# Effectiveness of Interactive Audio Lessons in Grade 6 Social Science among Children with Special Needs

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**CERTIFIED AS BONAFIDE RESEARCH WORK**

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## DECLARATION

I, **AAIYSHABANU. A**, hereby declare that the thesis entitled **"Effectiveness on Interactive Audiolessons in Grade 6 Social Science Among Children with Special Needs"** submitted to Avinashilingam Institute for Home Science and a Higher Education for Women, Coimbatore, in partial fulfillment of the requirements for the award of the **Degree of Master of Education,** is a record of original and independent research work done by me during the period under the supervision and guidance of **Dr. C KARTHIKDEEPA, Assistant Professor , Department of Education,** Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, and it has not formed the basis for the award of any Degree/ Diploma/ Associateship/ Fellowship or other similar title to any candidate of this or any other University.

for C. Karthikdeepa

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# Chapter 1: Introduction

# CHAPTER I
# INTRODUCTION

## 1.1 Introduction

Audio-based instructional strategies have emerged as a powerful pedagogical approach in inclusive education, particularly for learners with visual impairment who depend primarily on auditory input for accessing academic content. According to the principles of Universal Design for Learning (UDL), providing multiple means of representation—especially auditory modes—enhances accessibility and supports diverse learners by minimizing barriers to learning (Rose & Meyer, 2002). For visually impaired learners, audio-based instruction is not merely supportive but essential, as it compensates for the absence of visual input and enables equitable participation in classroom learning.

Research in cognitive psychology further supports the effectiveness of auditory learning. The Cognitive Theory of Multimedia Learning posits that learners process information through dual channels—auditory and visual—and that optimizing the auditory channel can significantly enhance comprehension when visual input is limited or unavailable (Mayer, 2009). In the case of visually impaired learners, the auditory channel becomes the primary pathway for information processing, thereby increasing the instructional value of well-designed audio lessons.

Interactive audio lessons, which integrate elements such as voice modulation, repetition, rephrasing, spelling cues, and embedded questioning, provide structured and meaningful auditory input. Studies indicate that repetition and rephrasing improve retention and facilitate deeper cognitive processing by reinforcing neural pathways associated with memory and understanding (Baddeley, 1992). Additionally, embedded questioning promotes active engagement and retrieval practice, which are critical for long-term learning (Roediger & Karpicke, 2006).

Empirical research highlights that audio-assisted learning environments significantly enhance comprehension, engagement, and recall among visually impaired learners by transforming visual information into structured auditory experiences (Griffin, Picinali, & Scase, 2020). Similarly, audio-based assistive technologies such as screen readers, audiobooks, and recorded lessons have been found to improve academic performance by reducing dependence

on print-based materials and enabling independent learning (Holmes & Silvestri, 2012; Cavanaugh, 2002).

Further, Cappagli et al. (2019) demonstrated that structured audio-based training enhances not only academic learning but also cognitive and perceptual abilities among visually impaired children, indicating the broader developmental impact of auditory instructional approaches.

Social Science education at the upper primary level presents unique challenges due to its abstract nature, inclusion of historical events, geographical concepts, and reliance on visual representations such as maps, charts, and diagrams. For students with visual impairment, these visual dependencies can significantly hinder comprehension unless content is adapted into accessible formats. Audio-based instruction, when designed interactively, enables the sequential presentation of information, descriptive narration of visual content, and reinforcement of key concepts, thereby supporting meaningful learning.

Despite the increasing integration of assistive technologies in education, existing research has largely focused on general audio tools such as audiobooks and screen readers, with limited emphasis on structured interactive audio lessons as a pedagogical intervention in subject-specific contexts like Social Science (Fernández-Batanero et al., 2022). Moreover, there is a scarcity of empirical studies conducted at the upper primary level, particularly within the Indian educational context that evaluate the effectiveness of such interventions for visually impaired learners.

Therefore, the present study attempts to address this research gap by systematically examining the effectiveness of interactive audio lessons in enhancing the academic achievement of Grade 6 students with visual impairment in Social Science. The study also seeks to contribute to evidence-based inclusive pedagogical practices by demonstrating how audio-based instructional strategies can support equitable and meaningful learning experiences.

### 1.2 Need and Significance of the Study

Conventional textbook-based instruction in Social Science often proves insufficient in addressing the diverse learning needs of students, particularly children with special needs

such as visual impairment. Social Science content at the upper primary level is characterized by abstract concepts, extensive factual information, historical dates, and unfamiliar names, which are difficult for many learners to comprehend and retain through visual-textual methods alone. For children with special needs, especially those with visual impairment, dependence on printed textbooks creates significant barriers to access, thereby limiting their participation and academic achievement in classroom learning.

In line with inclusive education frameworks such as Universal Design for Learning (Rose & Meyer, 2002), there is a need to provide alternative modes of content delivery that ensure equitable access for learners with special needs. Interactive audio lessons incorporating voice modulation, repetition, rephrasing, spelling, and questioning can stimulate active cognitive processing, sustain attention, and improve content retention. Research based on the Cognitive Theory of Multimedia Learning (Mayer, 2009) suggests that auditory channels can be effectively utilized to enhance comprehension, particularly for learners who are unable to rely on visual input.

