MS Research Thesis

EFFECT OF COLLABORATIVE LEARNING ON ACADEMIC ACHIEVEMENT OF PRIMARY SCHOOL STUDENTS IN ISLAMABAD

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APPROVAL SHEET

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By

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This thesis has been accepted by the Department of Teacher Education, Faculty of Education, International Islamic University Islamabad in partial fulfillment of the degree of **MS Teacher Education**.

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AUTHOR'S DECLARATION

It is hereby declared that author of the study has completed the entire requirement for submitting this research work in partial fulfillment for the degree of MS Teacher Education. This thesis is in its present form is the original work of the author except those which are acknowledged in the text. The material included in the thesis has not been submitted wholly or partially for the award of any other academic certification than for which it is being presented.

Saba Sakhi
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SUPERVISOR'S CERTIFICATE

This is to certify that the research work entitled "Effect of Collaborative Learning on Academic Achievement of Primary School Students in Islamabad" has been carried out by Saba Sakhi reg. no. 13-FOE/MSTE/F23, a student of MS Teacher Education, at International Islamic University Islamabad, under my supervision. This research is an original work and has been conducted in partial fulfillment of the requirements for the award of the degree of Master of Science in Education. The study meets the academic standards expected for a postgraduate research project and is suitable for submission and evaluation. I further certify that the research findings, interpretations, and conclusions presented in this thesis are based on data collected and analyzed by the researcher, and that proper acknowledgments and references have been provided where appropriate.

Dr. Fouzia Ajmal

Dedication

I dedicate this thesis to my parents for their endless support and encouragement throughout my studies. Special thanks to my supervisor, Dr. Fouzia Ajmal, for her invaluable guidance and support during this research. I also dedicate this work to my teachers and the students who inspired this study, hoping it contributes to improving teaching and learning in primary education.

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First and foremost, I am deeply grateful to Allah Almighty for granting me the strength, patience, and wisdom to complete this research. I sincerely thank my supervisor, Dr. Fouzia Ajmal, for her continuous guidance, constructive feedback, and unwavering support throughout the entire process. Her expertise and encouragement were invaluable in shaping this study. I also extend my heartfelt thanks to my parents for their constant motivation and prayers. Special appreciation goes to my teachers and peers who provided helpful suggestions and moral support. Finally, I am thankful to the students and schools that participated in this research, without whom this study would not have been possible.

Saba Sakhi

Abstract

Collaborative Learning (CL) is a well-established instructional strategy known to enhance academic achievement by promoting peer interaction and cooperative engagement in learning tasks. Despite its recognized global significance, there is limited empirical evidence on its impact at the primary school level in Islamabad. This study aimed to examine the effect of collaborative learning strategies—specifically group projects, peer tutoring, and collaborative problem-solving—on the academic achievement and knowledge retention of Grade V students in Federal Government Primary Schools. Employing a true experimental design, 62 students were randomly assigned to control and experimental groups (31 each). Over an 8-week instructional period, the experimental group was taught Science Explorations using collaborative methods, while the control group received instruction through traditional lecture-based teaching. A researcher-developed achievement test comprising 50 multiple-choice questions (MCQs) was used as a pre-test, post-test, and retention test. Statistical analysis using independent sample t-tests, along with effect size calculations, revealed that students in the collaborative learning group significantly outperformed those in the control group in both post-test scores and knowledge retention. These findings confirmed that collaborative learning not only improves immediate academic achievement but also supports retention of scientific concepts. The study recommends integrating collaborative learning strategies into classroom instruction at the primary level to promote deeper understanding and sustained academic success among students.

Keywords*: Collaborative Learning, Academic Achievement, Primary Education, Retention, Peer Tutoring, Science Instruction*

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List of Abbreviations

A.V.	Audio-Visual
ANCOVA	Analysis of Covariance
BAT	Biology Achievement Test
CL	Collaborative Learning
COIL	Collaborative Online International Learning
CQS	Cultural Intelligence Scale
EFL	English as a Foreign Language
FOE	Faculty of Education
FDE	Federal Directorate of Education
F.G.	Federal Government
ICT	Information and Communication Technology
MCQs	Multiple Choice Questions
MPQ	Multicultural Personality Questionnaire
MS	Master of Science
MSTE	Master of Science in Teacher Education
SPSS	Statistical Package for the Social Sciences
TOS	Table of Specification
ZPD	Zone of Proximal Development

CHAPTER 1

INTRODUCTION

Collaborative Learning is a pedagogical approach that focuses on student collaboration and teamwork to boost up their learning outcomes (Vineeta, 2025). Academic Achievement is the students' performance in their academic subjects, measured through written tests, quizzes, and teacher-assigned grades (Pius & Anidu, 2023). This study helped examine the effect of collaborative learning on the academic achievement of primary school students in Islamabad. Academic achievement of students engaged in collaborative activities, for instance group projects and peer tutoring, and those who follow traditional individual learning methods were studied. The research was a gateway for the effectiveness in polishing the collaborative strategies in improving academic achievement. On a positive note informing teaching practices and educational policies to ensure healthy learning environments for primary school students. this investigation ensures to provide worthy insights into ways of how collaborative learning can be an armed sentinel to support instructive development in a local context.

Education in the 21st century requires pedagogical approaches that move beyond rote memorization and passive learning to methods that actively engage students in the construction of knowledge. Among these approaches, collaborative learning has gained global recognition as an effective instructional strategy that enhances academic achievement, critical thinking, communication, and social skills (Pius & Anidu, 2023). In Pakistan, however, primary school classrooms are still dominated by traditional lecture-based methods, which often emphasize teacher-centered content delivery rather than active student participation (Shouib & Aslam, 2024). This persistent reliance on rote instruction creates a learning environment where students' ability to critically analyze, retain knowledge, and work collectively remains underdeveloped.

Collaborative learning is particularly important in the primary school context. At this developmental stage, children are forming foundational cognitive and social skills that shape their lifelong learning behaviors. Introducing strategies such as peer tutoring, group projects, and collaborative problem-solving tasks can foster not only academic

success but also teamwork, empathy, and responsibility—skills essential for 21st-century learners. Moreover, collaborative learning, if systematically integrated into primary classrooms in Islamabad, can play a transformative role in strengthening both academic outcomes and social development.

1.1 Background of the Study

Traditional (lecture) teaching methods in primary education often struggle to improve academic achievement. Collaborative learning has been found to enhance student outcomes by encouraging active participation and peer support. However, most researches center on secondary education, with limited focus on primary students in specific regions like Islamabad. The literature consistently shows that collaborative learning leads to higher academic achievement in both science and mathematics, improved student attitudes, better problem-solving skills, and enhanced social competence (Shouib & Aslam, 2024). These benefits underline the pedagogical importance of integrating collaborative strategies into the curriculum, especially at the elementary and secondary education levels.

Several studies have demonstrated the positive impact of collaborative learning strategies on students' science performance. Parveen et al. (2019) conducted an experimental study using the Jigsaw technique with 8th-grade students in district Sheikhupura, Pakistan. Their findings indicated a statistically significant improvement in the science achievement of students who were taught using collaborative strategies compared to those taught through traditional methods. The 26-week intervention, which covered the full General Science curriculum, provided robust evidence that collaborative learning enhances conceptual understanding and retention While the optimistic effects of collaborative learning on academic achievement have been well-documented in higher education, there is an obvious gap in research explicitly speaking its effect on primary school students. Most studies have concentrated on older students, leaving a significant gap in thoughtful how collaborative learning strategies can be effectively executed and measured in primary education. The examination of the effect of collaborative learning on the academic achievement of primary school students at Federal Government Primary School pursues to address this gap. By concentrating on two sections of grade V students, this research aims to provide insights into how

collaborative learning effects younger learners, who are at a crucial stage of cognitive and social development. More often like older students, primary school children may reply mannerly to collaborative learning strategies just so of their developing stage, making it exigent to explore how these strategies can be custom-made to meet them utters needs.

Moreover, current studies have not quiet seen how collaborative learning imparts an effect on specific academic fields such as literacy and numeracy among primary school students. This research has the stamina to address this gap by investigating the effects of collaborative learning on different aspects of academic achievement in a primary school context. This surely had part in valuable knowledge to the field and offer practical insights for educators who are agree to appliance collaborative learning strategies in primary classrooms (Aryal, 2022).

1.2 Problem Statement

In Pakistani primary schools, teaching is predominantly lecture-based, with limited use of interactive strategies that actively involve students in learning. As a result, students often struggle with academic scores, active engagement, and long-term retention of science concepts. Although collaborative learning has been suggested as a strategy that may enhance academic achievement (Kim, 2021), there is little empirical evidence from the local context, particularly at the primary level in Islamabad. Therefore, it remains unclear whether collaborative learning is more effective than traditional methods in improving the academic achievement and retention of Science students. This study measured the effect of collaborative learning on the academic achievement of primary school students. Without this research in Islamabad, traditional individual learning methods continued to dominate the primary education system, overseeing the advantages of collaborative learning.

1.3 Objectives of the Study

Objectives of the study were to:

1. compare the academic achievement of students involved in traditional learning with those involved in collaborative learning.
2. assess the retention of academic knowledge among students who experienced collaborative learning and those who underwent traditional learning.

1.4 Hypotheses of the Study

H_{01} There is no significant difference between the academic achievement of students involved in traditional learning and those involved in collaborative learning.

H_{02}: There is no significant difference between the knowledge retention of students involved in traditional learning and those involved in collaborative learning.

1.5 Significance of Study

Studying the effect of collaborative learning on primary school students in Islamabad is significant as it can lighten how these methods affect academic achievement in this specific context. The research offered insights into whether collaborative learning strategies enhance student performance and engagement, providing valuable direction for educators on cooperative teaching practices. Additionally, it can highpoint bigger benefits such as better social skills and teamwork among students. Results could update policymakers and administrators on integrating these methods into curricula, leading to more effective educational strategies. Furthermore, the study can benefit parents understand and support collaborative learning practices at home, while also laying the basis for future research on its effectiveness in diverse educational settings.

1.6 Delimitations of Study

This study was delimited to:

1. Grade V students of Federal Government Primary School in Islamabad.
2. It was specifically focused on Science Explorations by National Book Foundation 2022.
3. The chapters included in it from Science subject were Inside Human Body and Life of Unseen.

1.7 Operational Definitions

1.7.1 Collaborative Learning

In this study, collaborative learning refers to instructional strategies where students work together in small groups to accomplish learning objectives. This comprises activities such as group projects, peer tutoring, and collaborative problem-solving tasks. The efficiency of collaborative learning was measured by evaluating student performance on academic assessments and observing their contribution and interaction during these activities.

1.7.2 Academic Achievement

Academic achievement is operationally defined as the students' performance in their academic subjects, measured through written tests, quizzes, and teacher-assigned grades. This study is dedicated to students' scores and well-being in subjects like Science, contrasting between those participating in collaborative learning activities and those resulting in traditional learning methods.

1.7.3 Primary School Students

Primary school students in this study were grade V students at Federal Government Primary School in Islamabad. These students are merely aged 10 to 11 years old and are getting their primary education in a disciplined classroom environment.

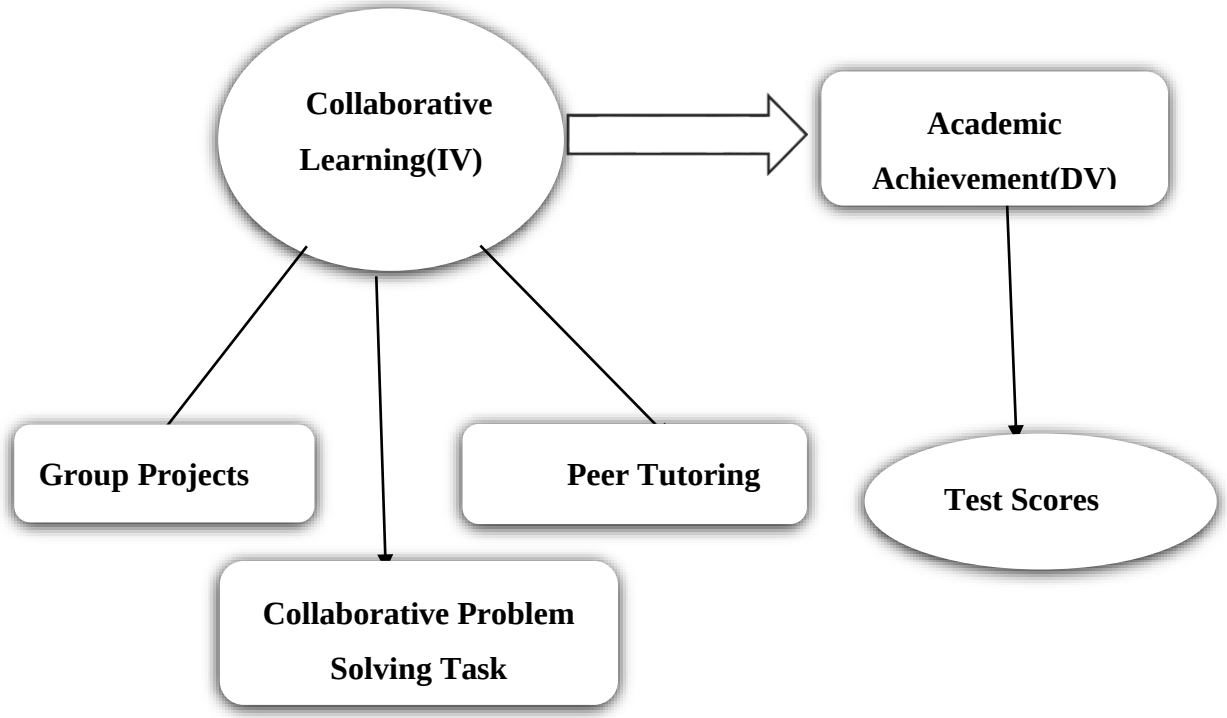
1.8 Theoretical Framework

The study is grounded in social constructivism (Vygotsky, 1978), which emphasizes that learning occurs through social interaction within the Zone of Proximal Development (ZPD). Collaborative learning activities such as peer tutoring and group projects provide opportunities for scaffolding, where students learn from peers with greater understanding. Piaget's theory of cognitive development (1952) also underpins this research, suggesting that children construct knowledge through active engagement with their environment. At the primary level, students in the concrete operational stage benefit from interaction and dialogue that challenge their cognitive structures.

1.9 Conceptual Framework

Figure 1

Conceptual Framework



The conceptual framework of this study was adapted from a study in which it is highlighted the connection between instructional strategies, learning processes, and student achievement. There framework serves as the basis for examining the effect of collaborative learning on primary school students' academic performance (Nazeef & Ali, 2024).

CHAPTER 2

LITERATURE REVIEW

Collaborative Learning (CL) is an adaptive approach in education, specifically in enhancing academic achievement and social skills among primary school students. It has been widely studied as an instructional strategy that enhances student outcomes across different educational contexts. Rooted in social constructivist theory (Vygotsky, 1978), collaborative learning emphasizes peer interaction, shared problem-solving, and active engagement in knowledge construction. While substantial literature confirms the positive effects of CL in secondary and higher education, the primary school context—particularly in Pakistan—remains underexplored**.** This chapter reviews key studies on collaborative learning, identifies existing gaps, and positions the present research within ongoing scholarly debates.

2.1 Review of Related Literature

Over the past several decades, educational researchers and practitioners have increasingly turned their attention to student-centered pedagogical approaches, among which collaborative learning has emerged as a particularly effective strategy for promoting academic achievement. Grounded in the theoretical framework of social constructivism, as articulated by Vygotsky and other educational theorists, collaborative learning is based on the premise that knowledge is constructed through social interaction and meaningful dialogue. In collaborative learning settings, students work together in small groups to solve problems, complete tasks, or construct knowledge, with each member contributing to the group's shared understanding. This collaborative environment not only encourages academic engagement but also fosters communication skills, critical thinking, and peer accountability. As education systems worldwide shift from traditional rote learning to more interactive and student-centered models, the significance of collaborative learning continues to grow (Pajarillo-Aquino, 2019).

In the context of primary education, collaborative learning is especially important, as it aligns with the developmental needs of learners who benefit from hands-on, interactive, and socially driven experiences. Research has shown that when primary

school students engage in collaborative activities—such as group discussions, peer tutoring, and joint problem-solving—they are more likely to develop a deeper understanding of subject matter, improve their retention of knowledge, and display more positive attitudes towards learning. Moreover, collaborative learning has been associated with increased motivation, enhanced academic self-concept, and greater classroom participation, all of which contribute to improved academic outcomes. This is particularly relevant in subjects like General Science, where abstract concepts can be made more concrete through collaborative exploration and dialogue among peers.

Within the Pakistani educational landscape, where teacher-centered instruction and rote memorization continue to dominate many classrooms, the integration of collaborative learning strategies presents both opportunities and challenges. While some studies have begun to investigate the application of collaborative learning in local contexts, there remains a need for more systematic and context-specific research to examine its impact, especially at the primary level. This literature review aims to explore the theoretical foundations, pedagogical benefits, and empirical evidence surrounding collaborative learning, with a focus on its potential to enhance the academic achievement of primary school students. By synthesizing both international and local studies, this chapter establishes the scholarly foundation upon which the current study—conducted in the primary schools of Islamabad—builds, and highlights the relevance and necessity of investigating collaborative learning within the Pakistani educational context (Parveen, et.al 2019).

2.1.1 Students' Standpoint on Collaborative Learning Approach

Collaborative learning has been widely acknowledged as a constructive teaching approach that fosters student engagement, deeper learning, and improved classroom interaction. However, learners' perceptions and comfort levels with this method can significantly influence its success. In a study conducted by Pajarillo-Aquino (2019), the researcher investigated students' standpoints on the application of collaborative learning in classroom settings and examined the relationship between their views and demographic characteristics.

Using a descriptive correlational research design**,** the study employed a structured questionnaire divided into two sections: one focusing on the respondents'

profiles and the other exploring their perceptions of collaborative learning. Data were analyzed using statistical tools such as frequency counts, percentages, weighted means, t-tests, and ANOVA**.**

The findings revealed that although some students acknowledged the benefits of collaborative learning—such as improved learning attitudes and better group outcomes—there was a general hesitation to engage in collaborative tasks. This reluctance was often attributed to discomfort when working with assigned peers and a lack of motivation in group activities. The study emphasized that the effectiveness of collaborative learning is greatly enhanced when students are allowed to choose their own group members and when the activities are designed to be engaging and relevant to their interests (Pajarillo-Aquino, 2019).

Furthermore, the research suggested that while collaborative learning can support positive behavioral and academic outcomes, its implementation must be thoughtfully structured to address students' interpersonal dynamics and preferences. Teachers are advised to design interest-driven collaborative tasks and allow flexibility in group formation to foster a more supportive and productive learning environment.

2.1.2 Science Achievements

The literature consistently shows that collaborative learning leads to higher academic achievement in both science and mathematics, improved student attitudes, better problem-solving skills, and enhanced social competence. These benefits underline the pedagogical importance of integrating collaborative strategies into the curriculum, especially at the elementary and secondary education levels.

