1.96	10.75

Source: SPSS results

Independent Samples t-test

The findings of the independent samples t-test reveal a statistically significant difference between the two groups in terms of post-test performance, $t(df = 48) = 7.90$, $p = 0.001$. The experimental group ($M = 45.36$, $SD = 2.57$) performed significantly better compared to the control group ($M = 28.93$, $SD = 10.75$). It is evident that the treatment was effective in improving the academic achievement of the students since those who were exposed to the experimental teaching method had higher scores compared to those who were taught through the traditional method.

Table-2

Independent Sample t-test Results

Group	N	Mean	SD	t	df	p-value
Experimental Group	25	45.36	2.57	7.90	48	0.001
Control Group	25	28.93	10.75			

Source: SPSS results

ANCOVA Results

Based on the findings from ANCOVA, it can be observed that the effect of pre-test (covariate) on the dependent variable is significant at $p=0.022$, $F(1, 47) = 5.62$, $\eta^2p = 0.106$. In other words, students' previous ability has significantly contributed to their scores obtained in the post-test. However, the most important finding is the significant effect of the teaching method at $p<0.001$, $F(1, 47) = 47.68$, $\eta^2p = 0.499$. It implies that there is a substantial difference between the experimental and control groups in relation to students' academic achievements due to different types of teaching used. The large effect size indicates that nearly half of the variation in the result can be attributed to the teaching technique. Thus, the obtained result is corroborated by the study by Mumtaz et al. (2025). They stated that an integrated approach leads to better students' performance compared to conventional teaching in District Peshawar, Pakistan.

Table 3

ANCOVA Results (Post-test Scores with Pre-test as Covariate)

Source	Sum of Squares	df	Mean Square	F	P-value	Partial Eta Sqrd (η^2p)
Pre-test (Covariate)	182.44	1	182.44	5.62	0.022	0.106
Teaching Method (Group)	1548.76	1	1548.76	47.68	0.001	0.499
Error	1568.30	47	33.37			
Total	3299.50	49				

Source: SPSS results

Conclusion and Recomendations

Conclusion

Conclusively, this research established that curriculum integration using science subjects leads to better reading and writing comprehension by students taking the SSC examination. It was noted that the students exposed to the

integrated curriculum scored far better in post-tests than those subjected to the traditional method of teaching. As seen from the results obtained from the independent samples t-test and ANCOVA, the teaching method used was found to be effective, regardless of the students' previous achievements. The huge effect size also indicated that the teaching method was one of the factors responsible for the variation in students' achievement. From these results, it is clear that curriculum integration not only improves the students' academic achievement but also helps to boost their comprehension and communication skills.

Recommendations

Considering the results obtained from the conducted study, it is suggested that secondary schools adopt integrated curricula that would incorporate reading and writing exercises into science classes in order to help students improve their literacy skills and academic performance. Teachers must be offered appropriate training and resources for implementing interdisciplinary teaching methods. Disciplinary literacy must be incorporated in science curricula and textbooks. Learner-centered activities which would help students learn how to read scientific material and write about it must be encouraged in schools. Moreover, future studies are suggested to be carried out with larger samples and in other regions and disciplines in order to obtain wider evidence on the effects of curricular integration.

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