Studies also indicate that structured auditory input, along with repetition and retrieval-based questioning, significantly enhances memory retention and conceptual understanding among learners with special needs (Baddeley, 1992; Roediger & Karpicke, 2006). Despite the growing emphasis on inclusive education in India, there remains limited empirical research specifically examining the effectiveness of interactive audio lessons in Social Science among children with special needs at the upper primary level.

Establishing evidence on the impact of such interventions is essential for informing inclusive pedagogical practices and educational policy. Furthermore, understanding how interactive audio instruction influences learners' achievement, motivation, and engagement can assist educators in designing accessible, learner-centered, and inclusive instructional strategies that support equitable learning opportunities for children with special needs.

### 1.3 Statement of Problem

In recent years, educational systems have increasingly emphasized the need to provide equitable learning opportunities for children with special needs, particularly those with visual impairment. However, conventional teaching methods in Social Science classrooms continue to rely predominantly on textbook-based instruction and teacher-led explanations, which are

largely visual in nature and often inaccessible to visually impaired learners. As a result, these students encounter significant challenges in accessing content, maintaining attention, and achieving meaningful comprehension (Singh & Verma, 2020; UNESCO, 2020).

Social Science at the upper primary level involves abstract concepts, historical narratives, geographical terminology, and cause–effect relationships that require effective representation for understanding. For children with visual impairment, the absence of accessible instructional formats restricts their ability to engage with such content, often leading to reduced academic achievement and limited participation in classroom learning (Fernández-Batanero et al., 2022).

Interactive audio lessons have emerged as a promising instructional approach for addressing these challenges. By incorporating structured narration, voice modulation, repetition, rephrasing, spelling cues, and embedded questioning, audio-based instruction can facilitate auditory processing, improve comprehension, and enhance retention among visually impaired learners (Mayer, 2009; Clark & Mayer, 2016). Such approaches align with the principles of Universal Design for Learning, which advocate the use of multiple means of representation to ensure accessibility for all learners (Rose & Meyer, 2002).

Despite the recognized potential of audio-based instructional strategies, there is a paucity of empirical research examining their effectiveness in teaching Social Science at the upper primary level, particularly among children with visual impairment. Most existing studies focus on language learning or general assistive technologies rather than subject-specific instructional interventions in Social Science.

Therefore, there is a clear need to investigate whether interactive audio lessons can effectively enhance the academic achievement of visually impaired students in Grade 6 Social Science.

Hence, the present study seeks to examine the effectiveness of interactive audio lessons in Grade 6 Social Science among children with special needs (visually impaired), in order to determine their impact on learning outcomes and to contribute to the development of accessible and inclusive instructional practices.

### 1.4 Operational Definitions of Key Terms:

- **Interactive Audio Lessons:** Interactive audio lessons refer to systematically designed, digitally recorded instructional materials aligned with the Tamil Nadu State Board Grade 6 Social Science curriculum.
    - These lessons incorporate pedagogical features such as voice modulation, repetition of key concepts, rephrasing for clarity, spelling support, and embedded questioning to facilitate active auditory engagement and comprehension among visually impaired learners (Clark & Mayer, 2016; Mayer, 2009).
- **Effectiveness:** Effectiveness refers to the extent to which the interactive audio lessons bring about measurable improvement in the academic achievement of visually impaired students in Grade 6 Social Science, as determined through their performance in a standardized achievement test administered after the instructional intervention.
- **Social Science Achievement:** Social Science achievement refers to the level of knowledge, conceptual understanding, and recall ability attained by Grade 6 visually impaired students in Social Science, as measured through scores obtained in the researcher-developed achievement test based on the prescribed syllabus.
- **Children with Special Needs:** In the context of the present study, children with special needs refer specifically to students with visual impairment (fully blind) who are identified through school records and are unable to access printed instructional materials independently.
    - These learners rely primarily on auditory and alternative sensory modes for learning and require accessible instructional formats such as audio-based content (WHO, 2019; UNESCO, 2020).

### 1.5 Variables of the Study

The present study includes independent and dependent variables**,** where the *interactive audio lessons* serve as the independent variable, and students' *academic achievement (pre-test and post-test scores)* and *perception toward audio lessons* constitute the dependent variables, with *gender* considered as a moderating variable for comparative analysis.

### 1.5.1 Independent Variable

The independent variable of the study is:

**Interactive Audio-Based Instruction** – This refers to the systematically developed audio lessons based on the Tamil Nadu State Board Grade 6 Social Science curriculum. The lessons incorporate instructional features such as voice modulation, repetition of key concepts, rephrasing of explanations, spelling support, and embedded questioning designed specifically to facilitate auditory learning among visually impaired students

### 1.5.2 Dependent Variables

- **Academic Achievement in Social Science**: Academic achievement refers to the level of learning attained by visually impaired students in Grade 6 Social Science after exposure to the instructional intervention.
    - It is measured through the scores obtained in the achievement test.
- **Learners' Opinion on Interactive Audio Lessons:** Learners' opinion refers to the perceptions, attitudes, and level of acceptance of visually impaired students toward the use of interactive audio lessons in learning Social Science.
    - It is measured using a structured opinionnaire developed by the researcher.