Several studies have demonstrated the positive impact of collaborative learning strategies on students' science performance. Parveen, et.al (2019) conducted an experimental study using the Jigsaw technique with 8th-grade students in district Sheikhupura, Pakistan. Their findings indicated a statistically significant improvement in the science achievement of students who were taught using collaborative strategies compared to those taught through traditional methods. The 26-week intervention, which covered the full General Science curriculum, provided robust evidence that collaborative learning enhances conceptual understanding and retention.

2.1.3 Student Perception of Collaborative Learning

The integration of collaborative learning strategies in higher education has become increasingly significant in promoting not only academic achievement but also vital interpersonal and communication skills. Kyaw (2019) conducted a descriptive research study to explore second-year students' perceptions of the effectiveness of collaborative learning at the Sagaing University of Education. The study focused on understanding students' experiences, perceived benefits, and recommendations regarding collaborative learning as part of their academic journey.

Using a purposive sampling technique, the researcher selected 38% of second-year students who had been involved in collaborative learning. The primary tools for data collection included a structured questionnaire addressing both closed and open-ended items. These tools aimed to capture demographic data, the extent of students' involvement in collaborative activities, their perceived learning gains, and qualitative insights about their experiences.

Findings from the questionnaire responses indicated several key benefits associated with collaborative learning. Most prominently, students reported enhanced social skills as a result of working in small, interactive groups. These interactions helped students engage more actively with peers and contributed to the development of teamwork abilities. Furthermore, students highlighted that collaborative learning promoted deeper understanding of academic content, as they could exchange knowledge, ask questions, and clarify doubts through peer discussion. In addition, participants expressed that the approach contributed positively to the development of communication and interpersonal skills**,** which they believed would be crucial for their future careers in education and beyond.

Open-ended responses reinforced these findings by demonstrating students' appreciation for a learning environment that encouraged cooperation, shared responsibility, and collective problem-solving. Although the study did not report quantitative effect sizes or comparisons with traditional learning methods, the qualitative feedback revealed strong student endorsement for collaborative learning as an effective pedagogical strategy.

This research contributes to the growing body of literature supporting active and student-centered learning practices in teacher education programs. It also underscores

the importance of designing classroom activities that promote interaction, cooperation, and communication—skills that are essential for success in both academic and professional contexts.

2.1.4 Collaborative Learning for Enhancing Students' Social Skills

In the context of 21st-century education, fostering active learner participation is crucial not only for academic achievement but also for the development of essential social skills such as communication and societal interaction. Ghavifekr (2020) investigated students' perceptions of collaborative learning and its impact on their social interaction skills in secondary school classrooms in Klang, Malaysia. This study also explored students' understanding, knowledge, and attitudes toward collaborative learning and examined how these factors relate to demographic variables like gender and family background.

Using a survey questionnaire distributed randomly among 100 secondary school students, the study found that the majority of students preferred group work over individual tasks. The results highlighted that collaborative learning significantly enhances students' social interaction skills by encouraging collaborative efforts and promoting socialization within group members. Students reported that collaborative learning environments foster motivation to work effectively with peers and improve interpersonal relationships, which are essential for holistic educational development.

The findings underscore the vital role of collaborative learning in developing social competencies alongside academic goals, suggesting that educators should incorporate collaborative strategies to nurture communication and interaction skills in students (Ghavifekr, 2020).

2.1.5 Student Satisfaction

Salam and Farooq (2020 studied the relationship between students' participation in collaborative learning activities and their academic learning and satisfaction levels in an interactive classroom environment. The study explored how group activities and classroom discussions influenced both cognitive outcomes and students' overall experience in the course.

Their findings revealed that collaborative strategies, such as group work and active class discussions, significantly enhanced student learning and engagement.

Additionally, students reported higher satisfaction with both the course structure and the collaborative methods employed, suggesting that interaction-rich environments contribute positively to both learning outcomes and student perception of the educational experience.

2.1.6 True Active Learning Method for the College Classroom

Major (2020) discusses collaborative learning as a well-established active learning strategy in higher education. The article highlights how collaborative learning fosters student engagement, deeper understanding, and critical thinking by encouraging students to work together in groups. It emphasizes the practical implementation of collaborative techniques and their benefits in enhancing student learning outcomes in college classrooms. The study supports collaborative learning as an effective pedagogical approach that contributes positively to student success and retention

2.1.7 Strategic Responses to Collaborative Learning Challenges

Aguilar (2020) explored how teacher education students identify and manage challenges during collaborative learning. The study involved 43 second-year students working in small groups over a seven-week didactic math course. Post-course interviews and video recordings of group work were used to examine students' reflective interpretations of difficulties and their strategic responses.

Findings revealed that students were generally effective at addressing cognitive challenges—such as content misunderstandings—through clarification and cooperation. However, emotional and motivational issues, including disengagement and unequal participation, were often overlooked. These unaddressed challenges affected group dynamics and reduced satisfaction with learning.

The study concluded that while students can handle cognitive barriers, they require more support to recognize and manage emotional and motivational obstacles during collaboration. Teacher education programs should incorporate training in both cognitive and socio-emotional collaborative skills.

2.1.8 Collaborative Learning in Mathematics Education

In mathematics, collaborative learning has also shown considerable promise. studied secondary school hostel students in rural India and observed that collaborative

methods led to a significant increase in academic performance and positive student attitudes toward learning math. Similarly, Abd Algani (2021) conducted a quasi-experimental study in Arab schools in northern Israel, confirming that collaborative learning yielded better results in math achievement compared to conventional teaching methods.

2.1.9 Holistic Student Development

Sotto (2021) examined the impact of Collaborative Learning (CL) on the cognitive, affective, and psychomotor development of students within the 21st-century educational context. Using a descriptive-evaluative research design and a validated questionnaire, the study assessed how collaborative strategies influence student learning across multiple domains.

Findings indicated that collaborative learning had a very high effect on students' academic (cognitive) performance and collaborative (affective) skills. However, its influence on psychomotor development was comparatively lower. The study also noted gender imbalances, with female students participating more actively. Sotto recommended enhancing male student engagement through activity-based strategies that promote holistic development.

2.1.10 Collaborative Learning in Virtual and Higher Education

Expanding beyond traditional classrooms, Kim (2021) explored collaborative learning in a virtual environment and found a positive correlation between collaborative activities and both academic achievement and student satisfaction. These findings suggest the adaptability and effectiveness of collaborative methods across different learning modalities.

2.1.11 Teachers and Students' Attitude Towards Collaborative Learning

Teachers and students' attitudes toward collaborative learning and its effectiveness in the educational system, particularly focusing on high school settings. Collaborative learning is defined as an educational approach that actively involves both students and teachers in intellectual efforts, fostering both academic and social learning experiences. It represents a shift from traditional teacher-centered methods to a more

student-centered philosophy, emphasizing shared responsibility in learning. (Aryal, 2022)

The study highlights the essential elements of collaborative learning and discusses its numerous benefits, including enhanced motivation and improved academic achievement. Specifically, the research focuses on the impact of collaborative learning on Iranian EFL (English as a Foreign Language) learners, noting significant improvements in their motivation and reading comprehension skills. To gather data, the researchers employed three instruments: a reading comprehension test, a questionnaire assessing attitudes, and interviews. The analysis of the findings revealed positive attitudes among both teachers and students toward collaborative learning and confirmed the method's effectiveness in enhancing motivation and achievement.

The study concludes by emphasizing the importance of collaborative learning for teachers, students, and educational decision-makers, advocating for its wider implementation to improve educational outcomes. Additionally, the collaborative learning model fosters a sense of responsibility among students for both their learning and that of their peers. Such educational experiences contribute not only to academic development but also to personal and social growth.

2.1.12 Collaborative Learning Influence on Social Skills in Higher Education

Collaborative learning has garnered increasing attention in higher education for its potential to not only boost academic achievement but also foster essential social and interpersonal skills among students. In this regard, Laksmiwati et al. (2022) conducted a true experimental study aimed at evaluating the effect of collaborative learning on the development of social skills among psychology students in a higher education context.

The study employed a true experimental design, which is considered the most rigorous method for determining causal relationships between variables. By dividing 78 psychology students into two groups—an experimental group exposed to collaborative learning and a control group engaged in regular discussion—the researchers sought to isolate the impact of collaborative strategies on students' social skill acquisition. This design allowed for a valid comparison between the two instructional methods, providing empirical insight into their relative effectiveness.

Data collected from both groups revealed significant differences in social skill development. The students in the collaborative learning group consistently outperformed their counterparts in the discussion-based control group. Specifically, the experimental group showed notably higher average scores in social skill indicators, underscoring the effectiveness of structured peer collaboration in enhancing interpersonal communication, empathy, teamwork, and mutual respect. The statistical results demonstrated a marked gap between the two groups, affirming the superiority of collaborative learning in developing students' social abilities.

The study also situates social skills within a broader framework of high-order thinking skills, suggesting that collaborative learning creates a dynamic environment where students are not only interacting but also analyzing, synthesizing, and evaluating information collectively. Such cognitive and social engagement aligns with the demands of 21st-century education, where success increasingly depends on the ability to communicate, collaborate, and think critically. In light of these findings, Laksmiwati et al. (2022) emphasize the importance of integrating collaborative learning into higher education pedagogy. They recommend that educators adopt collaborative instructional models to create more interactive and student-centered classrooms, thereby equipping learners with the skills necessary for both academic success and real-world interpersonal challenges.

2.1.13 The Benefits Collaborative Learning Strategy in Higher Education

Sidgi (2022) investigates the impact of collaborative learning strategies on academic achievement and student engagement in higher education. The study emphasizes that group work fosters better knowledge retention and participation by encouraging students to share ideas, discuss concepts, and collectively solve problems. The research highlights the need for educational institutions to adopt collaborative learning environments, moving away from traditional competitive and lecture-based models. Teachers are encouraged to shift toward active facilitation to enhance students' collaborative skills and overall learning experiences.

2.1.14 Academic Achievement of Secondary School

Pius and Anidu (2023) conducted a study to investigate the impact of the collaborative learning method on the academic achievement of secondary school

Biology students in Abia State. This study was guided by two research questions and two null hypotheses, focusing on whether collaborative learning improves students' academic performance and whether gender differences influence outcomes. The research adopted a quasi-experimental design involving a population of 13,306 SSII Biology students during the 2020/2021 academic session, with 6,415 males and 6,891 females. The sample comprised 84 students (38 males and 46 females) selected through multi-stage sampling techniques that included purposive and simple random sampling to ensure representative participation.

For data collection, the researchers used a Biology Achievement Test (BAT) adapted from past WAEC examination questions, ensuring relevance and alignment with the curriculum. The BAT instrument's reliability was verified using the Kuder Richardson 20 (KR20) formula, yielding a reliability coefficient of 0.78, which indicates acceptable internal consistency. Data analysis involved descriptive statistics—mean and standard deviation—to answer the research questions. To test the hypotheses, Analysis of Covariance (ANCOVA) was employed at a significance level of 0.05. The findings revealed that students instructed through the collaborative learning method outperformed those taught using traditional lecture methods, demonstrating that collaborative learning significantly enhances academic achievement in Biology.

Moreover, the study found no significant gender differences in academic performance among students exposed to collaborative learning, indicating that both male and female students benefit equally from this instructional strategy. Based on these results, Pius and Anidu (2023) recommended that Biology teachers integrate collaborative learning strategies into their teaching practices to foster higher academic achievement among secondary school students. This approach encourages peer interaction, knowledge sharing, and active participation, all of which contribute to deeper understanding and better retention of Biology concepts.

2.1.15 Enhancing Higher-Order Thinking and Reflective Learning in Tertiary Education

Collaborative learning has been widely acknowledged as a powerful approach to foster student success in higher education settings. Awang-Hashim et al. (2023)

applied Biggs' presage-process-product (3P) general model of learning to explore the dynamics that contribute to effective collaborative learning among Malaysian undergraduates. The study specifically investigated the influence of teaching quality, student-faculty interaction, and relatedness as presage factors, collaborative learning as the process factor, and reflective and integrative learning alongside higher-order thinking as product factors.

Employing a cross-sectional methodology, data were gathered from 1,892 undergraduates through the Quality of University Learning Experience (QULEX) survey. Confirmatory Factor Analysis (CFA) verified the psychometric robustness of the instruments used, while Structural Equation Modeling (SEM) helped elucidate the relationships among latent variables. The findings demonstrated that collaborative learning fully mediated the effects of teaching quality, student-faculty interaction, and relatedness on students' reflective and integrative learning as well as higher-order thinking skills.

The significance of this research lies in its demonstration that collaborative learning, when combined with social components and high-quality teaching, maximizes students' learning activities and academic achievement. This underscores the necessity for academic institutions to promote collaborative learning environments enriched with effective teaching practices and meaningful social engagement to enhance students' academic success. The study provides valuable implications for educational stakeholders aiming to improve teaching methodologies and foster deeper learning outcomes in tertiary education contexts (Awang-Hashim et al., 2023).

2.1.16 Effect on Social Skill Development in Primary School Pupils

Collaborative learning has arisen as a powerful instructional strategy, particularly relevant for fostering not only academic achievement but also the development of critical social competencies among young learners. In this context, Okeke and Akobi (2023) led a quasi-experimental study to investigate the effect of a collaborative learning instructional strategy on the social skill development of primary school pupils. The study was grounded in the theoretical framework of social constructivism, emphasizing student-centered learning environments where learners take charge of constructing knowledge through peer interaction and shared exploration.

Collaborative learning in this study was a process where students work together—either face-to-face or via digital platforms—to discourse open-ended tasks and develop mutual understanding. This instructional model stands out for its emphasis on student autonomy, distinguishing it from collaborative learning by minimizing teacher-directed procedures. Within such settings, learners are vested to engage in meaningful dialogue, negotiate roles, and collectively reach consensus, which inherently promotes the development of interpersonal and social skills.

The researchers applied a quasi-experimental design involving 130 primaries five pupils drawn from four intact classes, selected from a population of 19,677 pupils. A specially designed rating scale focused on social skill development served as the instrument for data collection. The instrument's reliability, confirmed via Cronbach's alpha, was 0.82, and its validity was ensured through expert review. Data analysis employed mean and standard deviation for descriptive statistics, and Analysis of Covariance (ANCOVA) to test the hypotheses at a 0.05 significance level.

Findings revealed that pupils exposed to the collaborative instructional strategy demonstrated significantly higher levels of social skills compared to those taught through traditional lecture-based methods. The difference between the groups was statistically significant ($p < 0.05$), affirming the superiority of collaborative approaches in nurturing communication, teamwork, and empathy among primary-level students. Interestingly, gender was found to have no significant effect on the outcomes, suggesting that collaborative learning benefits all pupils regardless of demographic differences. In light of these results, Okeke and Akobi (2023) supported for systemic professional development opportunities such as workshops and conferences to train teachers in implementing collaborative learning strategies effectively. Such pedagogical innovations are vital for equipping educators with the skills to enhance students' social and academic growth in primary education settings.

2.1.17 Academic Achievement in Postgraduate Education

In the context of higher education, effective teaching strategies are vital to stand-in students' academic success and intellectual growth. Azam and Hina (2023) explored the effect of collaborative learning on the academic achievements of postgraduate students at the University of Agriculture Faisalabad. Their study backs to

the growing body of research emphasizing the role of collaborative instructional approaches in enhancing educational outcomes at the university level.

Collaborative learning is defined in the study as a pedagogical method where students collectively engage in tasks to solve problems, produce meaningful work, and develop critical thinking skills. This approach not only stimulates academic growth but also strengthens students' social and communicative competencies. Azam and Hina (2023) highlighted how students in a collaborative environment are exposed to diverse perspectives, required to articulate their viewpoints, and must defend their positions, which leads to a deeper, student-generated understanding of the content—independent of reliance on textbooks or instructors.

The study targeted postgraduate students from the Faculty of Education, specifically M.Sc. Education students from the 2nd and 4th semesters. A total of 113 students were selected using simple random sampling from a population of 160, with the help of an online sample size calculator. The researchers employed a well-structured questionnaire for data collection, and the analysis was conducted using SPSS software**.** The findings revealed both facilitating and inhibiting factors influencing the effectiveness of collaborative learning. Facilitating factors included the use of Audio-Visual (A.V.) aids in the classroom, active participation by all group members, and the presence of a relaxed learning environment. These factors supported collaborative engagement and contributed positively to students' academic performance. On the other hand, inhibiting factors included competition among group members**,** diverse personalities**,** and the lack of individual recognition for group efforts. These obstacles posed challenges to the successful implementation of collaborative learning strategies and could hinder student motivation or cohesion.

This study underscores the potential of collaborative learning in elevating the standards of teaching and learning in higher education, while also acknowledging that certain structural and interpersonal barriers need to be addressed. The findings suggest that with proper planning, equitable assessment, and inclusive facilitation, collaborative learning can significantly benefit postgraduate students' academic outcomes. (Azam & Hina, 2023)

2.1.18 Online International Learning (COIL) on Intercultural Competence Development

Hackett et al. (2023) examined the effect of Collaborative Online International Learning (COIL) on the intercultural competence of undergraduate students in higher education. Using a quasi-experimental design, the study involved 108 students from two universities—one in the Netherlands and one in the United States. The researchers evaluated intercultural competence through pre- and post-surveys employing the Cultural Intelligence Scale (CQS) and the Multicultural Personality Questionnaire (MPQ). Results specified a important increase in intercultural competence for the US experimental group compared to the control group, validating the positive effects of COIL. However, this effect was not detected in the Dutch sample, possibly due to the control group's exposure to other international experiences during their course. Qualitative data further enriched the understanding of students' experiences with COIL.

2.1.19 Student`s Academic Performance in Teacher's Education Program.

Creating an engaging and participatory classroom environment is a cornerstone of effective educational practice in higher education. A recent study titled *Impact of Collaborative Learning on Student's Academic Performance in Teacher's Education Program* explored how collaborative learning (CL) strategies, influenced by social factors, enhance academic performance among B.Ed. Honors students in Pakistan. Data were collected through questionnaires administered to B.Ed. students across four private universities. The instrument's internal consistency was confirmed with a high composite reliability ($\alpha = 0.954$**)**. The data were analyzed using SPSS version 22, with regression analysis confirming the significance of all three independent variables—interaction with peers, interaction with teachers, and social media usage—as predictors of effective collaborative learning practices (Shouib and Aslam, 2024).

The findings disclose that each of these social components had a positive and statistically significant effect on collaborative learning. In turn, collaborative learning led to measurable improvements in students' academic performance. The study established that fostering meaningful peer-to-peer interaction, encouraging productive engagement between students and instructors, and integrating social media tools into educational settings significantly add to the effectiveness of collaborative learning

strategies. This research has strong suggestions for teacher education programs. It emphasizes the need for instructors and curriculum designers to create collaborative environments where students feel supported socially and academically. It also validates the role of collaborative learning as a pedagogical approach that not only builds academic competence but also develops interpersonal and communication skills vital for future educators

2.1.20 Academic Outcomes of Collaborative Learning in Secondary School Biology Education

The study by Stella and Okoli (2024) examined the effect of collaborative learning style on the academic achievement of secondary school students in Biology in Orumba South Local Government Area. The study was guided by two research questions and tested three null hypotheses at a 0.05 level of significance. Employing a quasi-experimental design, the researchers targeted a population of 936 Senior Secondary School II (SSII) students offering Biology. A sample of 87 students from two schools was selected through simple random sampling. Data collection was conducted using a Biology Achievement Test (BAT), which was validated by three experts from Nnamdi Azikiwe University, Awka — two from the Department of Science Education and one from Educational Foundations. The instrument's reliability was confirmed with a Kuder Richardson 20 (KR-20) coefficient of 0.86, demonstrating high reliability.

For data analysis, mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was applied to test the null hypotheses. The results indicated that students taught through collaborative learning achieved higher scores and showed increased interest in Biology compared to those taught using conventional methods. Furthermore, collaborative learning significantly influenced achievement scores and interest levels among students. Regarding gender, no significant differences were observed in academic achievement. However, female students showed a slightly greater increase in interest levels when exposed to collaborative learning. The interaction effect between gender and learning style was not significant, suggesting that the benefits of collaborative learning are universal across genders. The study concluded that collaborative learning is an effective instructional

strategy that enhances both academic achievement and student interest in Biology. It recommended the broader adoption of collaborative learning styles in secondary school science education to improve learning outcomes.

In Pakistan, Shouib and Aslam (2024) applied action research in a primary girls' school and found that group work notably improved the mathematics performance of third-grade students. This result supports the idea that even at early education levels, collaborative strategies can foster a better understanding of mathematical concepts. At the higher education level, a study published in the *Journal of Asian Development Studies;* Impact of Collaborative Learning on Student`s Academic Performance in Teacher's Education Program (2024) evaluated the impact of social interaction—peer and teacher communication, and social media use—on collaborative learning among B.Ed. students. The study confirmed that these social factors positively influenced collaborative learning and, in turn, improved academic performance, aligning with the principles of social constructivist theory.

2.1.21 Benefits of Collaborative Learning

Ahmad et al. (2024) gave a detailed overview of the benefits of collaborative learning by categorizing them into four key areas: social, psychological, academic, and assessment-related. Their review emphasizes that collaborative learning enhances student engagement, social interaction, motivation, critical thinking, and reflective learning. Additionally, it fosters positive interdependence and individual accountability, helping learners build essential life and academic skills.This synthesis of collaborative learning advantages reinforces its value as a transformative educational strategy that goes beyond cognitive development, supporting a holistic model of student growth.

2.1.22 Collaborative Learning and Mobile Devices

The role of Collaborative Learning (CL) models in education, focusing particularly on the integration of Information and Communication Technology (ICT). Using a case study involving, the study explores the design, implementation, and evaluation of a collaborative learning experience supported by mobile devices. Data collected from teachers, ICT tutors, and students highlight how ICT tools significantly expand opportunities for collaborative projects, enhancing communication and quality

of learning. The study challenges traditional, individual-centered teaching methods where the teacher is the sole knowledge transmitter, showing that ICT-supported collaboration fosters more dynamic and interactive learning environments (Ahmad et al., 2024).

2.1.23 Academic Achievement in Higher Education

Collaborative learning in enhancing academic achievement has been consistently demonstrated through empirical research. Nazeef and Ali (2024) conducted a quasi-experimental field to examine the effectiveness of collaborative (study group-based) teaching strategies on postgraduate students' academic performance. The study aimed to investigate whether students exposed to collaborative learning achieved better academic outcomes compared to those taught via traditional lecture-based instruction. Furthermore, it analyzed whether academic achievement varied among students of different academic strengths (strong, medium, weak) under participatory learning settings.

They utilized an achievement test developed by the researcher based on the textbook *Behavior Modification,* comprising eight open-ended questions with a total score of 20. A criterion score of 10 was established—scores above 10 signified high academic achievement, while scores below indicated low achievement. Statistical analysis revealed that the F-statistic was significant at the 0.05 level, confirming a positive and statistically significant relationship between the type of teaching method (independent variable) and students' academic achievement (dependent variable). Their findings confirm that collaborative learning, when implemented effectively, enhances the academic performance of postgraduate students. This supports the main hypothesis that collaborative or collaborative teaching methods positively influence educational outcomes. Additionally, the study emphasizes that collaborative environments benefit students across different performance levels, offering a supportive setting where learners can actively construct knowledge through mutual engagement. These findings align with broader educational research advocating for active learning pedagogies in higher education. The evidence suggests that structured collaborative learning not only fosters academic growth but also accommodates diverse learning profiles, making it a powerful tool for inclusive instruction.

2.1.24 Effect of Collaborative Pedagogies on Academic Achievement

Vineeta (2025) conducted a study examining the impact of collaborative pedagogies on students' academic achievement, focusing primarily on secondary sources to analyze both collaborative and non-collaborative teaching practices. The study highlights the increasing significance of collaborative pedagogies in contemporary education, especially within schools, where innovative technologies and advancements have transformed traditional teaching methods. The research focuses that collaborative learning, often used as an umbrella term, involves students working collectively towards shared learning goals. Over recent decades, collaborative learning has been recognized for its potential to enhance both academic and social outcomes in educational settings. By encouraging students to interact, share ideas, and engage in mutual problem-solving, collaborative pedagogies promote deeper understanding and active participation.

However, it was also noted that while many students find collaborative learning effective and beneficial, there is a subset of learners who report limited benefits from this approach. This mixed reception suggests that the effectiveness of collaborative learning may depend on several factors, including how it is implemented, student preferences, and the nature of group dynamics. Overall, the study sustains the value of collaborative pedagogies in fostering academic achievement and social development among students. It also arguments to the need for educators to consider diverse student responses and possibly tailor collaborative strategies to optimize learning outcomes.

2.2 Empirical Review

Collaborative learning has been widely researched across various educational levels and contexts, with numerous empirical studies examining its impact on students' academic achievement and other educational outcomes. This review synthesizes key empirical findings chronologically, emphasizing the evolution of research and identifying gaps for further investigation conducted one of the earlier empirical studies assessing the role of collaborative learning activities in higher education. Using data from interactive classroom settings, the study demonstrated that participation in group activities and class discussions significantly enhanced students' academic learning and satisfaction with the course. These findings underscored the effectiveness of

collaborative pedagogy in fostering engagement and knowledge retention, providing a foundation for subsequent research.

Expanding on cognitive gains, Sotto (2021) explored the effects of collaborative learning on multiple student dimensions: cognitive, affective, and psychomotor. Employing a descriptive-evaluative method with a validated questionnaire, Sotto found collaborative learning had a very high positive impact on cognitive and affective domains, particularly academic learning and collaborative skills. However, the psychomotor development effects were comparatively lower. This study highlighted the need for designing collaborative activities that engage all three learning domains holistically provided a comprehensive review of the benefits of collaborative learning, categorizing them into social, psychological, academic, and assessment benefits. Although primarily a review, the empirical studies they cited illustrated that collaborative learning fosters enhanced academic performance through increased social interaction, psychological support, and ongoing formative assessment. Their work contributed to a deeper understanding of collaborative learning as a multidimensional educational approach empirically investigated the differential effects of collaborative and individual learning on undergraduate English students' achievement using a quasi-experimental design with 40 participants. Using T-tests to compare achievement scores. He found that students exposed to collaborative learning techniques outperformed their peers engaged in individual learning. This study not only confirmed the academic benefits of collaborative learning but also highlighted the role of student-centered approaches over traditional, teacher-centered methods.

Multiple studies have specifically examined collaborative learning in science education, particularly biology. Pius and Anidu (2023) conducted a quasi-experimental study involving 84 secondary school Biology students in Abia State to evaluate collaborative learning's effect on academic achievement. Their results demonstrated that students taught using collaborative methods scored significantly higher on Biology Achievement Tests than those taught by lecture methods. Suggesting collaborative learning benefits are consistent across male and female students, the study found no significant gender differences in outcomes. Similarly, Stella and Okoli (2024) investigated effect of collaborative learning on secondary school students' academic achievement and interest in Biology within Orumba South Local Government Area.

Their quasi-experimental design involving 87 students revealed that collaborative learning not only improved achievement scores but also heightened students' interest in Biology. Gender differences were minimal, though females showed slightly greater increases in interest, reinforcing the universal applicability of collaborative methods.

Major (2020) reviewed the relevance of collaborative learning models in primary education, especially with ICT integration. Their case study found that collaborative learning, supported by technology, provided quality assurance in project communication and challenged traditional instructional methods, reinforcing collaborative learning's relevance in modern classrooms. The empirical literature consistently affirms the positive impact of collaborative learning on academic achievement across educational levels and subjects. Most studies adopt quasi-experimental designs and rely on achievement tests and surveys to assess outcomes. While cognitive gains are well documented, affective and psychomotor benefits, though acknowledged, require more focused investigation, especially in diverse educational settings.

Furthermore, although collaborative learning's effects on gender differences have generally been found to be minimal, some studies note variations in student interest and engagement that warrant further exploration. Research on strategic collaborative behaviors, especially addressing motivational and emotional challenges, remains limited. Additionally, integration of ICT and online international collaborations offers promising directions but requires more empirical validation in different cultural contexts and disciplines. Overall, the empirical evidence validates collaborative learning as an effective pedagogical approach that enhances academic achievement and supports holistic student development. However, future research should address identified gaps by employing longitudinal designs, exploring diverse learner populations, and expanding beyond cognitive outcomes to include social, emotional, and psychomotor domains.

2.3 Theoretical Review

This study is anchored in the theoretical framework of social constructivism, a perspective developed primarily by Lev Vygotsky. According to this theory, knowledge is not transmitted directly from teacher to learner but is instead co-constructed through

social interaction. Vygotsky emphasized the significance of the Zone of Proximal Development (ZPD), which raises to the difference between what a learner can do independently and what they can achieve with guidance from peers or adults. Collaborative learning strategies align closely with this concept, as they create opportunities for learners to engage in shared problem-solving, discussion, and peer tutoring within their ZPD (Vygotsky, 1978). This interaction among peers facilitates the internalization of knowledge, making learning a socially mediated process rather than an isolated cognitive activity.

In addition to Vygotsky, Jean Piaget's theory of cognitive development also ropes the rationale for using collaborative learning in primary education. Piaget posited that learners actively construct knowledge through engagement with their environment and through interactions that create cognitive disequilibrium, prompting learners to adapt their mental frameworks (Piaget, 1952). Collaborative settings offer children the chance to confront alternative viewpoints, negotiate meanings, and reflect on their understanding—activities that are crucial during the concrete operational stage typical of primary school learners. Thus, peer engagement in collaborative tasks adds to the development of higher-order thinking and logical reasoning.

Furthermore, the principles of cooperative learning as formulated by Johnson and Johnson offer additional theoretical justification for the use of collaborative instructional methods. Their model emphasizes key elements such as positive interdependence, individual accountability, face-to-face primitive interaction, and group processing. These components foster not only academic achievement but also interpersonal skills, such as communication, conflict resolution, and mutual respect. In primary classrooms, where students are developing both cognitively and socially, these elements are particularly beneficial. Cooperative learning theory suggests that structured group activities, such as those implemented in the current study—peer tutoring, group projects, and collaborative problem-solving—can lead to upgraded academic performance and stronger student engagement. Integrating these theoretical perspectives, the current study investigates how collaborative learning, grounded in social constructivist and cooperative principles, can impact the academic achievement of Grade V students in Islamabad. By drawing on well-established learning theories,

this research aims to provide a robust foundation for evaluating collaborative strategies in real classroom contexts.

2.4 Critical Summary

The literature review grants a comprehensive and well-structured analysis of Collaborative Learning (CL), drawing on diverse educational contexts including primary, secondary, and tertiary education. One of its key strengths is the thematic organization, which systematically addresses the effects of CL on academic achievement, social development, science and mathematics performance, and student satisfaction. By integrating both international and local studies, the review establishes a robust foundation for this research and highlights the global relevance of CL. The addition of recent studies, particularly from 2023 and 2024, adds to the currency and credibility of the evidence base.

A substantial achievement of the review is its grounding in the theory of social constructivism, particularly the work of Vygotsky. This theoretical lens aids explain why CL is effective—emphasizing peer interaction, dialogue, and knowledge co-construction. The consistent reference to this framework provides coherence across the various studies reviewed. Additionally, the review effectively outlines the pedagogical benefits of CL, such as enhanced academic performance, improved motivation, deeper conceptual understanding, and stronger communication and social skills. In doing so, it underscores the holistic nature of collaborative learning and its alignment with 21st-century educational goals.

However, one notable limitation is that the review sometimes shifts its focus away from the primary education context, which is the core of the present study. A substantial portion of the review examines CL in higher education, virtual learning environments, and teacher education programs. While these studies are valuable, their applicability to primary school settings is limited unless more clearly linked back to younger learners' developmental needs. This dilutes the specificity of the review and may weaken its alignment with the research problem. Condensing or synthesizing these sections to focus more sharply on primary education would enhance relevance and clarity.

Moreover, while the review draws from many empirical studies, it could benefit from a more critical evaluation of these sources. Most studies are described

descriptively without a discussion of their methodological strengths or limitations. For instance, variations in research design, sample size, and instruments used are not critically assessed, which is essential for determining the reliability and generalizability of the findings. Additionally, some cited studies—such as those involving B.Ed. students or virtual classrooms—would be more impactful if their limitations in context transferability were acknowledged explicitly. Another area for improvement is the synthesis and integration of findings. The review includes extensive summaries of individual studies but lacks sufficient cross-comparison or thematic integration. For example, it would be valuable to more directly compare how collaborative learning affects students' academic achievement across subjects like science, math, and language, or to examine whether specific CL strategies (e.g., peer tutoring, Jigsaw, group problem-solving) are more effective than others in primary settings.

In conclusion, the literature review demonstrates a strong foundational understanding of collaborative learning and its multifaceted benefits. It is commendable in scope, organization, and theoretical alignment. However, to better support the current study's objectives, the review should focus more tightly on primary education, offer deeper critical evaluation of cited studies, and provide greater thematic synthesis. Doing so would not only improve coherence but also strengthen the justification for conducting an experimental study on collaborative learning in primary schools in Islamabad.

CHAPTER 3

RESEARCH METHODOLOGY

The methodology chapter explains how the study is designed and carried out. It describes the research approach, participants, tools, and procedures used for data collection and analysis. This section provides clarity and ensures the study can be replicated or validated

3.1 Research Design

This quantitative research employed a true experimental design to measure the effect of collaborative learning on the academic achievement and knowledge retention of primary school students. Participants were randomly assigned to experimental group and the control group. The study includes three key assessments to measure academic achievement:

Pretest – conducted before the intervention to establish baseline knowledge of Science Exploration.

Posttest – administered immediately after the intervention to measure the impact of collaborative learning on academic achievement.

Retention Test – administered two weeks after the posttest to assess students' long-term retention of science concepts.

3.2 Population

The population of the study consisted of N=350 grade V primary school students at Federal Government Primary Schools Islamabad.

Table 3.2

Population

Federal Government Primary Schools(F.G.)	**Population Grade V**
F.G. Primary School Chak Shahzad Islamabad	62
F.G. Primary School G-6/1	77
F.G. Primary School G-10/2	66
F.G. Primary School Bahria Enclave	72
F.G. Primary School F-17	73
Total(N)	350

3.3 Instruments

Self-developed achievement test was aligned with the Science Curriculum measured students' academic achievement. The test included MCQs. The process of developing the achievement test included the following steps:

1. Content Selection: Topics were selected from the Science textbook (Grade V, Federal Curriculum).
2. Table of Specification (TOS): Developed to ensure proportional representation of content and cognitive levels.
3. Item Writing: 60 initial MCQs were prepared.
4. Expert Review: Three subject specialists reviewed items for content validity and alignment with learning outcomes.
5. Pilot Testing: Conducted with 10 students from FG Primary School G-6/1 (not included in the main study).

6. Item Analysis: Based on pilot results, items were analyzed for difficulty index and discrimination index. Poor items were revised or discarded.
7. Final Test: 50 well-functioning MCQs were finalized.

This test was administered as both a pre-test and a post-test to assess academic achievement. The pre-test was conducted before the intervention begins to establish a baseline for each student's academic achievement. Following the intervention, the post-test was administered to both the experimental and control groups. The post-test covered the main ideas related to the curriculum that are going to be taught during the intervention. Instruments was tailored to the study's specific context and objectives, ensuring that they effectively measure the intended outcomes. The retention test was administered two weeks after the post-test to assess knowledge retention.

3.4 Sample and Sampling Technique

Through Simple Random Sampling technique 62 of grade V students from Federal Government Primary School. Chak Shahzad Islamabad was selected as permission was granted from here only. Students were randomly assigned to the experimental group (collaborative learning) and the control group (traditional learning).

3.5 Procedure (Validity, Pilot testing, Reliability)

Through expert reviews by specialists in the Science subject, the instrument underwent a validation process. Instrument was refined by incorporating feedback ensuring content validity. The split-half method was used to check the reliability of the test by dividing it into two halves and scores were correlated from each half during pilot testing.

3.6 Validity

The instrument was validated to ensure it measured the intended outcomes effectively. Content validity was established by seeking feedback from subject matter experts in Science, ensuring alignment with the study objectives. Necessary modifications were made based on this feedback, to refine the instruments and improve their accuracy.

3.7 Reliability

Using the split-half method to ensure consistency in measurement, reliability of the instrument was assessed. Results from pre-tests and post-tests were compared to confirm the stability of the instruments over time. Achieving high reliability indicated that the instruments produced dependable and repeatable outcomes

3.8 Pilot Testing

A pilot test was conducted on the students of grade V from Federal Government Primary School G6/1 before the actual data collection phase to evaluate the instruments. The pretest was conducted on 10 students and Science Exploration achievement test to Grade V students. This process helped to identify potential flaws and ensured that the instruments functioned as intended. The insights gained from pilot testing guided adjustments to enhance their overall effectiveness for the study. Results obtained in pilot testing are given below in the table:

3.9 Reliability of Achievement Test

Table 3.9

Reliability of Achievement Test

Reliability Measure	**Value**
Correlation Between Forms	.927
Spearman-Brown Coefficient	
Equal Length	.962
Unequal Length	.962
Guttmann Split-Half Coefficient	.732

The reliability statistics in table 3.9 indicated that the 50-item MCQ test has strong internal consistency overall. The very high correlation between forms (0.927) and the excellent Spearman-Brown coefficients (0.962 for both equal and unequal lengths) confirm that the test as a whole is highly reliable. Additionally, the Guttmann Split-Half Coefficient (0.732) falls within an acceptable range, indicating a balanced

division between the two halves. Altogether, these results confirm that the test is suitable for research.