### 1.5.3 Demographic Variables

The following variable will be studied in relation to achievement and opinion scores:

- Gender (Male / Female)

## 1.6 Scope of the Study

The present study is confined to examining the effectiveness of interactive audio-based instructional lessons on the academic achievement and learners' opinion of Grade 6 students with visual impairment in Social Science. The study focuses on four selected lessons prescribed in the Tamil Nadu State Board Social Science textbook for Class VI.

The instructional intervention consists of investigator-developed interactive audio lessons incorporating pedagogical features such as voice modulation, repetition of key concepts, rephrasing for clarity, spelling support, and embedded questioning. These features are designed to facilitate auditory learning and enhance comprehension among visually impaired

learners, who primarily rely on auditory input for accessing academic content (Mayer, 2009; Clark & Mayer, 2016).

The sample for the study includes only students with special needs, specifically those who are fully visually impaired**,** identified through school records. These students are divided into two groups: an experimental group and a control group. The experimental group is exposed to interactive audio-based instruction, while the control group receives conventional teaching methods adapted for visually impaired learners, such as oral explanation and textbook-based narration.

The study also examines learners' opinion toward the use of interactive audio lessons and explores differences in achievement based on gender. The scope is therefore limited to evaluating both cognitive (achievement) and affective (opinion) outcomes of audio-based instruction within a specialized learner group.

### 1.7 Limitation of the Study

The present study has certain limitations that need to be acknowledged. The study is confined to selected schools following the Tamil Nadu State Board curriculum and is restricted to a specific geographical area, which may limit the generalizability of the findings.

The study includes only visually impaired (fully blind) students**,** and therefore, the findings may not be applicable to students with other types of disabilities such as learning disabilities or hearing impairment.

The variables considered in the study are limited to academic achievement in Social Science and learners' opinion on interactive audio lessons**,** along with gender as the only demographic variable**.** Other potentially influential variables such as socio-economic status, prior knowledge, and learning environment are not considered.

Additionally, the duration of the intervention is limited to selected lessons, which may not fully capture the long-term impact of interactive audio instruction on students' learning outcomes and retention.

### 1.8 Delimitation of the Study

The present study is delimited to a quantitative quasi-experimental research approach**,** employing achievement tests and an opinionnaire as tools for data collection.

The study is restricted to Grade 6 students following the Tamil Nadu State Board Social Science curriculum and is limited to four selected lessons. The instructional strategy is confined to investigator-developed interactive audio lessons with specific features such as voice modulation, repetition, rephrasing, spelling support, and embedded questioning.

Further, the study is delimited to children with special needs who are fully visually impaired**,** excluding students with other types of disabilities. This delimitation ensures homogeneity of the sample and allows for a focused investigation of the effectiveness of audio-based instruction for learners who primarily depend on auditory modes of learning (UNESCO, 2020; WHO, 2019).

The findings of the study are therefore limited to the selected sample, instructional method, and context, and their generalization is restricted to similar educational settings involving visually impaired learners.

### 1.9 Objectives

The objectives of the present study are as follows:

1. To determine the effectiveness of interactive audio lessons by comparing the pre-test and post-test achievement scores of visually impaired students in Social Science.
2. To examine whether there is any significant difference in the pre-test scores of visually impaired students based on gender.
3. To examine whether there is any significant difference in the post-test scores of visually impaired students based on gender.
4. To analyze whether there is any significant difference in the overall opinion scores on interactive audio lessons based on gender.
5. To find out the relationship between overall opinion scores on interactive audio lessons and post-test achievement scores of boys.
6. To find out the relationship between overall opinion scores on interactive audio lessons and post-test achievement scores of girls.

7. To examine the relationship between post-test achievement scores and different attributes of opinion on interactive audio lessons.
8. To analyze the relationship between post-test achievement scores and attributes of opinion on interactive audio lessons among boys.
9. To analyze the relationship between post-test achievement scores and attributes of opinion on interactive audio lessons among girls.

### 1.10 Research Hypotheses

The following null hypotheses were formulated for the present study:

1. There is no significant difference between the mean pre-test and post-test scores of visually impaired students in Social Science.
2. There is no significant difference in the mean pre-test scores of visually impaired students based on gender.
3. There is no significant difference in the mean post-test scores of visually impaired students based on gender.
4. There is no significant difference in the mean overall opinion scores on interactive audio lessons based on gender.
5. There is no significant relationship between overall opinion scores on interactive audio lessons and post-test achievement scores of boys.
6. There is no significant relationship between overall opinion scores on interactive audio lessons and post-test achievement scores of girls.
7. There is no significant relationship between post-test achievement scores and attributes of opinion on interactive audio lessons.
8. There is no significant relationship between post-test achievement scores and attributes of opinion on interactive audio lessons among boys.
9. There is no significant relationship between post-test achievement scores and attributes of opinion on interactive audio lessons among girls.