3.10 Threats and Steps to Control These Threats

Table 3.10

Internal Threats

Threats	Steps To Control These Threats
History	External events occurring during the study period (e.g., holidays, school events) could influence students' academic achievement. Control: Both groups were taught the same content and tested under 24 similar conditions, helping to mitigate external influences.
Maturation	Changes in students' cognitive development over the two-month period may affect their academic performance. Control: Ensuring that students in both groups are of similar age and developmental stage can help reduce this threat. Additionally, keeping the intervention period relatively short (two months) limits maturation effects.
Selection	Differences between groups due to non-random assignment could influence results. Control: This threat is minimized by using random assignment, where students are randomly assigned to either the experimental or control (traditional learning) group
Mortality (Attrition)	Students dropping out from either group could skew results, especially if those who drop out have particular characteristics. Control: If a student drops out, consider excluding data related to that student from both groups to maintain comparability between groups.
Testing	The pre-test may influence students' responses on the post-test, as they may remember the questions. Control: To reduce this threat, you could vary the sequence or format of post-test questions, while keeping content consistent.

Instrumentation	Differences in how the pre-test and post-test are administered or scored could impact results. Control: Use the same instrument and evaluation criteria for both the pre-test and post-test, ensuring consistency in test administration, scoring, and time allocated for each test.

Table 3.11

External Threats

Threats	**Steps To Control These Threats**
Interaction of Selection and Treatment	The findings may not generalize to students outside the sampled school or Grade V level, as the sample may not represent the wider population. Control: Random sampling helps improve generalizability. Additionally, providing detailed descriptions of the sample and setting aided future researchers in assessing applicability to other contexts.
Interaction of Setting and Treatment	Results may be specific to the environment of the Federal Government Primary School in Islamabad and may not generalize to other school settings. Control: Use consistent classroom settings and the same instructor for both groups to ensure the treatment's effects are measured without being overly influenced by specific environmental factors.
Interaction of History and Treatment	Unique events occurring during the study period at this particular school might limit generalizability to other times or settings. Control: The study period is relatively short (two months), which minimizes the likelihood of major external events affecting results. Documenting any significant external events can also assist in interpreting the findings

3.11 Implementation Plan and Activities

Duration of experiment was 8 weeks. In each week, students engaged 5 sessions, each lasting 40 minutes. The intervention integrated topics from Grade V Science Exploration specifically from unit 1: Inside Human Body and unit 2: Life of Unseen.

Both group had equal number of student i.e. 31. Both groups were taught same content and equal time duration was given to both groups.

The experimental group received collaborative learning-based instruction involving group projects, peer tutoring, and problem-solving tasks over an 8-week period. The control group was taught using traditional lecture-based instruction. The intervention was structured as follows:

- **Week 1:** Pre-test administration (day 1).
- **Weeks 1-7:** (started from day 2 from week 1) Implementation of collaborative learning strategies for the experimental group.
- **Week 8:** (last day) Post-test administration.
- **Week 10:** Retention test administration to assess knowledge retention.

The intervention focused on implementing various collaborative learning activities tailored to an Experimental group (in which collaborative learning took place) of Grade V students while teaching Science Subjects. Different Collaborative Learning Strategies were used during intervention in experimental group like:

- Collaborative Problem Solving Task
- Group Projects
- Peer Tutoring

Students in the experimental group worked in small groups to complete projects that required collaborative problem-solving, research, and presentation skills. These projects were designed to integrate curriculum content with real-world applications. Students engaged in peer tutoring activities within their groups, taking turns as tutors and tutees to assist each other in understanding difficult concepts and reinforcing learning through teaching. Structured activities were designed to encourage students to work together to solve complex problems. These tasks promoted critical thinking, communication, and teamwork skills. Teacher was a facilitator and guide who guided and answers the queries of students during intervention along with guiding and monitoring peer tutoring as well.

The control group (which underwent traditional learning) was taught using lecture method in which teacher was authority and students were passive participants. Traditional lectures and rote memorization took place in control group.

3.12 Data Collection

Achievement was measured through pre-tests given to both the experimental and control groups before the intervention period. The tests provided the main concepts related to the curriculum. Academic achievement was measured through post-tests administered to both the experimental as well as control groups right after the intervention period.

- **Pre-test** administration before the intervention to establish a baseline. Implementation of collaborative learning techniques for the experimental group.
- **Post-test** administration to measure immediate learning outcomes.
- **Retention test** administration four weeks after the post-test to assess knowledge retention.

Week	Unit(s)	Focus	Experimental Group Activities (Collaborative Learning)	Control Group Activities (Traditional Learning)
Week 1	—	Pre-test & Diagnostic	Pre-test conducted; diagnostic task; students grouped for collaborative learning.	Pre-test conducted; teacher introduces topic through lecture.
Week 2	Inside the Human Body	Organs to Organ Systems	Group-based problem-solving; collaborative flowcharts and poster creation.	Teacher-led explanation using textbook and board; students complete individual written exercises.
Week 3	Inside the Human Body	Integration of Body Systems	Scenario-based group task (e.g., digestion during exercise); system coordination explained.	Lecture-based teaching with examples; individual question-answer session.
Week 4	Inside the Human Body	Digestive & Circulatory Systems	Collaborative diagram-building; role-playing; explanation by peer groups.	Teacher draws system diagrams; students copy and memorize; question-answer session with teacher.

Week 5	Inside the Human Body	Respiratory & Nervous Systems	Peer tutoring, diagram analysis, and group Q&A sessions.	Traditional chalk-and-talk method; individual note-taking and reading aloud.
Week 6	Life of the Unseen (begins)	Microorganisms and Their Types	Group poster-making on bacteria, viruses, fungi, etc.; discussion of helpful vs harmful types.	Teacher describes types of microorganisms using charts; students listen and write definitions.
Week 7	Life of the Unseen	Spread and Prevention of Diseases	Group role-play and discussions on disease transmission and prevention strategies.	Explanation through lecture and textbook examples; students write short answers in notebooks.
Week 8	Both Units Reviewed	Collaborative Review & Post-test	Collaborative review activities; peer correction; group summaries; post-test conducted.	Teacher-led review; students revise individually; post-test conducted.
Week 9	—	Waiting Period	No sessions (retention gap).	No sessions (retention gap).
Week 10	—	Retention Test	Retention test to evaluate knowledge retention from both units.	Retention test to evaluate knowledge retention from both units.

3.13 Data Analysis

Quantitative data from pre and post-tests were analyzed through statistical methods like descriptive statistics i.e., mean and standard deviation to conclude the data and inferential statistics such as t-tests for comparison of academic achievement of the experimental and control group.

3.14 Ethical Considerations

Informed permits from School administration, parents or guardians and assent from students ensured they comprehend the study's purpose, procedures, and there was right to withdraw at any time. And, confidentiality is obliged to be strictly maintained through data anonymization and secure storage. They minimized risks and respected cultural and individual differences. Accurate reporting of the whole finding and

providing all the feedback to participants were crucial to maintaining transparency and appreciation.

CHAPTER 4

DATA ANALYSIS AND INTERPRETATIONS

This chapter presented the analysis and interpretation of the data collected to examine the effect of collaborative learning on the academic achievement of primary school students in the subject of Science Exploration. A true experimental was employed in the study involving two groups: a control group, which received traditional instruction, and an experimental group, which was taught using collaborative learning strategies.

Data were analyzed using both descriptive and inferential statistics. Descriptive statistics, including mean and standard deviation, provided a general overview of student performance. To determine whether there were significant differences between the control and experimental groups, independent samples t-tests were conducted for post-test and retention test scores.

To assess differences in performance between the two groups, the results were presented in tabular form and interpreted in details. These findings provided empirical evidence regarding the impact of collaborative learning not only on immediate academic achievement but also on students' ability to retain knowledge over time.

4.1 Descriptive Statistics

Table 4.1

Descriptive Statistics

	N	Minimum (Control group)	Maximum (Experimental group)	Mean	Std. Deviation
Pre test scores	62	17	24	20.56	1.724
Posttest	62	30	47	38.35	4.266
Score Difference Score	62	10	27	17.79	4.189
Valid N (list wise)	62				

In table 4.1 the descriptive statistics summarized the pretest, posttest, and difference scores of 62 students who participated in the study. The pretest scores ranged from 17

to 24, with a mean of 20.56 and a standard deviation of 1.724, indicating relatively uniform academic performance before the intervention. The posttest scores ranged from 30 to 47, with a higher mean of 38.35 and a standard deviation of 4.266, suggesting notable improvement and slightly greater variability in students' performance after the intervention. The difference scores, which represent the gain from pretest to posttest, ranged from 10 to 27, with a mean of 17.79 and a standard deviation of 4.189. A substantial average improvement in academic achievement was reflected, indicating that the instructional approach used in the study had a positive effect on student learning outcomes. All 62 students completed both assessments, ensuring the reliability of the results.

Table 4.1

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
PostTestScore	experimental	31	41.68	2.891	.519
	control	31	35.03	2.415	.434

The table displays the group statistics for the Posttest Scores of two groups: an experimental group (N = 31) and a control group (N = 31), each containing an equal number of students.

The experimental group, which received the intervention (e.g., collaborative learning strategy), had a mean posttest score of 41.68 with a standard deviation of 2.891. This suggests that the students in this group performed relatively well, and the scores were moderately spread around the mean. The standard error of the mean is 0.519, indicating that the sample mean is a fairly accurate estimate of the population mean for this group.

In contrast, the control group, which was taught using traditional methods, had a mean posttest score of 35.03 with a standard deviation of 2.415. This group's average performance was notably lower than that of the experimental group. The standard error of the mean for this group is 0.434, suggesting a slightly tighter estimate of the population mean due to the lower standard deviation.

The difference in mean posttest scores between the two groups is 6.65 points (41.68 – 35.03), favoring the experimental group. The instructional intervention applied

to the experimental group had a positive impact on students' academic achievement compared to the control group.

In short, students in the experimental group significantly outperformed those in the control group on the posttest, and the small standard errors suggest that these results are reliable and not due to sampling variation. This difference supports the effectiveness of the collaborative learning approach used in the experimental group.

To address the first objective of the study—comparing the academic achievement of students involved in traditional learning with those engaged in collaborative learning—an independent samples t-test was conducted on the post-test scores of both the experimental and control groups. This analysis aimed to test the null hypothesis (H_{01}), which stated that there is no significant difference between the academic achievement of students taught through traditional methods and those taught using collaborative learning strategies. The results revealed a statistically significant difference in mean scores between the two groups, indicating that students who participated in collaborative learning outperformed their peers in the traditional learning environment. These findings provide empirical support for rejecting the null hypothesis and suggest that collaborative learning has a positive impact on students' academic achievement. The difference in given below in the table 4.1-1:

4.2 Independent Samples Test

Table 4.2

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means					
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
								Lower Upper

	Equal variances assumed	.067	.796	9.821	60	.000	6.645	.677	5.292	7.999
PostTestScore	Equal variances not assumed			9.821	58.156	.000	6.645	.677	5.291	7.999

The Levene's Test for Equality of Variances was conducted to check whether the variances of the two groups are statistically equal. The F-value is 0.067 with a significance (Sig.) value of 0.796. Since this p-value is greater than 0.05, it indicates that the assumption of equal variances is not violated. Therefore, we interpret the t-test results under the "Equal variances assumed" row.

The **t**-test for Equality of Means compares the posttest scores between the experimental and control groups:

- The t-value is 9.821, with 60 degrees of freedom (df)**.**
- The p-value (Sig. 2-tailed**)** is **.000**, which is less than 0.05, indicating that the difference between the two group means is statistically significant**.**
- The mean difference between the two groups is 6.645**,** meaning that students in the experimental group scored on average 6.645 points higher on the posttest than students in the control group.
- The standard error of the difference is 0.677**,** suggesting that the estimate of the difference is precise.
- The 95% confidence interva**l** for the mean difference ranges from 5.292 to 7.999, which does not include zero, further confirming that the difference is statistically significant.

There is a statistically significant difference in posttest scores between the experimental and control groups **(**$p < .001$), with the experimental group performing significantly better. This suggests that the intervention applied to the experimental group—likely a collaborative learning strategy—had a positive and meaningful impact on students' academic achievement.

4.3 Effect Size

Table 4.3

Independent Samples Effect Sizes

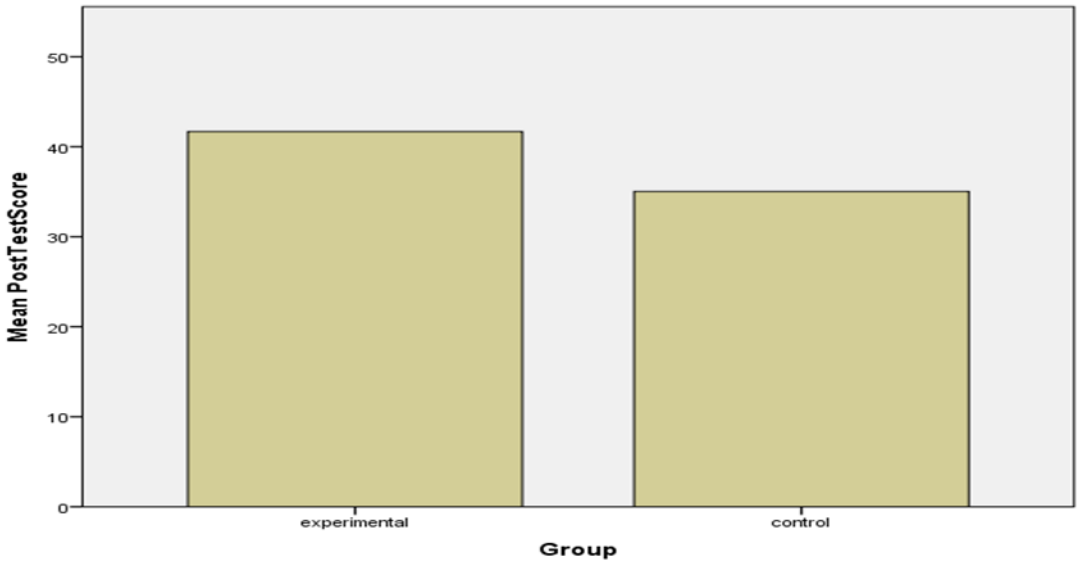
				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
Posttest	Cohen's d	2.664	2.495	1.821	3.157
	Hedges' correction	2.698	2.463	1.798	3.117
	Glass's delta	2.415	2.752	1.890	3.597

In Table 4.3 Cohen's d is 2.495, with a 95% confidence interval ranging from 1.821 to 3.157, indicating a strong and consistent effect. Hedges' g, which adjusts for potential sample size bias, yields a similar effect size of 2.463, with a confidence interval from 1.798 to 3.117, confirming the robustness of the findings. Glass's delta, which is based on the standard deviation of the control group, shows an effect size of 2.752, with a confidence interval from 1.890 to 3.597, further supporting the significant difference between the experimental and control groups. These values collectively demonstrate that collaborative learning considerably improved students' academic performance in the posttest compared to traditional instructional methods.

4.4 Graphical Representation

Figure 2

Graphical Representation



The bar chart clearly shows that students in the experimental group (those who participated in collaborative learning) achieved higher mean posttest scores compared to those in the control group, who were taught using traditional instructional methods. The experimental group's mean is approximately 42, whereas the control group's mean is around 35.

This visual difference supports the earlier statistical findings from the independent samples t-test, which showed that the difference in posttest scores between the two groups was statistically significant. The height of the bars visually reinforces the effectiveness of collaborative learning in improving students' academic performance immediately after the intervention. The difference in bar height represents a clear learning gain for students exposed to collaborative learning techniques.

In summary, this bar chart visually confirms that collaborative learning had a positive and meaningful impact on students' achievement, as reflected in their higher posttest scores.

4.5 Retention Test

Table 4.5

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
pretest	62	17	24	20.56	1.724
posttest	62	30	47	38.34	4.273
retention test	62	29	50	38.95	5.764
Valid N (list wise)	62				

The descriptive statistics inj table 4.5.1 for the pretest, posttest, and retention test scores provide insight into students' academic performance before and after the collaborative learning intervention, as well as their ability to retain the learned material over time. The pretest scores, administered prior to the intervention, ranged from 17 to 24 with a mean of 20.56 and a standard deviation of 1.724. It suggests that students across both groups started at a relatively similar and low baseline level of understanding. Following the intervention, posttest scores increased, ranging from 30 to 47, with a mean of 38.34 and a standard deviation of 4.273, a significant

improvement in academic achievement immediately is indicated after instruction. The retention test, conducted after a delay to assess long-term knowledge retention, showed scores ranging from 29 to 50, with a slightly higher mean of 38.95 and a larger standard deviation of 5.764. This increase in the mean score from posttest to retention test suggests that overall learning was not only maintained but slightly improved in some cases, potentially due to continued peer interaction or reinforcement of concepts. The higher variability in retention scores, as indicated by the standard deviation, may reflect individual differences in students' ability to retain information over time. These findings suggest that collaborative learning had a positive and lasting effect on student achievement and knowledge retention.

Table 4.6

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
Retention test	1	31	44.06	2.898	.520
	2	31	33.84	2.267	.407

The group statistics for the retention test indicate a substantial difference in long-term academic retention between the experimental and control groups. The experimental group (Group 1), which was taught using collaborative learning strategies, had a mean retention test score of **44.06** with a standard deviation of **2.898**, suggesting high performance with relatively low variability among students. In contrast, the control group (Group 2), which received traditional instruction, had a significantly lower mean retention score of **33.84** and a standard deviation of **2.267**. The mean difference of **10.22** point**s** between the two groups is considerable, suggesting that students who engaged in collaborative learning retained more information over time compared to those in the control group. The relatively small standard errors of the mean (.520 for the experimental group and .407 for the control group) indicate that the sample means are precise estimates of the population means. These findings strongly suggest that collaborative learning methods not only improved immediate academic performance but also contributed positively to students' ability to retain knowledge in the longer term.

The second objective of the study was to assess the retention of academic knowledge among students who experienced collaborative learning compared to those who underwent traditional instruction**.** To examine this, a retention test was

administered two weeks after the post-test, and an independent samples t-test was conducted to analyze the scores. This analysis tested the null hypothesis (H_{02}), which stated that there is no significant difference in knowledge retention between students exposed to collaborative learning and those taught through traditional methods. The statistical results indicated a significant difference in favor of the experimental group, demonstrating higher retention levels among students who engaged in collaborative activities. Based on these findings, the null hypothesis was rejected, confirming that collaborative learning strategies contribute more effectively to knowledge retention.

4.6 Independent Samples Test

Table 4.7

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
retentiontest	Equal variances assumed	.106	.746	15.475	60	.000	10.226	.661	8.904	11.548
	Equal variances not assumed			15.475	56.718	.000	10.226	.661	8.902	11.549

An independent samples t-test was conducted to compare the retention test scores between the experimental group (collaborative learning) and the control group (traditional instruction). Levene's Test for Equality of Variances showed a non-significant result (**F = 0.106, p = .746**), indicating that the assumption of equal variances was met. Therefore, the row for equal variances assumed is appropriate for interpreting the results.