### 1.11 Organisation of the Thesis

The present study titled **"Effectiveness of Interactive Audio Lessons in Grade 6 Social Science among Children with and without Special Needs"** is organized into the following chapters:

**Chapter I: Introduction**

This chapter presents the background of the study, statement of the problem, need and significance of the study, objectives of the study, hypotheses, variables of the study, operational definitions of key terms, and the limitations and delimitations of the study.

**Chapter II: Review of Related Literature**

This chapter deals with the review of previous studies and literature related to interactive audio lessons, technology-based learning, Social Science teaching methods, and inclusive education for children with and without special needs. The review helps in understanding the research gap and provides a foundation for the present study.

**Chapter III: Methodology of the Study**

This chapter explains the research design, population and sample of the study, sampling technique, tools used for data collection, procedure of the study, and statistical techniques used for analyzing the data.

**Chapter IV: Analysis and Interpretation of Data**

This chapter presents the analysis and interpretation of the data collected from the sample using appropriate statistical methods. The results are presented through tables, charts, and explanations to test the hypotheses of the study.

**Chapter V: Summary, Findings, Conclusions, and Educational Implications**

This chapter provides the summary of the entire study, major findings, conclusions drawn from the results, educational implications, suggestions for teachers and educators, and recommendations for further research.

# Chapter 2: Review of Literature

# Chapter 2

# REVIEW OF LITERATURE

## 2.1 Introduction

Review of literature is a systematic and critical examination of previous research related to the problem under investigation. It provides insights into theoretical foundations, research trends, and empirical findings, thereby helping the researcher to identify gaps and justify the need for the present study.

In educational research, reviewing earlier studies is essential to understand the effectiveness of various instructional strategies and technological innovations in enhancing learning outcomes. With the advancement of educational technology, innovative approaches such as multimedia learning, assistive technologies, and audio-based instruction have gained importance, particularly in the context of inclusive education.

The present study focuses on the effectiveness of interactive audio lessons in Grade 6 Social Science among visually impaired students**.** Hence, the review is organized under the following themes:

- Audio-based learning
- Educational technology and multimedia learning
- Instructional strategies for visually impaired learners
- Interactive audio lessons
- Social Science teaching and learning
- Studies related to achievement and learner opinion

## 2.2 Audio-Based Learning in Education

Audio-based learning refers to the use of sound-based instructional materials such as audiobooks, recorded lessons, and podcasts to facilitate learning. It is particularly effective for learners who rely on auditory input.

Mayer (2009), through the Cognitive Theory of Multimedia Learning, emphasized that information processed through auditory channels enhances understanding, especially when

visual input is limited. Audio learning enables repetition, which strengthens memory retention and comprehension.

Clark and Mayer (2016) highlighted that well-designed audio instruction reduces cognitive overload and improves learning efficiency. They emphasized that structured narration, pacing, and reinforcement strategies are essential for effective audio learning.

Dale (1969), in the Cone of Experience, suggested that learning becomes more meaningful when multiple sensory channels are engaged. Audio serves as an important sensory medium that enhances conceptual clarity.

Thus, audio-based learning is a powerful instructional approach that supports comprehension, retention, and engagement.

### 2.3 Educational Technology and Inclusive Learning

Educational technology plays a significant role in addressing diverse learning needs and promoting inclusive education.

Rose and Meyer (2002), through the Universal Design for Learning (UDL) framework, emphasized the need for multiple means of representation to ensure accessibility for all learners. Audio-based materials are particularly important for visually impaired students as they provide alternative access to content.

Fernández-Batanero et al. (2022) found that assistive technologies significantly improve participation, accessibility, and academic performance among students with disabilities.

Lin and Riccomini (2024) reported that technology integration in inclusive classrooms enhances engagement and allows students with disabilities to actively participate in learning activities.

UNESCO (2020) also emphasized that inclusive education requires the integration of accessible digital tools, including audio resources, to ensure equitable learning opportunities.

These studies indicate that technology-based instruction, especially audio-based tools, is essential for inclusive education.

## 2.4 Instructional Strategies for Visually Impaired Learners

Visually impaired learners depend primarily on auditory and tactile modes of learning. Therefore, instructional strategies must be adapted to meet their needs.

Singh and Verma (2020) reported that audiobooks significantly improve access to educational content and enhance learning outcomes among visually impaired students.

Mangal and Mangal (2013) emphasized that audio-based instructional tools support comprehension by presenting information in accessible formats.

NCERT (2019) highlighted that audio resources play a crucial role in facilitating learning for visually impaired students in school education.

For visually impaired learners, audio instruction is not supplementary but essential, as it enables independent learning and improves academic participation.

## 2.5 Interactive Audio Lessons as an Instructional Strategy

Interactive audio lessons go beyond passive listening by incorporating elements such as questioning, repetition, and learner engagement.

Hanum et al. (2023) developed interactive audio learning materials and found that they significantly improved student engagement and motivation.

Clark and Mayer (2016) emphasized that interactivity in instructional materials enhances active learning and improves retention.

Jonassen (2011) suggested that interactive technologies promote meaningful learning by encouraging learners to think, respond, and engage actively with content.

Interactive audio lessons, therefore, provide a dynamic learning experience that supports both cognitive and affective learning outcomes.

## 2.6 Teaching of Social Science at the Upper Primary Level

Social Science is a complex subject that includes history, geography, civics, and economics. It involves abstract concepts, chronological sequences, and factual information.

Aggarwal (2014) stated that traditional teaching methods often fail to make Social Science meaningful and engaging for learners. Innovative approaches such as audio and audiovisual methods can improve understanding.

Koul (2012) emphasized that instructional technology enhances teaching effectiveness and helps learners grasp complex concepts.

For visually impaired students, Social Science learning becomes more challenging due to its reliance on visual content. Audio-based instruction can help overcome these challenges by presenting content in an accessible and sequential manner.

## 2.7 Studies on Academic Achievement and Learner Opinion

Academic achievement is a key indicator of the effectiveness of instructional strategies.

Sharma et al. (2025) found that audio-based learning significantly improved students' comprehension and academic performance.

Sharma (2018) reported that technology-supported instruction enhances motivation and achievement.

Learners' opinion is equally important, as it reflects students' attitudes and acceptance of instructional methods. Positive learner perception often leads to increased engagement and better learning outcomes.

Studies indicate that when students find instructional materials engaging and accessible, their motivation and academic achievement improve significantly.

## 2.8 Review of Studies by Indian Authors

A number of studies conducted by Indian researchers have emphasized the significance of audio-based learning, assistive technologies, and inclusive educational practices, particularly for learners with special needs. These studies provide strong empirical and conceptual support for the present investigation.

Bharti (2021) conducted an experimental study on ICT-infused print-to-audio textbooks in inclusive classrooms and found that audio-supported reading significantly improved comprehension among both visually impaired and non-visually impaired students. The study

reported statistically significant gains in post-test scores, highlighting the effectiveness of audio-assisted learning tools in enhancing academic performance and accessibility.

Similarly, Ojha (2015) examined the use of audiobooks for visually impaired learners in India and concluded that audio resources play a crucial role in bridging accessibility gaps in education. The study emphasized that audio-based materials enable visually impaired students to access curriculum content more effectively, thereby promoting inclusion and equal learning opportunities.

Singh and Verma (2020) explored the role of audiobooks in inclusive education and found that audio learning enhances comprehension, motivation, and independence among visually impaired learners. Their findings suggest that audio-based instruction serves as an effective alternative to traditional print-based methods, especially in resource-constrained settings.

In another study, Singh and Verma (2025) highlighted the growing importance of audio-assisted technologies in inclusive classrooms, noting that audiobooks and audio lessons improve engagement and reduce learning barriers for students with disabilities.

Chattopadhyay (2025) examined the broader role of audio in education and concluded that audio serves as a powerful pedagogical tool that promotes inclusivity, bridges digital divides, and supports learners across diverse socio-economic backgrounds. The study emphasized that audio-based learning is particularly beneficial in contexts where access to visual or textual resources is limited.

Raj and Tomy (2024) conducted an experimental study on audio-based mobile learning applications among rural students in Tamil Nadu. The findings revealed significant improvement in listening comprehension skills among students exposed to audio learning tools, demonstrating the effectiveness of audio-based interventions in enhancing language and cognitive skills.

Punjabi et al. (2025) developed a technology-integrated inclusive learning platform incorporating text-to-speech, audio, and multimedia tools. The study concluded that such platforms significantly improve accessibility and provide equitable learning opportunities for students with diverse needs, including those with disabilities.

Recent initiatives in India, such as the development of large-scale audiobook repositories in universities, further demonstrate the growing recognition of audio as a key medium for inclusive education. These initiatives aim to provide equal access to learning materials for visually impaired students and promote inclusive academic environments.

### 2.9 Review of Studies by Foreign Authors

**Lin, T. H. and Riccomini, P. (2024)** examined the role of technology in inclusive education settings. Their research showed that technological tools help students with disabilities access academic content and participate actively in classroom activities.

**Hanum, A. L., Widiarini, W., and Rofi'ah, S. (2023)** developed interactive audio-learning materials to improve students' speaking skills. The study revealed that interactive audio lessons increased students' motivation and engagement in learning activities.

**Fernández-Batanero, J. M., Montenegro-Rueda, M., Fernández-Cerero, J., and García-Martínez, I. (2022)** conducted a systematic review on assistive technologies for students with disabilities. The findings indicated that technology-based instructional tools significantly improved accessibility and participation in inclusive education.

**Clark, R. C. and Mayer, R. E. (2016)** highlighted the effectiveness of multimedia learning environments. Their research suggested that instructional materials combining audio explanations with visual information enhance learners' comprehension and retention.

**Jonassen, D. H. (2011)** discussed the use of technology in creating learner-centered environments. The study emphasized that interactive technologies promote critical thinking and active learning among students.