The t-test revealed a highly significant difference between the two groups' retention test scores, **t(60) = 15.475, p < .001**. The mean difference between the experimental and control groups was **10.226 points**, with a standard error of **.661**. The **95%** confidence interval for the mean difference ranged from **8.904 to 11.548**, indicating that the true population mean difference is highly likely to fall within this range and is substantially different from zero.

These results demonstrate that students in the experimental group, who were taught using collaborative learning strategies, retained significantly more knowledge over time compared to those in the control group. The magnitude of the difference is large and statistically strong, reinforcing the effectiveness of collaborative learning for long-term academic retention.

4.7 Effect Size

Table 4.8

Independent Samples Effect Sizes

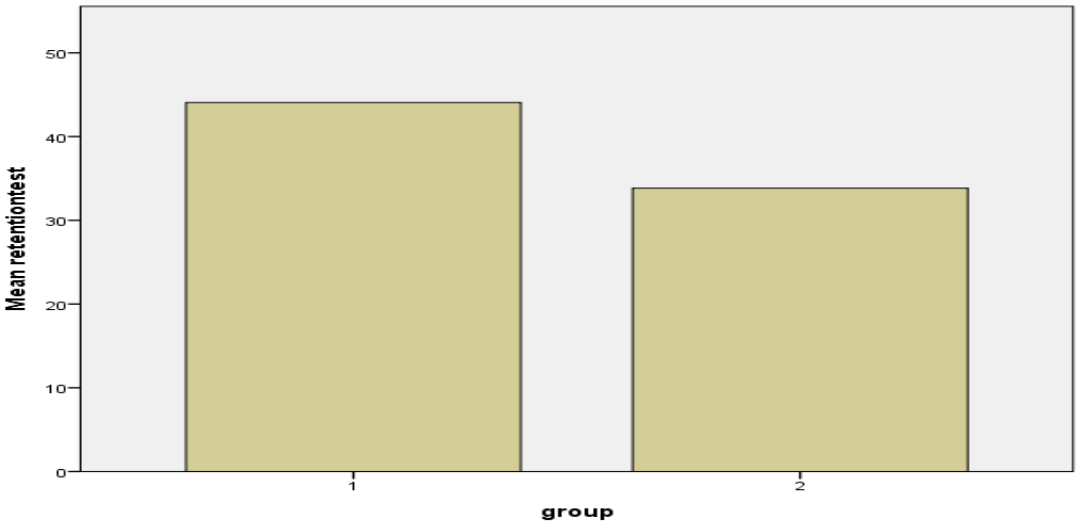
				95% Confidence Interval	
		Standardizer	Point Estimate	Lower	Upper
retention test	Cohen's d	2.601	3.931	3.065	4.785
	Hedges' correction	2.635	3.881	3.026	4.725
	Glass's delta	2.267	4.511	3.264	5.743

The standardized effect size measures indicate that the collaborative learning intervention had a very large and statistically significant impact on students' retention of scientific knowledge. Cohen's d is 3.931, with a 95% confidence interval ranging from 3.065 to 4.785, suggesting a substantial and consistent effect. Hedges' g, a corrected version of Cohen's d for small sample bias, is also very large at 3.881, with a confidence interval from 3.026 to 4.725, reinforcing the reliability of the result. Glass's delta, which uses the control group's standard deviation, shows a slightly smaller but still extremely large effect size of 2.267, with a wide confidence interval (3.264 to 5.743). Collectively, these effect sizes confirm that collaborative learning strategies significantly enhanced students' long-term academic retention compared to traditional teaching methods.

4.8 Graphical Representation

Figure 3

Graphical Representation



The bar chart illustrates the mean retention test scores of two groups of Grade V students—Group 1 (experimental group) and Group 2 (control group). Group 1, which received instruction through collaborative learning strategies such as group projects, peer tutoring, and problem-solving tasks, achieved a noticeably higher mean retention score compared to Group 2, which was taught using traditional lecture-based methods. This visual representation clearly demonstrates that students who engaged in collaborative learning retained more scientific knowledge over time than those who participated in conventional instruction. The substantial difference in mean scores suggests that collaborative learning is more effective in supporting long-term memory and conceptual understanding.

CHAPTER 5

SUMMARY, FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a comprehensive overview of the research by summarizing the study's purpose, methodology, and key results. It highlights the major findings derived from data analysis and interprets them in light of the research objectives and existing literature. The chapter further provides a critical discussion of the results, draws conclusions based on the evidence, and offers practical recommendations for educators, policymakers, and future researchers. The goal of this chapter is to consolidate the research insights and suggest actionable steps for enhancing educational practices.

5.1 Summary

This study was conducted to examine the effect of collaborative learning on the academic achievement and knowledge retention of primary school students in the subject of Science Exploration. Utilizing a true experimental design, the research involved two groups of Grade V students from a Federal Government Primary School in Chak Shahzad: an experimental group taught using collaborative learning strategies and a control group taught through traditional lecture-based methods.

The instructional content covered two core units from the science curriculum: “Inside the Human Body” and “Life of the Unseen.” A self-developed achievement test, designed using a curriculum-aligned Table of Specifications, was administered at three stages—pre-test, post-test, and retention test—to measure baseline knowledge, immediate learning gains, and long-term retention respectively.

Students in the experimental group worked in small groups to complete projects that required collaborative problem-solving, research, and presentation skills. These projects were designed to integrate curriculum content with real-world applications. Students engaged in peer tutoring activities within their groups, taking turns as tutors and tutees to assist each other in understanding difficult concepts and reinforcing learning through teaching. Structured activities were designed to encourage students to work together to solve complex problems. These tasks promoted critical thinking, communication, and teamwork skills. Teacher was a facilitator and guide who guided

and answers the queries of students during intervention along with guiding and monitoring peer tutoring as well. The control group (which underwent traditional learning) was taught using lecture method in which teacher was authority and students were passive participants. Traditional lectures and rote memorization took place in control group. Data were analyzed using both descriptive and inferential statistics. Descriptive statistics, including mean and standard deviation, provided a general overview of student performance. To determine whether there were significant differences between the control and experimental groups, independent samples t-tests were conducted for post-test and retention test scores.

5.2 Findings

The findings of the research were:

1. The experimental and control groups showed similar academic levels before the intervention, with both scoring closely on the pre-test (Mean = 20.56, SD = 1.724), indicating that they were equivalent at the start of the study.
2. After the intervention, both groups improved in the post-test, but the experimental group, which received collaborative learning instruction, scored significantly higher (Mean = 41.68, SD = 2.891) than the control group (Mean = 35.03, SD = 2.415), showing a mean difference of 6.65 points.
3. The difference in post-test scores between the two groups was statistically significant, as confirmed by an independent samples t-test ($t = 9.821$, $p < .001$), suggesting that the improvement was not due to chance.
4. The calculated effect size (Cohen's $d = 2.495$) for the post-test results indicated a very large impact of collaborative learning on student academic achievement.
5. In the retention test, the experimental group again outperformed the control group with a mean score of 44.06 (SD = 2.898) compared to the control group's mean of 33.84 (SD = 2.267), showing a mean difference of 10.22 points.
6. The retention test results were also statistically significant ($t = 15.475$, $p < .001$), showing that the experimental group retained more knowledge over time than the control group.

7. The effect size for retention scores was extremely large (Cohen's d = 3.93), indicating that collaborative learning had a powerful and lasting effect on students' ability to retain information.
8. The study maintained a consistent and complete sample size of 62 students across all three assessments (pre-test, post-test, and retention test), ensuring reliable results.
9. Visual representations, such as bar charts and suggested boxplots, supported the statistical analysis by clearly illustrating the superior performance of the experimental group.

Overall, the findings provide strong evidence that collaborative learning is more effective than traditional teaching methods in improving both immediate academic achievement and long-term knowledge retention among primary school students.

5.3 Discussion

The findings of this study provide strong evidence that collaborative learning significantly improves both academic achievement and knowledge retention among Grade V students in General Science. These results carry important implications for both theory and practice and extend the current body of knowledge on collaborative learning in several ways. First, the significant differences between the experimental and control groups in post-test scores demonstrate that student-centered, collaborative approaches are more effective than teacher-centered, lecture-based instruction for primary-level learners. This aligns with global findings, such as those by Parveen et al. (2019) in Punjab and in Nigeria, a study showed higher science achievement through collaborative methods (Stella & Okoli, 2024). This study contributes to this body of work by confirming that such benefits also apply to primary school contexts in Islamabad, an area where limited empirical research exists.

Second, the study confirmed that collaborative learning promotes long-term retention of knowledge. Students in the collaborative group outperformed their peers in the retention test conducted two weeks after instruction. This result is particularly significant, as retention is often a neglected outcome in Pakistani classrooms, where success is measured largely through immediate test performance. The findings resonate with Sidgi (2022), who emphasized that peer dialogue and repeated engagement with

concepts during group activities lead to stronger memory consolidation. By demonstrating that collaborative strategies strengthen both short-term and long-term learning, this study addresses a critical gap in existing knowledge.

Third, the findings have important theoretical implications. The results validate Vygotsky's (1978) principle that learning is a socially mediated process within the Zone of Proximal Development (ZPD). Through peer tutoring and group projects, students scaffolded one another's learning, achieving outcomes that would not have been possible individually. Similarly, Piaget's (1952) notion of cognitive development in the concrete operational stage is supported, as students benefited from interactive tasks that required reasoning and explanation. Cooperative learning model is also exemplified, particularly the elements of positive interdependence and individual accountability, which were embedded in the group activities designed for this study. Thus, the theoretical base of collaborative learning is reinforced through evidence from a new and under-researched context.

Fourth, while the findings highlight the effectiveness of collaborative learning, they also shed light on the practical challenges of implementation. Some students tended to dominate discussions, while others were reluctant to participate without teacher guidance. These observations echo the findings of Koivuniemi et al. (2018), who warned that group learning can result in unequal participation if not carefully managed. For Islamabad's federal primary schools, where class sizes are often large and resources limited, this suggests that teacher training in structured group facilitation techniques is essential for scaling collaborative approaches successfully.

Finally, the study's findings are significant because they contribute locally relevant evidence to a field dominated by international research. While much of the existing literature comes from higher education or secondary school settings, this study demonstrates that collaborative learning is equally valuable at the primary level in Pakistan. It provides empirical support for policy reforms aimed at moving away from rote memorization toward student-centered, competency-based education.

5.4 Conclusions

This study was conducted to determine the impact of collaborative learning strategies on the academic achievement and knowledge retention of Grade V students

in the subject of Science Explorations. Using a true experimental design, the study compared outcomes between an experimental group that received collaborative learning interventions and a control group taught through traditional lecture-based instruction. Based on the analysis of post-test and retention test results, following significant conclusions were drawn:

1. The study compared the academic achievement of students taught through traditional methods with those engaged in collaborative learning strategies. It was concluded that students in the collaborative learning group demonstrated improved academic performance, highlighting the effectiveness of group-based tasks, peer tutoring, and cooperative learning in enhancing learning outcomes.
2. The study assessed the retention of academic knowledge among students who experienced collaborative learning versus those who received traditional instruction. It was found that students taught through collaborative learning retained information for a longer period and performed better in the retention phase, indicating the long-term benefits of interactive and peer-supported learning environments.

5.5 Recommendations

In light of the findings and conclusion, it is clear that collaborative learning has a positive effect on students' academic performance, engagement, and social development at the primary level. However, its effectiveness depends largely on thoughtful implementation, teacher preparedness, and institutional support. To translate these research insights into meaningful change in classrooms, the following recommendations are proposed.

1. For Teachers (Objective 1 – Academic Achievement):
    a. Teachers may adopt collaborative teaching strategies such as group projects, peer tutoring, and collaborative problem-solving, as these were shown to significantly improve academic achievement compared to traditional methods.
    b. They may incorporate structured group roles to ensure equal participation and prevent dominance by certain students.

c. They may use formative assessments during group activities to monitor both individual and group progress, thereby reinforcing accountability.
a. They may develop teacher guides with model lesson plans that illustrate how to use collaborative methods for improving science achievement.

2. For Teachers (Objective 2 – Retention of Knowledge):
   a. They may use follow-up collaborative review sessions after completion of science units to reinforce long-term retention of concepts.
   b. They may encourage students to create peer-generated learning materials (e.g., group summaries, concept maps, or diagrams) that can be revisited later to refresh memory.
3. For School Administrators (Objective 2 – Retention of Knowledge):
   a. They may schedule periodic revision weeks where collaborative activities focus on revisiting previously taught science content to strengthen retention.
   b. They may provide support for collaborative spaces in classrooms (e.g., flexible seating, group tables) that encourage sustained engagement.

5.6 Recommendations for Future Studies

1. This study was delimited to Grade V students of Federal Government Schools in Islamabad. Future research may include other grades, school types, and regions for broader applicability.
2. This study focused on Science subject only. Future studies may explore the effects of collaborative learning across different subjects.
3. The duration of the intervention was limited to 8 weeks. Future research can be extended over a longer period to examine long-term impacts.
4. This study examined only academic achievement. Further research may investigate the effects on emotional, social, and interpersonal development.
5. The current research used a true experimental design. Future studies may adopt mixed-method approaches for deeper insight.
6. This study did not include the use of digital tools. Future studies can integrate technology to assess tech-based collaborative learning.

7. Individual learner differences such as gender, learning styles, and socio-economic background were not analyzed. Future research may address these variables

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APPENDICES

7.1 Appendix A: Lesson Plans for Collaborative Learning (Experimental Group)

Topic: Organs to Organ System

Grade: 5

Subject: Science

Chapter: Inside Human Body

Duration: 40 minutes

Objectives

- Identify and explain the relationship between organs and organ systems.
- Understand the functions of major human organ systems (e.g., digestive, circulatory, respiratory).
- Collaboratively work on tasks to deepen understanding and application of the topic.

Lesson Structure

Introduction (5 minutes)

Briefly introduce the topic **"Organs to Organ System"** and outline the lesson objectives.

- Ask students: What do you think happens inside our body when we eat food? (This helped activate prior knowledge.)
- Divide students into **mixed-ability groups of 4-5** for collaborative activities.

Step 1: Collaborative Problem-Solving Task (15 minutes)

Scenario: "Imagine you are eating an apple. Explain how different organs and organ systems work together to help you chew, digest, absorb nutrients, and circulate them throughout the body."

- Each group **identify key organs** involved (e.g., teeth, stomach, intestines, heart) and discuss their roles.
- Groups **create a flowchart** showing how food moves through different organ systems.

Step 2: Group Presentations & Visual Representation (15 minutes)

Task: Creating a **mini-poster** showing the relationship between organs and organ systems.

- Students **draw diagrams** illustrating how different organs form a system (e.g., digestive, respiratory, circulatory).
- Each group include **a real-life example** of how organ systems work together (e.g., breathing while running).
- Groups present their posters, and the teacher provide feedback.

Conclusion (5 minutes)

- Summarize the key concepts through a **quick discussion** on how organ systems work together.
- Ask a **reflection question:** What would happen if one organ in a system stopped working?
- Assign **follow-up homework:** Write a paragraph explaining how the digestive system and circulatory system work together to provide energy to the body.

Lesson Plan 2

Integration of Different Systems in Carrying Out Life Processes

Grade:5

Subject: Science

Chapter: Inside Human Body

Duration: 40 minutes

Objectives

Explain how different organ systems work together to carry out life processes.

Identify the roles of key systems (digestive, circulatory, respiratory, nervous, muscular) in maintaining body functions.

Collaborate with peers to analyze real-life scenarios demonstrating system integration.

Lesson Structure

Introduction (5 minutes)

Begin with a question: What happens in your body when you eat food and start running after some time?

Briefly explain that no single system works alone—organ systems are interconnected.

Divide students into mixed-ability groups of 4-5 for the collaborative task

Step 1: Collaborative Problem-Solving Task (15 minutes)

Scenario:

"*Ali is eating his lunch. After some time, he starts playing football. Explain how different organ systems work together during these activities."*

Each group identifies the role of at least three systems (e.g., Digestive, Circulatory, Respiratory, Muscular, Nervous).

They create a flowchart showing how food is digested, nutrients absorbed, oxygen supplied, and muscles activated.

Groups discuss what would happen if one system failed.

Step 2: Group Presentations & Class Discussion (15 minutes)

Each group presents their flowchart and explanation to the class.

Teacher asks guiding questions:

- How does the circulatory system help the digestive system?
- What role does the nervous system play in movement?

Teacher provides feedback and clarifies key points.

Conclusion (5 minutes)

Summarize key learning points:

- The digestive system provides nutrients.
- The circulatory system transports them.
- The respiratory system provides oxygen.
- The muscular and nervous systems coordinate movement.

Reflection Question: What would happen if one of these systems stopped working?

Homework: Write a paragraph explaining how the nervous and muscular systems work together when you ride a bicycle.

Lesson Plan 3

Receiving Information

Grade: 5

Subject: Science

Chapter: Inside Human Body

Duration: 40 minutes

Objectives:

Understand how sensory organs detect stimuli and send signals to the brain.

Explain the role of the nervous system in receiving and responding to information.

Collaborate to solve a real-life problem related to sensory reception.

Lesson Structure:

Introduction (5 minutes)

Ask students: How do you know if someone calls your name from behind?

Explain the process of receiving information through **sensory organs, nerves, and the brain.**

Divide students into **groups of 4-5** for the problem-solving task.

Step 1: Collaborative Problem-Solving Task (15 minutes)

Scenario:

"Ali was walking barefoot when he suddenly stepped on a sharp stone. Within seconds, he lifted his foot without thinking. Explain how Ali's body detected and responded to the pain."

Each group **discusses and creates a flowchart** of the process.

They explain the role of the **skin (sensory organ), nerves, spinal cord, and brain** in sending and processing information.

Step 2: Group Presentations (15 minutes)

Each group presents their **flowchart and explanation** to the class.

Teacher asks follow-up questions:

- Why was Ali able to react so quickly?
- What would happen if his nerves didn't work properly?

Teacher provides feedback and clarifies key points.

Conclusion (5 minutes)

Summarize key learning points:

- Sensory organs detect **stimuli** (sharp stone).
- Nerves send **signals** to the spinal cord and brain.
- The brain processes information and triggers a **response** (lifting foot).

Homework: Write a short paragraph explaining how our ears help us recognize different sounds.

Lesson Plan 4

Receiving Information

Grade: 5

Subject: Science

Chapter: Inside Human Body

Duration: 40 minutes

Objectives:

Describe how sensory organs detect and transmit information to the brain.

Learn from and teach peers to strengthen understanding.

Develop communication and teamwork skills.

Lesson Structure:

Introduction (5 minutes)

Ask students: How do we recognize a familiar smell or taste?

Briefly explain the function of the **nervous system in receiving and processing sensory information.**

Pair up students for **peer tutoring.**

Step 1: Peer Tutoring Activity (15 minutes)

Each pair picks a **sensory organ** (eyes, ears, skin, tongue, or nose).

One student acts as the **teacher** and explains:

How the sensory organ detects stimuli.

How nerves send messages to the brain.

How the brain interprets the information.