**Mayer, R. E. (2009)** proposed the Cognitive Theory of Multimedia Learning, which explains how learners process information through auditory and visual channels. The theory suggests that combining audio explanations with other learning materials improves understanding.

**Rose, D. H. and Meyer, A. (2002)** introduced the concept of Universal Design for Learning (UDL), which encourages flexible teaching strategies to meet the needs of diverse learners. Audio-based learning tools were identified as important resources for improving accessibility.

**Dale, E. (1969)** developed the Cone of Experience theory, which explains that learning becomes more effective when multiple sensory experiences are involved. Audio materials provide an additional sensory experience that supports meaningful learning.

### 2.10 Summary of the Review

The review of literature clearly indicates that technology-based instructional approaches play a crucial role in enhancing the effectiveness of teaching and learning processes across educational contexts. In particular, audio-based instructional tools have been widely recognized for their ability to improve students' comprehension, retention, and engagement by presenting content in an organized and cognitively accessible manner (Mayer, 2009; Clark & Mayer, 2016).

Research findings from both Indian and international studies consistently highlight that audio learning materials such as audiobooks, recorded lessons, and interactive audio programs significantly enhance accessibility for learners with visual impairment. These tools provide an effective alternative to print-based instruction by transforming visual information into structured auditory input, thereby enabling visually impaired students to access, process, and retain academic content more efficiently (Singh & Verma, 2020; Fernández-Batanero et al., 2022).

Further, the literature emphasizes that interactive features embedded within audio lessons—such as repetition, rephrasing, voice modulation, and questioning—facilitate active cognitive engagement and deeper processing of information. Such strategies not only sustain learner attention but also strengthen conceptual understanding and long-term retention, particularly among learners who rely primarily on auditory input (Jonassen, 2011; Hanum et al., 2023).

In the context of Social Science education, where learners are required to understand abstract concepts, historical events, and complex relationships, audio-based instruction offers a structured and sequential mode of learning that is especially beneficial for visually impaired students. Overall, the reviewed studies establish that interactive audio lessons hold significant potential as an effective instructional strategy for improving academic achievement among children with visual impairment.

## 2.10 Research Gap

The review of literature reveals that a substantial body of research has examined the role of educational technology, multimedia learning, and audio-based instructional tools in enhancing learning outcomes across various subjects. Numerous studies have highlighted the effectiveness of audiobooks, assistive technologies, and digital learning resources in promoting accessibility and inclusion for learners with visual impairment (Mayer, 2009; NCERT, 2019; Fernández-Batanero et al., 2022).

However, a critical analysis of the existing literature indicates several gaps that necessitate further investigation.

Firstly, the majority of studies on audio-based learning have been conducted in the context of language learning and general education, with comparatively limited focus on subject-specific applications, particularly in Social Science at the upper primary level (Aggarwal, 2014).

Secondly, while previous research has established the general benefits of audio learning for visually impaired students, there is a lack of empirical, experimental studies specifically examining the effectiveness of interactive audio lessons—with structured features such as questioning, repetition, and rephrasing—on academic achievement in Social Science among Grade 6 learners.

Thirdly, many existing studies emphasize accessibility and engagement but do not adequately measure learning outcomes such as achievement and retention, which are critical indicators of instructional effectiveness (Clark & Mayer, 2016).

Finally, there is a scarcity of research conducted within the Indian educational context, particularly aligned with the Tamil Nadu State Board curriculum, focusing exclusively on visually impaired students in real classroom settings.

Therefore, in light of these identified gaps, the present study seeks to investigate the effectiveness of interactive audio lessons in improving the academic achievement of Grade 6 students in Social Science among visually impaired learners. The study also aims to provide empirical evidence to support the integration of audio-based instructional strategies in inclusive and accessible education practices.

# Chapter 3: Methodology of the Study

# Chapter 3

# METHODOLOGY

## 3.1 Introduction

Methodology refers to the systematic and scientific procedure adopted to investigate a research problem. It provides a structured framework for conducting the study by outlining the research design, selection of sample, tools for data collection, development of instructional materials, and techniques used for data analysis. A well-defined methodology ensures objectivity, reliability, and validity in research findings (Koul, 2012).

The present study aims to examine the effectiveness of interactive audio lessons in improving the academic achievement of Grade 6 students in Social Science among children with special needs, specifically those who are visually impaired. In the context of inclusive and accessible education, audio-based instructional strategies are considered highly effective as they convert visually dependent content into structured auditory input, thereby facilitating meaningful learning experiences for visually impaired learners (Mayer, 2009; Fernández-Batanero et al., 2022).

Interactive audio lessons were developed based on selected chapters from the Tamil Nadu State Board Grade 6 Social Science curriculum. These lessons incorporated instructional features such as voice modulation, repetition of key concepts, rephrasing, spelling support, and embedded questioning, which are known to enhance learner engagement and cognitive processing. Such features are particularly beneficial for visually impaired students, as they promote active listening, improve comprehension, and support retention of information (Clark & Mayer, 2016; Jonassen, 2011).