After **7 minutes**, they **switch roles**, and the other student explains a different sensory organ.

Step 2: Class Discussion (15 minutes)

Volunteers from different pairs share what they learned.

The teacher asks:

What was the most interesting fact you learned from your partner?

How do multiple sensory organs work together (e.g., smell and taste)?

Teacher clarifies any misconceptions.

Conclusion (5 minutes)

Summarize key takeaways:

- Sensory organs detect **different types of stimuli** (light, sound, touch, etc.).
- The **nervous system** helps us interpret and respond.

Homework: Write a short explanation of how the eyes and ears work together when watching a movie.

Lesson Plan 5

Human Respiratory System

Grade: 5

Subject: Science

Chapter: Inside Human Body

Duration: 40 minutes

Objectives:

Identify the major organs of the human respiratory system.

Explain the process of breathing and gas exchange.

Collaborate in groups to create a visual representation of the respiratory system.

Lesson Structure:

Introduction (5 minutes)

Ask students: What happens to your breathing when you run fast? Why?

Explain the function of the **respiratory system** in providing oxygen and removing carbon dioxide.

Divide students into **groups of 4-5** for a **group project.**

Step 1: Group Project Task (15 minutes)

Each group **creates a labeled diagram** of the respiratory system on a chart paper.

They explain the function of each part:

Nose & Mouth (Air intake)

Trachea (Windpipe)

Lungs (Oxygen exchange)

Diaphragm (Controls breathing)

Groups write a **short explanation** of how air moves in and out of the lungs.

Step 2: Group Presentations (15 minutes)

Each group presents their **poster and explanation** to the class.

The teacher asks follow-up questions:

- What happens if your trachea is blocked?
- Why do we breathe faster during exercise?

Teacher provides feedback and clarifies key points.

Conclusion (5 minutes)

Summarize key learning points:

Oxygen enters through the nose/mouth.

Gas exchange happens in the lungs.

Carbon dioxide is exhaled from the body.

Homework: Write a paragraph explaining what happens inside your lungs when you inhale and exhale.

Lesson Plan 6

Human Respiratory System

Grade: 5

Subject: Science

Chapter: Inside Human Body

Duration: 40 minutes

Objectives:

Explain how the respiratory system works with other systems.

Analyze a real-life scenario to understand breathing and oxygen supply.

Work in groups to solve a problem related to respiration.

Lesson Structure:

Introduction (5 minutes)

Ask students: Why do mountain climbers find it harder to breathe at high altitudes?

Briefly explain the **importance of oxygen in respiration** and how the **body adjusts to different oxygen levels.**

Divide students into **small groups of 4-5** for a problem-solving task.

Step 1: Collaborative Problem-Solving Task (15 minutes)

Scenario:

"*A boy named Ahmed is running a race. Suddenly, he starts breathing heavily and feels dizzy. What could be happening inside his body? Explain how his respiratory system is working to help him recover."*

Each group discusses and writes:

- Why Ahmed is breathing heavily.
- How his lungs and heart work together to supply oxygen.

- What would happen if he couldn’t get enough oxygen.

Groups **create a step-by-step explanation** of the process.

Step 2: Group Discussions & Presentations (15 minutes)

Each group shares their **solution and reasoning** with the class.

The teacher asks:

What role does the circulatory system play in breathing?

How can deep breathing help Ahmed recover?

Teacher provides feedback and clears misconceptions.

Conclusion (5 minutes)

Summarize key learning points:

- Breathing increases during **physical activity** to supply more oxygen.
- The **respiratory and circulatory systems** work together.
- Oxygen is essential for **energy production.**

Homework: Write a paragraph explaining why people feel breathless after climbing stairs but breathe normally when sitting.

Lesson Plan 7

Human Circulatory System

Grade: 5

Subject: Science

Chapter: Inside Human Body

Duration: 40 minutes

Objectives:

Identify the main components of the circulatory system.

Explain the function of the heart, blood, and blood vessels.

Collaborate in groups to create a visual model of the circulatory system.

Lesson Structure:

Introduction (5 minutes)

Begin with a question: Why does your heart beat faster when you run?

Explain that the **circulatory system** is responsible for transporting oxygen, nutrients, and waste throughout the body.

Divide students into **groups of 4-5** for a **group project.**

Step 1: Group Project Task (15 minutes)

Each group creates a **large diagram of the circulatory system** using chart paper.

They label and explain the **heart, arteries, veins, and capillaries.**

Groups add arrows to show **blood flow** and include a short explanation of how blood carries oxygen and nutrients.

Step 2: Group Presentations (15 minutes)

Each group presents their **diagram and explanation** to the class.

Teacher asks guiding questions:

- Why is the heart important for survival?
- What happens if blood cannot flow properly?

Teacher provides feedback and clarifies key points.

Conclusion (5 minutes)

Summarize key learning points:

The heart pumps blood through the body.

Arteries and veins carry oxygen and nutrients.

The circulatory system **keeps all organs working.**

Homework: Write a paragraph explaining what happens to your heart rate when you exercise and why it changes.

Lesson Plan 8

Human Circulatory System

Grade: 5

Subject: Science

Chapter: Inside Human Body

Duration: 40 minutes

Objectives:

Describe the role of the circulatory system in transporting oxygen and nutrients.

Explain how the heart, blood vessels, and blood work together.

Strengthen understanding by teaching and learning from peers.

Lesson Structure:

Introduction (5 minutes)

Ask students: What do you think happens inside your body when you get a small cut and it starts bleeding?

Explain that **blood carries oxygen, nutrients, and even helps heal wounds.**

Pair up students for **peer tutoring.**

Step 1: Peer Tutoring Activity (15 minutes)

Each pair selects a topic:

Heart: How it pumps blood.

Blood vessels: Difference between arteries and veins.

Blood: Role of red and white blood cells.

One student acts as the **teacher** and explains the topic using a small **diagram or chart.**

After **7 minutes, they switch roles** and the other student explains a different topic.

Step 2: Class Discussion (15 minutes)

Volunteers from different pairs share what they learned.

The teacher asks:

How does oxygen travel from the lungs to other parts of the body?

Why do veins appear blue but blood is red?

Teacher clarifies any misconceptions.

Conclusion (5 minutes)

Summarize key takeaways:

The heart pumps oxygen-rich blood.

Arteries carry blood away, veins bring it back.

Blood keeps us alive by delivering nutrients.

Homework: Draw a simple diagram of the circulatory system and label its parts.

Lesson Plan 9

Main Groups of Microorganisms

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Identify and describe the main groups of microorganisms (bacteria, fungi, viruses, protozoa, algae).

Understand the role of microorganisms in daily life (useful and harmful effects).

Collaboratively solve a real-life scenario to apply knowledge of microorganisms.

Lesson Structure:

Introduction (5 minutes)

Begin with a question: Why do we wash hands before eating?

Briefly introduce **microorganisms** as tiny living things found everywhere.

Divide students into **small groups of 4-5** for a **problem-solving activity.**

Step 1: Collaborative Problem-Solving Task (15 minutes)

Scenario:

"*Sara left a piece of bread on the kitchen counter for a week. When she checked, she saw fuzzy green spots on it. What happened? Which microorganism caused this change, and how does it grow?"*

Each group **discusses and writes their explanation**, identifying the microorganism (fungi).

Groups research and list **one useful and one harmful effect** of fungi.

Step 2: Group Presentations & Class Discussion (15 minutes)

Groups present their **findings and reasoning** to the class.

The teacher asks follow-up questions:

What other microorganisms cause food spoilage?

Are all microorganisms harmful?

The teacher clarifies key concepts about **bacteria, fungi, viruses, protozoa, and algae.**

Conclusion (5 minutes)

Summarize key learning points:

Microorganisms are everywhere and can be **helpful or harmful.**

Fungi cause food spoilage but also help in making medicines.

Other microorganisms play roles in **disease, food production, and the environment.**

Homework: List three helpful and three harmful microorganisms with examples.

Lesson Plan 10

"Spread of Infectious Diseases and Transmission to Humans

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Identify different ways infectious diseases spread (air, water, food, direct contact, vectors).

Explain how proper hygiene and vaccination prevent disease transmission.

Work collaboratively to create a **poster** about disease prevention.

Lesson Structure:

Introduction (5 minutes)

Ask students: Why do doctors tell us to cover our mouths when we cough or sneeze?

Explain that **infectious diseases spread through air, water, food, and contact.**

Divide students into **groups of 4-5** for a **group project.**

Step 1: Group Poster Activity (15 minutes)

Each group selects **one mode of disease transmission** (e.g., air, food, water, direct contact, or insects).

They create a **mini-poster** with:

How diseases spread through this method.

Examples of diseases spread this way (e.g., flu spreads through air).

Ways to **prevent infection** (e.g., handwashing, vaccinations).

Step 2: Group Presentations (15 minutes)

Each group presents their **poster and findings** to the class.

Teacher asks questions like:

Why do some diseases spread faster than others?

How can simple actions like handwashing stop disease transmission?

Teacher provides feedback and clarifies misconceptions.

Conclusion (5 minutes)

Summarize key learning points:

Diseases spread through different ways (air, water, contact, vectors).

Prevention measures (hygiene, safe food handling, vaccinations) are important.

Homework: Write a paragraph on how vaccinations help stop the spread of diseases.

Lesson Plan 11

Spread of Infectious Diseases and Transmission to Humans

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Explain how infectious diseases are transmitted from one person to another.

Analyze real-life scenarios to identify modes of transmission.

Work in groups to suggest ways to prevent disease spread.

Lesson Structure:

Introduction (5 minutes)

Begin with a question: If one child in a class has the flu, why do others start getting sick?

Briefly explain **how infectious diseases spread from person to person.**

Divide students into **small groups of 4-5** for a **problem-solving activity.**

Step 1: Collaborative Problem-Solving Task (15 minutes)

Scenario:

"*Ali went to a birthday party where one child had a cold. A few days later, Ali also got sick. How do you think Ali got infected, and what could have been done to prevent this*?"

Each group **discusses and writes their explanation,** identifying how the disease spread (airborne or direct contact).

Groups create a **list of prevention methods** (e.g., washing hands, covering mouth when sneezing, staying home when sick).

Step 2: Class Discussion & Presentations (15 minutes)

Groups present their **findings and solutions.**

Teacher asks:

What would happen if no one followed hygiene practices?

How can schools prevent the spread of infectious diseases?

Teacher clarifies key points about **disease transmission and prevention.**

Conclusion (5 minutes)

Summarize key learning points:

Diseases spread through contact, air, food, water, and vectors.

Simple habits like handwashing and vaccinations help prevent infections.

Homework: Interview a family member and write about one time they got sick. How do they think they caught the disease?

Lesson Plan 12

Prevention of Infectious Diseases

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Identify different methods to prevent infectious diseases.

Explain the importance of hygiene, vaccinations, and a healthy lifestyle in disease prevention.

Enhance understanding through peer tutoring and discussion.

Lesson Structure:

Introduction (5 minutes)

Ask students: Why do doctors recommend washing hands before eating?

Briefly explain that **infectious diseases can be prevented through simple daily habits.**

Pair up students for a **peer tutoring activity.**

Step 1: Peer Tutoring Activity (15 minutes)

Each pair selects a **prevention method** from the following:

Personal Hygiene (handwashing, covering mouth when sneezing)

Vaccinations (how vaccines protect from diseases)

Safe Food and Water (boiling water, avoiding contaminated food)

Avoiding Contact with Sick People (social distancing, using tissues)

One student acts as the **teacher** and explains the method using a **short diagram or example.**

After **7 minutes, they switch roles,** and the other student explains a different method.

Lesson Plan 13

Prevention Against Insect Bites

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Identify common insects that spread diseases (mosquitoes, ticks, fleas).

Explain ways to prevent insect bites and related diseases.

Collaborate in groups to create an awareness poster.

Lesson Structure:

Introduction (5 minutes)

Ask students: Have you ever been bitten by a mosquito? What happens after the bite?

Explain that **some insects carry harmful diseases like malaria, dengue, and Lyme disease.**

Divide students into **groups of 4-5** for a **collaborative poster-making activity.**

Step 1: Group Poster Activity (15 minutes)

Each group creates a **mini-poster** that includes:

Common insects that spread diseases.

How these insects bite and spread infections.

Ways to prevent bites (using mosquito nets, wearing protective clothing, using insect repellent).

Groups use **drawings, short explanations, and real-life examples.**

Step 2: Group Presentations & Discussion (15 minutes)

Each group presents their **poster and key prevention tips.**

Teacher asks:

Why do mosquitoes bite more at night?

How does standing water contribute to mosquito breeding?

The teacher **clarifies any misconceptions** and reinforces key points.

Conclusion (5 minutes)

Summarize key learning points:

Insects like mosquitoes and ticks spread diseases.

Prevention methods include using insect repellent, covering skin, and eliminating breeding sites.

Homework: Write three ways you can protect yourself and your family from insect bites.

Step 2: Class Discussion (15 minutes)

Pairs share **one key point** from their discussion with the class.

The teacher asks:

Why is vaccination important even if we feel healthy?

How can schools help prevent the spread of infections?

Teacher clarifies key concepts and reinforces the importance of disease prevention.

Conclusion (5 minutes)

Summarize key learning points:

Good hygiene, vaccinations, and healthy habits prevent diseases.

Everyone has a role in stopping disease spread.

Homework: Write a short paragraph explaining three ways you can prevent infectious diseases at home and school.

Lesson Plan 14

"Useful Role of Microorganisms"

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Identify different ways microorganisms are useful in daily life.

Explain the role of microorganisms in food production, medicine, and the environment.

Collaborate in groups to analyze real-life applications of microorganisms.

Lesson Structure:

Introduction (5 minutes)

Ask students: Have you ever eaten yogurt or cheese? Do you know microorganisms help make them?

Briefly explain that **not all microorganisms are harmful; some are very useful.**

Divide students into **groups of 4-5** for a **problem-solving activity.**

Step 1: Group Problem-Solving Task (15 minutes)

Each group is assigned **one real-life situation** where microorganisms play a role:

Food Production – How is yogurt or cheese made?

Medicine – How do microorganisms help make antibiotics like penicillin?

Environment – How do bacteria help clean waste and decompose dead plants?

Agriculture – How do microorganisms help plants grow (nitrogen-fixing bacteria)?

Groups **discuss and write their explanation** of how microorganisms are useful in their assigned area.

Step 2: Group Presentations & Discussion (15 minutes)

Each group presents their findings to the class.

Teacher asks:

What would happen if we didn't have microorganisms?

Why do some microorganisms help while others harm?

The teacher **clarifies key points** and provides additional examples.

Conclusion (5 minutes)

Summarize key learning points:

Microorganisms help in food, medicine, agriculture, and environmental balance.

Not all microorganisms cause diseases; many are beneficial.

Homework: Write a short paragraph on one useful microorganism and how it helps humans.

Lesson Plan 15

"Role of Microorganisms as Decomposers"

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Explain how microorganisms act as decomposers in nature.

Identify the importance of decomposition in maintaining soil fertility and recycling nutrients.

Enhance understanding through **peer tutoring and discussion.**

Lesson Structure:

Introduction (5 minutes)

Show students a **fallen leaf or a spoiled fruit** and ask:

What happens to dead plants and animals in nature?

Why don't they stay forever on the ground?

Explain that **microorganisms break down dead matter and recycle nutrients, keeping nature balanced.**

Pair students for a **peer tutoring activity.**

Step 1: Peer Tutoring Activity (15 minutes)

Each pair discusses:

What are decomposers? (Bacteria, fungi, and other microorganisms)

How do they help nature? (Breaking down dead plants/animals, returning nutrients to soil)

Why is decomposition important? (Keeps soil fertile, prevents waste buildup)

One student **teaches** while the other **listens and asks questions.**

After **7 minutes, they switch roles.**

Step 2: Class Discussion & Application (15 minutes)

Teacher asks pairs to **share one key point** they learned from their partner.

Show images/videos of **mushrooms growing on logs or decaying leaves.**

Ask:

What would happen if decomposers didn't exist?

How do decomposers help farmers and gardeners?

The teacher **clarifies concepts and connects them to real life.**

Conclusion (5 minutes)

Summarize key learning points:

Microorganisms decompose dead matter and recycle nutrients.

Decomposers help keep the environment clean and soil healthy.

Homework: Observe and write about an example of decomposition in your surroundings (e.g., fallen leaves, spoiled food, or composting).

Lesson Plan 16

"Defense Mechanisms Against Infectious Diseases"

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Identify the body's defense mechanisms against infectious diseases.

Explain the roles of the skin, white blood cells, and antibodies in protection.

Collaborate in groups to solve a real-life scenario about disease defense.

Lesson Structure:

Introduction (5 minutes)

Ask students: What happens when you get a small cut on your hand? Why does it heal after a few days?

Briefly explain that **the body has natural defense mechanisms to fight infections.**

Divide students into **groups of 4-5** for a **problem-solving activity.**

Step 1: Group Problem-Solving Task (15 minutes)

Present the following scenario:

Ali fell and got a small cut on his knee. After a few days, it healed. How did his body protect itself from infection?

Each group discusses and writes their answer based on the body's **three main defense mechanisms:**

First Line of Defense – Skin, mucus, and stomach acid prevent germs from entering.

Second Line of Defense – White blood cells attack and destroy germs.

Third Line of Defense – Antibodies are created to fight infections.

Step 2: Group Presentations & Class Discussion (15 minutes)

Groups present their **explanations.**

Teacher asks:

Why don’t we get sick every time we touch something dirty?

How do vaccines help our body’s defense system?

Teacher **clarifies key points and reinforces understanding.**

Conclusion (5 minutes)

Summarize key learning points:

The body has multiple defense mechanisms to protect against infections.

Skin, white blood cells, and antibodies play important roles.

Homework: Draw and label a simple diagram of the body's three lines of defense.

Lesson Plan 17

Defense Mechanisms Against Infectious Diseases"

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Describe how the immune system fights infectious diseases.

Explain the role of white blood cells and antibodies.

Reinforce learning through **peer tutoring.**

Lesson Structure:

Introduction (5 minutes)

Show students a picture of **a shield and a soldier.**

Ask: How does a shield protect a soldier? How is this similar to our body fighting germs?

Explain that **our body fights infections just like a shield and a soldier protect a castle.**

Pair students for **peer tutoring.**

Step 1: Peer Tutoring Activity (15 minutes)

One student in each pair **teaches the following:**

White Blood Cells – Attack and destroy harmful germs.

Antibodies – Help the body recognize and fight diseases.

Vaccination – Trains the immune system to fight specific infections.

After **7 minutes, they switch roles.**

Step 2: Class Discussion & Application (15 minutes)

Pairs share **one key point** they learned.

Teacher asks:

Why do some people recover quickly from illnesses while others take longer?

How do vaccines help protect us before we even get sick?

Teacher **clarifies concepts and connects them to real-life examples.**

Conclusion (5 minutes)

Summarize key learning points:

White blood cells, antibodies, and vaccines protect us from diseases.

Our immune system remembers germs to fight them better next time.

Homework: Write a short paragraph explaining how vaccines help the immune system.

Lesson Plan 18

Defense Mechanisms Against Infectious Diseases"

Grade: 5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Describe how the immune system fights infectious diseases.

Explain the role of white blood cells and antibodies.

Reinforce learning through **peer tutoring.**

Lesson Structure:

Introduction (5 minutes)

Show students a picture of **a shield and a soldier.**

Ask: How does a shield protect a soldier? How is this similar to our body fighting germs?

Explain that **our body fights infections just like a shield and a soldier protect a castle.**

Pair students for **peer tutoring.**

Step 1: Peer Tutoring Activity (15 minutes)

One student in each pair **teaches the following:**

White Blood Cells – Attack and destroy harmful germs.

Antibodies – Help the body recognize and fight diseases.

Vaccination – Trains the immune system to fight specific infections.

After **7 minutes, they switch roles.**

Step 2: Class Discussion & Application (15 minutes)

Pairs share **one key point** they learned.

Teacher asks:

Why do some people recover quickly from illnesses while others take longer?

How do vaccines help protect us before we even get sick?

Teacher **clarifies concepts and connects them to real-life examples.**

Conclusion (5 minutes)

Summarize key learning points:

White blood cells, antibodies, and vaccines protect us from diseases.

Our immune system remembers germs to fight them better next time.

Homework: Write a short paragraph explaining how vaccines help the immune system.

Lesson Plan 19

Effects of Too Much Sugar in Food

Grade: 5

Subject: Science

Chapter: Health and Nutrition

Duration: 40 minutes

Objectives:

Identify the effects of excessive sugar consumption on health.

Explain how too much sugar can lead to problems like obesity, diabetes, and tooth decay.

Reinforce learning through **peer tutoring.**

Lesson Structure:

Introduction (5 minutes)

Show students pictures of **high-sugar foods (candies, sodas, cakes) and healthy alternatives (fruits, water, vegetables).**

Ask: What happens if we eat too many sweets every day?

Briefly introduce the topic: **While sugar gives energy, too much can cause health issues.**

Pair students for **peer tutoring.**

Step 1: Peer Tutoring Activity (15 minutes)

One student in each pair **teaches the following points:**

Immediate Effects – Sugar gives quick energy but can cause tiredness later.

Long-Term Effects – Too much sugar can lead to weight gain, diabetes, and tooth decay.

Healthier Choices – Choosing natural sugars from fruits and avoiding sugary drinks is better.

The other student **listens and asks questions.**

After **7 minutes, they switch roles.**

Step 2: Class Discussion & Application (15 minutes)

Pairs share **one key point** they learned from their partner.

Teacher asks:

Why do we feel tired after eating too many sweets?

How can we replace unhealthy sugary snacks with better choices?

Teacher clarifies **key concepts** and gives **practical examples** of reducing sugar intake.

Conclusion (5 minutes)

Summarize key learning points:

Too much sugar causes health problems like obesity, diabetes, and tooth decay.

Choosing natural sugars and reducing processed sugar is healthier.

Lesson Plan 20

Effects of Too Much Sugar in Food

Grade: 5

Subject: Science

Chapter: Health and Nutrition

Duration: 40 minutes

Objectives:

Identify the effects of excessive sugar consumption on health.

Explain how too much sugar can lead to problems like obesity, diabetes, and tooth decay.

Reinforce learning through **peer tutoring.**

Lesson Structure:

Introduction (5 minutes)

Show student's pictures of **high-sugar foods (candies, sodas, cakes) and healthy alternatives (fruits, water, vegetables).**

Ask: What happens if we eat too many sweets every day?

Briefly introduce the topic: **While sugar gives energy, too much can cause health issues.**

Pair students for **peer tutoring.**

Step 1: Peer Tutoring Activity (15 minutes)

One student in each pair **teaches the following points:**

Immediate Effects – Sugar gives quick energy but can cause tiredness later.

Long-Term Effects – Too much sugar can lead to weight gain, diabetes, and tooth decay.

Healthier Choices – Choosing natural sugars from fruits and avoiding sugary drinks is better.

The other student **listens and asks questions.**

After **7 minutes, they switch roles.**

Step 2: Class Discussion & Application (15 minutes)

Pairs share **one key point** they learned from their partner.

Teacher asks:

Why do we feel tired after eating too many sweets?

How can we replace unhealthy sugary snacks with better choices?

Teacher clarifies **key concepts** and gives **practical examples** of reducing sugar intake.

Conclusion (5 minutes)

Summarize key learning points:

Too much sugar causes health problems like obesity, diabetes, and tooth decay.

Choosing natural sugars and reducing processed sugar is healthier.

7.2 Appendix B: Lesson Plans for Traditional Teaching (Control Group)

Topic: Organs to Organ System

Grade: 5

Subject: Science

Duration: 40 minutes

Objectives:

Define **organs and organ systems**.

Explain how **organs work together to form organ systems**.

Identify **major human organ systems**.

Materials Needed:

Chart of **human organ systems**

Flashcards with **organ names**

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: *"What is the stomach used for? What about the heart?"*

Explain that organs have **specific functions** and work **together**.

Introduce the **concept of an organ system**.

2. Explanation (Direct Instruction) (15 minutes)

Define **organ**: A structure made of **tissues** that performs a **specific function** (e.g., heart pumps blood).

Define **organ system**: A group of **organs working together** (e.g., digestive system).

Explain **examples of human organ systems**:

Digestive System → Stomach, intestines, liver

Circulatory System → Heart, blood, blood vessels

Respiratory System → Lungs, trachea

3. Guided Practice (10 minutes)

Show a **chart of organ systems** and discuss their functions.

Give students **flashcards with organ names** and ask them to group them into **correct organ systems**.

4. Independent Practice (5 minutes)

Students draw and **label an organ system of their choice**.

5. Conclusion & Assessment (5 minutes)

Recap: **Organs work together to form systems**.

Ask:

What is the function of the heart?

Which organs make up the respiratory system?

Assign homework: **Write the names of three organ systems and their main organs.**

Lesson Plan 2

Integration of Different Systems in Carrying Out Life Processes

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Explain how different organ systems work together.

Identify the **role of the circulatory, respiratory, and digestive systems** in life processes.

Materials Needed:

Chart of human body systems

Diagram of organ system interactions

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: "How do we breathe, eat, and move at the same time?"

Explain that **body systems work together** to support life.

2. Explanation (Direct Instruction) (15 minutes)

Discuss how systems are **interconnected**:

Respiratory & Circulatory System → Oxygen transport

Digestive & Circulatory System → Nutrient absorption

Muscular & Skeletal System → Movement

3. Guided Practice (10 minutes)

Show **body system diagrams** and explain their connections.

Ask students to describe **what happens if one system fails**.

4. Independent Practice (5 minutes)

Students draw and label **two body systems working together**.

5. Conclusion & Assessment (5 minutes)

Recap **how systems support life**.

Ask:

Why do we need the circulatory system?

How does food reach our cells?

Assign homework: **Write two examples of body systems working together.**

Lesson Plan 3

Receiving Information

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Explain how the **nervous system** helps the body receive and process information.

Identify the **brain and spinal cord** as key components in responding to information.

Materials Needed:

Model of the **nervous system**

Flashcards of **brain, spinal cord, and nerves**

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: "What happens when you touch something very hot?"

Briefly explain that the **nervous system** helps us **receive and respond to information**.

2. Explanation (Direct Instruction) (15 minutes)

Introduce the **nervous system** and its main parts:

Brain → Controls all body actions and thoughts.

Spinal Cord → Sends messages between the brain and body.

Nerves → Carry signals to different body parts.

Show a **nervous system model** and explain its function.

3. Guided Practice (10 minutes)

Show **flashcards** of the brain, spinal cord, and nerves.

Ask students to **identify the function** of each.

4. Independent Practice (5 minutes)

Students **draw and label** the nervous system.

5. Conclusion & Assessment (5 minutes)

Recap: **Brain, spinal cord, and nerves work together to receive and respond to information.**

Ask:

Which organ processes all information?

What is the function of the spinal cord?

Lesson Plan 4

Receiving Information

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Identify **sensory organs** and their roles in detecting stimuli.

Explain how the **brain interprets information** from sensory organs.

Materials Needed:

Sensory activity materials (**hot/cold objects, flashlight, bell**)

Pictures of **eye, ear, skin, tongue, nose**

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: "How do you know if a fruit is sweet or sour?"

Explain that **sensory organs** help us **receive information** from the environment.

2. Explanation (Direct Instruction) (15 minutes)

Discuss the **five sensory organs**:

Eyes (sight) → Detect light and colors.

Ears (hearing) → Detect sound.

Skin (touch) → Detect temperature, pain, and pressure.

Tongue (taste) → Detects sweet, salty, sour, and bitter.

Nose (smell) → Detects different scents.

Explain how the **brain processes signals from these organs**.

3. Guided Practice (10 minutes)

Conduct a **sensory experiment**:

Show a **flashlight** → Ask students what they see.

Ring a **bell** → Ask them how they hear sounds.

Let them **touch a warm and a cold object** → Ask how they feel temperature.

Discuss how **sensory organs send messages to the brain**.

4. Independent Practice (5 minutes)

Students **match sensory organs** with their **functions** using a worksheet.

5. Conclusion & Assessment (5 minutes)

Recap: **Sensory organs help us detect information, and the brain processes it.**

Ask:

Which organ helps us hear?

How does the skin help us feel things?

Assign homework: List three ways sensory organs help in daily life.

Lesson Plan 5

Human Respiratory System

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Identify the **main parts** of the respiratory system.

Explain the **function of lungs** in breathing.

Materials Needed:

Model of **human lungs**

Chart of the **respiratory system**

Balloons (for lung activity)

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: *"What happens when we breathe?"*

Explain that **oxygen is essential** for our survival.

2. Explanation (Direct Instruction) (15 minutes)

Discuss the **main parts** of the respiratory system:

Nose → Filters air.

Trachea → Carries air to the lungs.

Lungs → Help in breathing.

Diaphragm → Helps air move in and out.

Explain **gas exchange**: Oxygen enters, and carbon dioxide exits.

3. Guided Practice (10 minutes)

Demonstrate lung function using **balloons**:

Inflate = Lungs **fill with air**.

Deflate = Lungs **release air**.

4. Independent Practice (5 minutes)

Students **label a diagram** of the respiratory system.

5. Conclusion & Assessment (5 minutes)

Recap: **Parts and function of the respiratory system.**

Ask:

Why do we need oxygen?

What happens when we exhale?

Assign homework: **Write two ways to keep your lungs healthy.**

Lesson Plan 6

Human Respiratory System

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Explain how **inhalation and exhalation** occur.

Understand the **role of the diaphragm** in breathing.

Materials Needed:

Plastic bottle lung model (to show breathing)

Chart of **inhalation and exhalation**

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: *"Why do we breathe?"*

Explain that breathing is **an automatic process** controlled by the **diaphragm**.

2. Explanation (Direct Instruction) (15 minutes)

Explain the **breathing process**:

Inhalation (breathing in) → Lungs expand, oxygen enters.

Exhalation (breathing out) → Lungs contract, carbon dioxide exits.

Discuss the **role of the diaphragm** in breathing.

3. Guided Practice (10 minutes)

Demonstrate breathing using a **plastic bottle lung model**.

Show how the **diaphragm moves** during inhalation and exhalation.

4. Independent Practice (5 minutes)

Students **write one key function** of the diaphragm.

5. Conclusion & Assessment (5 minutes)

Recap: **How the breathing process works.**

Ask:

What happens to our lungs when we inhale?

What is the function of the diaphragm?

Assign homework: **Write three healthy habits for strong lungs.**

Lesson Plan 7

Human Circulatory System

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Explain the **function of the heart, blood, and blood vessels.**

Describe the **importance of circulation** in the body.

Materials Needed:

Model of the heart

Diagram of the circulatory system

Red and blue paper (to represent oxygen-rich and oxygen-poor blood)

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: *"How does blood move in our body?"*

Explain that the **heart pumps blood** to all parts of the body.

2. Explanation (Direct Instruction) (15 minutes)

Discuss the **main parts of the circulatory system**:

Heart → Pumps blood.

Blood → Carries oxygen and nutrients.

Arteries & Veins → Transport blood.

Explain the **difference between arteries and veins**:

Arteries carry **oxygen-rich blood** (except pulmonary artery).

Veins carry **oxygen-poor blood** (except pulmonary vein).

3. Guided Practice (10 minutes)

Use **colored paper** to show how blood moves through the body.

Demonstrate how the **heart beats** and pumps blood.

4. Independent Practice (5 minutes)

Students **label the parts of the heart** on a diagram.

5. Conclusion & Assessment (5 minutes)

Recap the **importance of circulation** in keeping us healthy.

Ask:

What is the main function of blood?

Why is the heart important?

Assign homework: Draw and label the circulatory system.

Lesson Plan 8

Human Circulatory System

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Explain **how blood circulates** through the body.

Describe the **role of the heart in circulation.**

Materials Needed:

Diagram of blood circulation

Heartbeat sound recording

Stopwatch for pulse activity

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: *"What happens when we run fast?"*

Let students check their **pulse rate** and discuss why it increases.

Explain that **blood circulation speeds up** during physical activity.

2. Explanation (Direct Instruction) (15 minutes)

Describe the **circulation process**:

The **heart pumps blood** through **arteries** to the body.

The **veins return oxygen-poor blood** to the heart.

The **lungs remove carbon dioxide** and add oxygen.

Explain the **heartbeat cycle** and how blood moves in a **loop.**

3. Guided Practice (10 minutes)

Students **listen to a heartbeat recording** and feel their own pulse.

Demonstrate how the heart works using a **simple hand-clapping activity** (open = fill with blood, close = pump out).

4. Independent Practice (5 minutes)

Students answer: **"Why does pulse rate change?"**

5. Conclusion & Assessment (5 minutes)

Recap **how blood circulates** in the body.

Ask:

What carries oxygen in the blood?

Why do we need circulation?

Assign homework: **Write three ways to keep the heart healthy.**

CHAPTER NO 2 Life of Unseen

Lesson Plan 9

Main Groups of Microorganisms

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Identify **main types of microorganisms**.

Explain their **characteristics and uses**.

Materials Needed:

Microscope images of bacteria, fungi, protozoa, and viruses

Chart showing microorganism types

Lesson Structure:

1. Introduction (5 minutes)

Ask: "Have you heard of bacteria or viruses?"

Explain that microorganisms are **tiny living things**.

2. Explanation (15 minutes)

Discuss **four main types**:

Bacteria → Some are useful, some cause diseases

Viruses → Cause diseases like flu

Fungi → Includes mold and yeast

Protozoa → Found in water, some cause malaria

3. Guided Practice (10 minutes)

Show images of **different microorganisms** and discuss their uses.

4. Independent Practice (5 minutes)

Students match **microorganisms to their characteristics**.

5. Conclusion & Assessment (5 minutes)

Recap **types of microorganisms**.

Ask:

Which microorganism is used to make yogurt?

Which microorganism causes flu?

Assign homework: **Find one useful and one harmful microorganism.**

Homework: Write a short paragraph about how you can reduce sugar in your daily diet.

Lesson Plan 10

Spread of Infectious Diseases & Transmission to Humans

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Define **infectious diseases.**

Explain **how diseases spread through air, water, contact, and insects.**

Materials Needed:

Chart of disease transmission

Whiteboard & markers

Pictures of germs, mosquitoes, and dirty water

Lesson Structure:

1. Introduction (5 minutes)

Ask: *"Have you ever caught a cold from someone in your family?"*

Explain that **infectious diseases spread from person to person.**

2. Explanation (Direct Instruction) (15 minutes)

Discuss **four main ways diseases spread**:

Airborne: Sneezing, coughing (e.g., flu, COVID-19).

Waterborne: Dirty water (e.g., cholera).

Direct Contact: Touching infected skin (e.g., ringworm).

Insects: Mosquito bites (e.g., malaria, dengue).

Show **pictures** of germs and how they spread.

3. Guided Practice (10 minutes)

Divide students into **four groups.**

Each group **acts out a mode of transmission** (sneezing, drinking dirty water, shaking hands, mosquito bite).

4. Independent Practice (5 minutes)

Students match **diseases** with their **modes of transmission** in a worksheet.

5. Conclusion & Assessment (5 minutes)

Recap:

How do diseases spread?

Which mode of transmission is most common?

Ask:

Why do we cover our mouth when we cough?

Why should we drink clean water?

Assign homework: **List three daily habits to prevent diseases.**

Lesson Plan 11

Spread of Infectious Diseases & Transmission to Humans

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Explain **ways to prevent disease transmission.**

Describe the **importance of hygiene and vaccinations.**

Materials Needed:

Handwashing poster

Video on hygiene practices

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: *"Why do doctors say 'wash your hands'?"*

Explain that **germs spread easily but can be prevented.**

2. Explanation (Direct Instruction) (15 minutes)

Discuss **four key ways to prevent infections**:

Handwashing: Removes germs before they spread.

Vaccinations: Protect against diseases (e.g., polio, flu).

Mosquito control: Use nets, spray repellents.

Clean water: Boil or filter before drinking.

Show **a handwashing poster** and explain steps.

3. Guided Practice (10 minutes)

Show a **short video** on handwashing and hygiene.

Demonstrate proper handwashing using a **bowl of water and soap.**

4. Independent Practice (5 minutes)

Students write **three rules** to prevent disease spread.

5. Conclusion & Assessment (5 minutes)

Recap key points:

Hygiene and vaccines help prevent diseases.

Mosquito control stops insect-borne infections.

Ask:

Why should we wash our hands before eating?

How do vaccines help us?

Assign homework: **Write three ways your family prevents infections.**

Lesson Plan 12

Prevention of Infectious Diseases

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Identify ways to **prevent infectious diseases**.

Explain the importance of **vaccination, hygiene, and sanitation**.

Materials Needed:

Posters of hygiene practices

Soap, water, and sanitizer

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: "What do you do to stay healthy?"

Explain that **prevention is better than cure**.

2. Explanation (Direct Instruction) (15 minutes)

Discuss **main prevention methods**:

Personal hygiene (handwashing, covering mouth)

Vaccination (polio, measles)

Sanitation (clean water, proper waste disposal)

3. Guided Practice (10 minutes)

Demonstrate **proper handwashing technique**.

Show **posters** on how vaccines protect people.

4. Independent Practice (5 minutes)

Students write **two ways to prevent diseases**.

5. Conclusion & Assessment (5 minutes)

Recap key points.

Ask:

Why is handwashing important?

What is the role of vaccines?

Assign homework: **Make a poster on disease prevention methods.**

Lesson Plan 13

Prevention Against Insect Bites

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Explain how insect bites can cause diseases.

Identify methods to **prevent insect bites**.

Understand the role of **mosquitoes, ticks, and fleas** in spreading diseases.

Materials Needed:

Chart of insect-borne diseases

Mosquito net and insect repellent

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: "Have you ever been bitten by a mosquito? What happened?"

Explain how **some insect bites** can cause serious diseases.