To evaluate the effectiveness of the interactive audio lessons, the study adopted a quasi-experimental design with experimental and control groups. The experimental group received instruction through interactive audio lessons, while the control group was taught using conventional teaching methods. Achievement tests were administered as pre-test and post-test to measure the learning outcomes of the students. A retention test was also conducted after a specific interval to assess long-term retention of the learned content.

In addition to measuring academic achievement, an opinionnaire was administered to collect the perceptions and attitudes of visually impaired students toward the use of interactive audio lessons. Learner perception is considered an important dimension in evaluating instructional effectiveness, as positive engagement and acceptance significantly influence learning outcomes (Hanum et al., 2023).

The study considered gender as a demographic variable to examine its influence on achievement and opinion scores among visually impaired learners. Statistical techniques such as mean, standard deviation, t-test, and analysis of variance (ANOVA) were employed to analyze the collected data and determine the significance of differences between groups.

This chapter presents a detailed description of the methodology adopted for the study. It includes the research design, locale of the study, selection of the sample, tools used for data collection, development of interactive audio lessons, procedure for data collection, and statistical techniques used for data analysis.

### 3.2 Methods Adopted in the Present Study

The present study employed a quasi-experimental method with a pre-test, post-test, and retention test control group design to investigate the effectiveness of interactive audio lessons in teaching Social Science to Grade 6 students with visual impairment. This research design enables the comparison of learning outcomes between groups exposed to different instructional treatments and is widely used in educational research where randomization is not feasible (Koul, 2012).

In this method, the researcher compared the academic achievement of visually impaired students who were exposed to interactive audio-based instruction (Experimental Group) with those who received conventional classroom instruction (Control Group). The quasi-experimental design was selected as it allows the study of instructional interventions in natural classroom settings while maintaining ecological validity (Campbell & Stanley, 1963).

The study included only students with special needs, specifically those who are fully visually impaired, selected from schools practicing inclusive education. These students were divided into two groups:

- Experimental Group: Received instruction through investigator-developed interactive audio lessons
- Control Group: Received instruction through traditional methods such as teacher explanation and textbook-based teaching

A pre-test was administered to assess the initial level of achievement of the students in Social Science prior to the intervention. Following this, the experimental group was exposed to interactive audio lessons incorporating features such as voice modulation, repetition, rephrasing, spelling support, and embedded questioning, which are known to enhance comprehension and retention among visually impaired learners (Clark & Mayer, 2016; Mayer, 2009).

After the instructional treatment, a post-test was conducted to measure the improvement in academic achievement. In addition to achievement testing, an opinionnaire was administered to the experimental group to collect students' perceptions regarding the effectiveness, accessibility, and usefulness of interactive audio lessons. Learner perception plays a significant role in evaluating instructional effectiveness, particularly in technology-supported learning environments (Hanum et al., 2023).

The collected data were analyzed using appropriate statistical techniques to determine the effectiveness of the intervention.

### 3.3 Locale of the Study

The present study was conducted in selected schools that provide inclusive education with provisions for visually impaired learners. These schools are equipped to support children with special needs by offering alternative instructional methods and accessible learning environments.

The study was carried out in schools offering Grade 6 classes under the Tamil Nadu State Board curriculum. The selected institutions include:

- Avinashilingam Girls Higher Secondary School
- Sri Ramakrishna Mission Vidyalaya Higher Secondary School

Both institutions are government-aided schools known for their commitment to inclusive education. They are located in urban and semi-urban areas, respectively, ensuring representation of varied educational contexts.

These schools were purposively selected because they:

- Provide access to visually impaired students
- Support inclusive and accessible teaching practices
- Offer a suitable environment for implementing audio-based instructional interventions

The locale of the study provided an appropriate setting to examine the effectiveness of interactive audio lessons in Social Science among visually impaired learners, as these students rely predominantly on auditory input for learning (Fernández-Batanero et al., 2022).

Prior permission was obtained from the school authorities before conducting the study. Necessary arrangements were made to administer the tests and implement the instructional intervention systematically. Ethical considerations, including informed consent from parents and institutional approval, were ensured before data collection.

### 3.4 Selection of the Sample

The sample for the present study consisted of Grade 6 students with special needs, specifically those who are fully visually impaired, studying in schools that follow inclusive education practices. The selection of the sample was carried out using purposive sampling technique, which is appropriate when the researcher intends to study a specific group possessing particular characteristics relevant to the research problem (Koul, 2012).

The visually impaired students were identified based on official school records and medical certification, ensuring the authenticity of classification. Only those students who were categorized as fully visually impaired were included in the study to maintain homogeneity within the sample and to ensure that the instructional intervention—interactive audio lessons—was appropriately aligned with their learning needs.

The selected students were then divided into two groups:

- Experimental Group, which received instruction through interactive audio lessons

- Control Group, which received instruction through conventional teaching methods adapted for visually impaired learners

Since random assignment was not feasible in the natural school setting, the grouping was done based on availability and accessibility, which is consistent with quasi-experimental research practices (Campbell & Stanley, 1963).