2. Explanation (Direct Instruction) (15 minutes)

Discuss **diseases caused by insects**:

Mosquitoes → Malaria, Dengue

Ticks → Lyme disease

Fleas → Plague

Explain **prevention methods**:

Using **mosquito nets**

Wearing **long-sleeved clothes**

Applying **insect repellents**

3. Guided Practice (10 minutes)

Show how **mosquito nets and repellents** work.

Ask students to suggest **other ways** to prevent insect bites.

4. Independent Practice (5 minutes)

Students **write three ways** to avoid insect bites.

5. Conclusion & Assessment (5 minutes)

Recap key points.

Ask:

Why should we cover stagnant water?

What can we do at home to prevent mosquito bites?

Assign homework: **Draw and label three ways to prevent insect bites.**

Lesson Plan 14

Useful Role of Microorganisms

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Explain how microorganisms are **useful** in daily life.

Identify microorganisms used in **food production, medicine, and environment**.

Materials Needed:

Pictures of yeast, bacteria, and fungi

Chart of food made by microorganisms

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: "Did you know that microorganisms help make bread and yogurt?"

Explain that **not all microorganisms** are harmful.

2. Explanation (Direct Instruction) (15 minutes)

Explain **how microorganisms are useful**:

Food production (Yeast → Bread, Bacteria → Yogurt, Cheese)

Medicine (Penicillium → Antibiotics)

Environment (Bacteria → Decomposing waste)

3. Guided Practice (10 minutes)

Show pictures of **useful microorganisms**.

Ask students to **name foods that need microorganisms**.

4. Independent Practice (5 minutes)

Students match **microorganisms** to their **useful role**.

5. Conclusion & Assessment (5 minutes)

Recap **the role of microorganisms**.

Ask:

Which microorganism is used to make bread?

What medicine is made from fungi?

Assign homework: **Write three ways microorganisms help us.**

Lesson Plan 15

Role of Microorganisms as Decomposers

Grade: 5

Subject: Science

Duration: 40 minutes

Objectives:

Explain how microorganisms **break down dead matter**.

Identify the **role of decomposers** in nature.

Materials Needed:

Soil samples with decomposed leaves

Chart showing the decomposition process

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: "What happens to dead plants and animals?"

Explain that **microorganisms help decompose them**.

2. Explanation (Direct Instruction) (15 minutes)

Discuss **the role of decomposers**:

Break down dead organisms

Return nutrients to the soil

Help plants grow

Examples of decomposers:

Bacteria, Fungi, and Earthworms

3. Guided Practice (10 minutes)

Show **soil samples with decomposed leaves**.

Ask students: "What do you think happened to these leaves?"

4. Independent Practice (5 minutes)

Students draw the **cycle of decomposition**.

5. Conclusion & Assessment (5 minutes)

Recap **how decomposers help nature**.

Ask:

Why are decomposers important?

What happens if decomposers disappear?

Assign homework: **Find and describe one example of decomposition in nature.**

Lesson plan 16

Defense Mechanisms Against Infectious Diseases

Grade:5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Explain **how the immune system fights diseases.**

Describe the **role of white blood cells in protecting the body.**

Materials Needed:

Picture of a shield and a soldier

Diagram of the immune system

Flashcards with immune system terms

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Show a **picture of a shield and a soldier.**

Ask: *"How does a shield protect a soldier?"*

Explain that our **immune system protects us like a shield against germs.**

2. Explanation (Direct Instruction) (15 minutes)

Discuss **how the immune system works**:

White Blood Cells → Attack and destroy harmful germs.

Antibodies → Help the body recognize and fight diseases.

Vaccination → Trains the immune system to fight specific infections.

Use **a diagram** to show how white blood cells attack germs.

3. Guided Practice (10 minutes)

Divide the class into **small groups.**

Each group **discusses** one immune system defense and shares their understanding.

4. Independent Practice (5 minutes)

Students **fill in the blanks** on a worksheet about the immune system.

5. Conclusion & Assessment (5 minutes)

Recap key points:

The **immune system fights diseases** using white blood cells and antibodies.

Vaccines help the immune system prepare for infections.

Ask:

What is the function of white blood cells?

How do vaccines help protect us?

Assign homework: **Draw and label three parts of the immune system.**

Lesson Plan 17

Defense Mechanisms Against Infectious Diseases

Grade:5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Explain **how vaccines help protect the body from diseases.**

Describe **how the immune system remembers infections.**

Materials Needed:

Picture of a vaccine and a syringe

Video clip on how vaccines work (optional)

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Show a **picture of a vaccine** and ask:

"Why do we get vaccines?"

Explain that **vaccines prepare the body to fight germs before we get sick.**

2. Explanation (Direct Instruction) (15 minutes)

Discuss **how vaccines help the immune system**:

Vaccines contain weak or dead germs that train white blood cells.

The body **produces antibodies** that stay ready for future infections.

People with vaccines **recover faster** or don't get sick at all.

3. Guided Practice (10 minutes)

Students **act out** how vaccines work:

One student = "Germ"

One student = "Vaccine"

One student = "Immune System Fighter" (white blood cells)

4. Independent Practice (5 minutes)

Students answer:

Why do doctors recommend vaccines?

5. Conclusion & Assessment (5 minutes)

Recap key points:

Vaccines train the immune system to fight diseases.

The body remembers germs to fight them better next time.

Ask:

Why do vaccines help prevent diseases?

How do antibodies protect us?

Assign homework: **Write a short paragraph explaining how vaccines work.**

Lesson Plan 17

Defense Mechanisms Against Infectious Diseases

Grade:5

Subject: Science

Chapter: Life of Unseen

Duration: 40 minutes

Objectives:

Explain **how vaccines help protect the body from diseases.**

Describe **how the immune system remembers infections.**

Materials Needed:

Picture of a vaccine and a syringe

Video clip on how vaccines work (optional)

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Show a **picture of a vaccine** and ask:

"Why do we get vaccines?"

Explain that **vaccines prepare the body to fight germs before we get sick.**

2. Explanation (Direct Instruction) (15 minutes)

Discuss **how vaccines help the immune system**:

Vaccines contain weak or dead germs that train white blood cells.

The body **produces antibodies** that stay ready for future infections.

People with vaccines **recover faster** or don’t get sick at all.

3. Guided Practice (10 minutes)

Students **act out** how vaccines work:

One student = "Germ"

One student = "Vaccine"

One student = "Immune System Fighter" (white blood cells)

4. Independent Practice (5 minutes)

Students answer:

Why do doctors recommend vaccines?

5. Conclusion & Assessment (5 minutes)

Recap key points:

Vaccines train the immune system to fight diseases.

The body remembers germs to fight them better next time.

Ask:

Why do vaccines help prevent diseases?

How do antibodies protect us?

Assign homework: **Write a short paragraph explaining how vaccines work.**

Lesson Plan 19

Effects of Too Much Sugar in Food

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Identify the **effects of too much sugar** on health.

Understand the **importance of balanced eating**.

Materials Needed:

Chart of **sugar content** in foods

Sugar cubes to demonstrate daily intake

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: "Do you like sweets? What happens if you eat too much?"

Explain **sugar's effects on health**.

2. Explanation (Direct Instruction) (15 minutes)

Effects of too much sugar:

Tooth decay

Obesity & diabetes

Lack of energy

Healthy alternatives: **Fruits, honey, balanced diet**

3. Guided Practice (10 minutes)

Show different **food items** and their **sugar content**.

Ask students to guess **which food has the most sugar**.

4. Independent Practice (5 minutes)

Students complete a **food log** tracking their sugar intake for one day.

5. Conclusion & Assessment (5 minutes)

Recap **negative effects of sugar**.

Ask:

Why is sugar bad for teeth?

What can we eat instead of sweets?

Assign homework: **Write one way to reduce sugar in your diet.**

Lesson Plan 20

Effects of Too Much Sugar in Food

Grade:5

Subject: Science

Duration: 40 minutes

Objectives:

Identify the **effects of too much sugar** on health.

Understand the **importance of balanced eating**.

Materials Needed:

Chart of **sugar content** in foods

Sugar cubes to demonstrate daily intake

Whiteboard & markers

Lesson Structure:

1. Introduction (5 minutes)

Ask: "Do you like sweets? What happens if you eat too much?"

Explain **sugar's effects on health**.

2. Explanation (Direct Instruction) (15 minutes)

Effects of too much sugar:

Tooth decay

Obesity & diabetes

Lack of energy

Healthy alternatives: **Fruits, honey, balanced diet**

3. Guided Practice (10 minutes)

Show different **food items** and their **sugar content**.

Ask students to guess **which food has the most sugar**.

4. Independent Practice (5 minutes)

Students complete a **food log** tracking their sugar intake for one day.

5. Conclusion & Assessment (5 minutes)

Recap **negative effects of sugar**.

Ask:

Why is sugar bad for teeth?

What can we eat instead of sweets?

Assign homework: **Write one way to reduce sugar in your diet.**

7.3 Appendix C: Table of Specification (TOS) for the Achievement Test

Table 7.3

Table of Specification

Content Areas	Knowledge (40%) (MCQs)	Comprehension (40%) (MCQs)	Application (20%) (MCQs)	Total Items
Inside the Human Body	3, 5, 8, 10, 11, 12, 13, 14, 23, 25	1, 2, 4, 6, 7, 9, 15, 16, 17, 18	19, 20, 21, 22, 24	25
Life of Unseen	27, 29, 30, 32, 36, 37, 38, 39, 47, 50	26, 28, 31, 33, 34, 35, 40, 41, 42, 43	44, 45, 46, 48, 49	25
Grand Total	20	20	10	**50**

Table 7.4

Rubric for MCQs (Academic Achievement Assessment)

Score Range	Performance Level
90 – 100% (45 – 50 correct answers)	Excellent
80 – 89% (40 – 44 correct answers)	Very Good
70 – 79% (35 – 39 correct answers)	Good
60 – 69% (30 – 34 correct answers)	Satisfactory
50 – 59% (25 – 29 correct answers)	Needs Improvement
Below 50% (0 – 24 correct answers)	Unsatisfactory

7.4 Appendix D: Pre-test and Post-test MCQs with Answer Keys

Self-Developed Achievement Test

This achievement test is developed by the researcher to measure students' academic achievement in the context of collaborative learning. The test specifically assesses students' understanding of Grade 5 **Science Exploration** concepts, with a structure aligned with key learning objectives. During the 8-week intervention, students engage in group projects, problem-solving tasks, and peer tutoring, but the test itself is focused on evaluating their academic achievement.

The test consists of 50 multiple-choice questions (MCQs) aligned with the Grade 5 **Science Exploration** curriculum, covering:

- **Unit 1: Inside the Human Body**
- **Unit 2: Life of Unseen**

This test serves as both a pre-test and post-test to evaluate students' academic achievements before and after the intervention.

- **Grade**: 5th
- **Chapters**: Inside the Human Body, Life of Unseen
- **Total Marks**: 50
- **Time**: 1 hour
- **Focus**: Academic Achievement

Multiple Choice Questions (MCQs) (Each question carries 1 mark. Total = 50 marks)

Unit 1: Inside the Human Body

Encircle the correct answer

1. **How are the respiratory and circulatory systems integrated?**
   a) The circulatory system transports oxygen from the lungs to body cells
   b) The respiratory system pumps blood to different body organs
   c) The circulatory system removes carbon dioxide from the lungs
   d) The respiratory system digests food and provides energy
2. **How does the human body receive and respond to specific information?**
   a) Through the circulatory system
   b) Through the nervous system
   c) Through the digestive system
   d) Through the muscular system
3. **Which of the following is NOT a part of the human respiratory system?**
   a) Trachea
   b) Lungs
   c) Esophagus
   d) Bronchi
4. **Why are the lungs spongy?**
   a) Because they store blood
   b) To hold a large amount of air for gas exchange
   c) To keep the heart protected
   d) To remove waste from the body
5. **Where does the exchange of gases occur in the human lungs?**
   a) In the trachea
   b) In the alveoli
   c) In the bronchi
   d) In the diaphragm
6. **During inhalation, the diaphragm:**
   a) Moves downward, expanding the chest cavity
   b) Moves upward, reducing lung capacity

c) Stays in the same position

d) Contracts and pushes air out of the lungs

7. **Why do humans need a blood circulatory system?**

a) To pump air throughout the body

b) To transport oxygen, nutrients, and waste materials

c) To digest food properly

d) To control body temperature only

8. **Which organ pumps blood throughout the body?**

a) Lungs

b) Liver

c) Heart

d) Kidneys

9. **What is the function of blood vessels?**

a) They store oxygen for later use.

b) They transport blood to different parts of the body.

c) They break down food into nutrients.

d) They control brain activity.

10. **Which type of blood cells help in oxygen transport?**

a) White blood cells

b) Red blood cells

c) Platelets

d) Nerve cells

11. **Which blood cells help fight infections?**

a) Red blood cells

b) Platelets

c) White blood cells

d) Plasma

12. **Which blood component helps in clotting?**

a) Red blood cells

b) White blood cells

c) Platelets

d) Plasma

13. **What do animals need from air?**

a) Carbon dioxide

b) Oxygen

c) Nitrogen

d) Helium

14. **Which gas is present in exhaled air in large amounts?**

a) Oxygen

b) Carbon dioxide

c) Nitrogen

d) Hydrogen

15. **How does air move in our body?**

a) Through the bloodstream

b) Through the respiratory system (nose, trachea, lungs)

c) Through the skin

d) Through the stomach

16. **How do the lungs work?**

a) They store food for digestion

b) They exchange oxygen and carbon dioxide in the blood.

c) They pump blood throughout the body

d) They help in breaking down proteins

a. **Which system controls the activities of the body?**

a) nervous system

b) digestive system

c) skeletal system

d) muscular system

17. **Which system enables the movement in the body?**

a) muscular system

b) nervous system

c) respiratory system

d) digestive system

18. **The respiratory system consists of the lungs, the trachea, and the:**

a) liver

b) diaphragm

c) pancreas

d) oesophagus

19. **When you breathe in air, you bring oxygen into your lungs and give out:**

a) oxygen

b) hydrogen

c) carbon monoxide

d) carbon dioxide

20. **When you inhale your lungs :**

a) expand

b) contract

c) become hard

d) become spongy

21. **The trachea is also called the:**

a) lung

b) diaphragm

c) windpipe

d) air passageway

22. **How many chambers does the human heart have?**

a) two

b) three

c) four

d) five

23. **The movement of blood through the human heart and body is called:**

a) circulation

b) locomotion

c) ventilation

d) heart pump

24. **Which type of blood vessel carries blood away from the heart?**

a) veins

b) arteries

c) capillaries

d) arteries and veins

Unit 2: Life of Unseen

25. **If you have flu, what you do to keep others safe from infection?**
    a) exercise
    b) sleep for more time
    c) sit in the sun
    d) wear a mask
26. **Which one of the following causes polio?**
    a) bacteria
    b) virus
    c) housefly
    d) mosquito
27. **Mainly, protection against infectious diseases is done by:**
    a) wearing a mask, washing hands, vaccination
    b) wearing a mask, washing hands, sunbathing
    c) washing hands, sunbathing, sleeping more
    d) vaccination, washing hands, staying indoors
28. **To which group of microorganisms do mushrooms belong?**
    a) virus
    b) fungi
    c) bacteria
    d) protozoa
29. **Penicillium is an example of which group?**
    a) protozoa
    b) fungi
    c) bacteria
    d) virus
30. **Which one of the following contaminates food?**
    a) moisture
    b) microorganisms

c) air

d) heat

31. **Which one of the following is NOT a microorganism?**

a) bacteria

b) virus

c) protozoa

d) ant

32. **What is one way that bacteria can be helpful?**

a) They live on spoiled food

b) They can make us sick

c) They help to break down dead leaves in soil

d) They like to eat sweet foods

33. **Where can microorganisms be found?**

a) in water

b) in air

c) all around us

d) in animals

34. **Microorganisms also help in the production of food like:**

a) bread

b) fruits and seeds

c) vegetables

d) pulses

35. **What are microorganisms?**

a) Large organisms

b) Tiny living things

c) Non-living particles

d) Large bacteria

36. **Which is NOT a microorganism group?**

a) Bacteria

b) Fungi

c) Plants

d) Protozoa

37. **Which disease is caused by a virus?**

a) Tuberculosis

b) Malaria

c) Influenza

d) Ringworm

38. **How do microbes enter humans?**

a) Food & water

b) Air & contact

c) Insect bites

d) All of these

39. **Infectious diseases:**

a) Spread between people

b) Never caused by bacteria

c) Are always fatal

d) Don’t spread

40. **Which prevents infections?**

a) Handwashing

b) Vaccines

c) Masks

d) All

41. **How do vaccines work?**

a) Kill microbes

b) Boost immunity

c) Cure infections

d) Stop symptoms

42. **What is the skin’s role?**

a) Allows entry of germs

b) Releases chemicals

c) Acts as a barrier

d) Absorbs bacteria

43. **A benefit of microbes:**

a) Cause diseases

b) Help make food

c) Pollute air

d) Stop digestion

44. **Bacteria decompose by:**

a) Producing oxygen

b) Breaking down dead matter

c) Infecting animals

d) Polluting soil

45. **A harmful effect of bacteria:**

a) Decomposing waste

b) Aiding digestion

c) Causing TB

d) Making medicine

46. **Fungi cause:**

a) Cold

b) Ringworm

c) TB

d) Malaria

47. **Which doesn’t prevent disease?**

a) Vaccination

b) Handwashing

c) Drinking dirty water

d) Disinfecting

48. **Stomach acid helps by:**

a) Breaking food

b) Killing germs

c) Helping digestion

d) Producing bacteria

49. **Mucus in the lungs:**

a) Absorbs oxygen

b) Traps germs

c) Produces bacteria

d) Blocks air

50. **Which part of the respiratory system allows the exchange of oxygen and carbon dioxide?**

a) Trachea

b) Bronchi

c) Alveoli

d) Mucus

Answer Key

Q#	Ans	Q#	Ans	Q#	Ans	Q#	Ans
1	a	2	b	3	c	4	b
5	b	6	a	7	b	8	c
9	b	10	b	11	c	12	c
13	b	14	b	15	b	16	b
17	a	18	a	19	b	20	d
21	a	22	c	23	c	24	a
25	b	26	d	27	b	28	a
29	b	30	b	31	b	32	d
33	c	34	c	35	a	36	b
37	c	38	c	39	d	40	a
41	d	42	b	43	c	44	b
45	b	46	c	47	b	48	c
49	b	50	c				

7.5 Appendix E: Instruments Validation Certificates

Certificate of Validation

Effect of Collaborative Learning on Academic Achievement of Primary School Students

By

Saba Sakhi

MS Scholar Department of Teacher Education, Faculty of Education, International Islamic University Islamabad(IIUI), Pakistan.

This is to certify that the researcher developed an instrument has been assessed by me, and I found that it has been designed adequately to address the title "Effect of Collaborative Learning on Academic Achievement of Primary School Students"

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Certificate of Validation

Effect of Collaborative Learning on Academic Achievement of Primary School Students

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