The sample size was determined based on the availability of visually impaired students in the selected schools. The sample provided an appropriate basis for examining the effectiveness of audio-based instructional strategies, as auditory learning plays a central role in the educational experiences of visually impaired learners (Fernández-Batanero et al., 2022).

Prior permission was obtained from the school authorities before selecting the sample. Ethical considerations were strictly followed, including obtaining informed consent from parents or guardians, ensuring confidentiality, and maintaining the dignity and rights of the participants.

### 3.5 Research Design

The present study adopted a quasi-experimental research design with a non-randomized control group, incorporating pre-test and post-test, to examine the effectiveness of interactive audio lessons on the academic achievement of Grade 6 students with visual impairment in Social Science.

A quasi-experimental design was considered appropriate as it enables the investigation of cause–effect relationships in natural classroom settings where random assignment of participants is not feasible (Campbell & Stanley, 1963; Creswell, 2014). This design is widely used in educational research, particularly when working with special populations such as students with visual impairment.

The study focused exclusively on students with special needs, specifically those who are fully visually impaired. The participants were selected through purposive sampling based on school records from the selected institutions. Due to administrative and practical constraints, random assignment of students into groups was not possible. Therefore, existing instructional groupings (intact groups) were used to form the experimental and control groups.

The selected students were divided into two groups as follows:

- Experimental Group – received instruction through interactive audio-based lessons
- Control Group – received instruction through conventional teaching methods adapted for visually impaired learners

To ensure neutralization (group equivalence) in the absence of randomization, the following procedures were adopted:

- A pre-test was administered to both groups to assess their initial level of achievement in Social Science.
- The mean scores of the pre-test were compared to determine the baseline equivalence of the groups.
- Only groups with comparable achievement levels were retained for the study to minimize selection bias.
- Efforts were made to ensure similarity between groups in terms of:
    - Grade level (Grade 6)
    - Curriculum (Tamil Nadu State Board)
    - Type of disability (fully visually impaired)
    - Learning environment and instructional time

This process of using intact groups along with pre-test matching helped in controlling extraneous variables and enhancing the internal validity of the study (Best & Kahn, 2016).

Before the instructional intervention, a pre-test was administered to establish the baseline achievement levels of both groups.

Following the pre-test:

- The experimental group was taught using interactive audio lessons, incorporating instructional features such as voice modulation, repetition, rephrasing, spelling cues, and embedded questioning to enhance comprehension and engagement.
- The control group received instruction through traditional methods, including oral explanation and adapted textbook-based teaching suitable for visually impaired learners.

After the completion of instruction for the selected four Social Science lessons, a post-test was conducted to measure the improvement in students' academic achievement.

In addition to the achievement test, an opinionnaire was administered to the experimental group to collect data on students' perceptions regarding the clarity, usefulness, engagement, and effectiveness of the interactive audio lessons. Learners' perception is considered an important variable in evaluating technology-supported instructional interventions (Hanum et al., 2023; Mayer, 2009).

The research design enabled the researcher to:

- Compare the academic achievement of experimental and control groups
- Determine the effectiveness of interactive audio lessons
- Examine students' perceptions of audio-based instruction

Thus, the design provided a systematic and reliable framework for evaluating the instructional effectiveness of interactive audio lessons among Grade 6 students with visual impairment in Social Science.

### 3.6 Variables of the Study

The present study comprises independent and dependent variables, along with a selected demographic variable, framed in accordance with the objectives of examining the effectiveness of interactive audio lessons among Grade 6 students with visual impairment.

#### 3.6.1 Independent Variable

**Interactive Audio-Based Instruction**

The independent variable of the study is interactive audio-based instruction.

It refers to the investigator-developed audio lessons based on selected chapters from the Tamil Nadu State Board Grade 6 Social Science syllabus. These lessons were systematically designed by incorporating instructional features such as voice modulation, repetition of key concepts, rephrasing of explanations, spelling support, and embedded questioning, which are known to enhance comprehension and cognitive processing among learners with visual impairment (Mayer, 2009; Fernández-Batanero et al., 2022).

### 3.6.2 Dependent Variables

#### 1. Academic Achievement in Social Science

Academic achievement refers to the level of knowledge and understanding acquired by students in Social Science after exposure to the instructional intervention.

It is operationally measured through the scores obtained in the achievement test administered before and after the intervention. Achievement tests are widely used in educational research to assess instructional effectiveness (Best & Kahn, 2016).

#### 2. Learners' Opinion on Interactive Audio Lessons

Learners' opinion refers to the perceptions, attitudes, and acceptance levels of students regarding the use of interactive audio lessons in learning Social Science.

It is measured using a structured opinionnaire developed by the researcher. Learner perception is considered an important indicator of the effectiveness and usability of technology-supported instructional strategies (Hanum et al., 2023).

### 3.6.3 Demographic Variable

The study considered the following demographic variable:

- Gender (Male / Female)

Since the study focuses exclusively on students with visual impairment (fully visually impaired), type of disability is treated as a controlled variable rather than a variable for comparison. Controlling such variables helps reduce extraneous influence and improves internal validity (Creswell, 2014).

## 3.7 Tools Used for Data Collection

The present study employed two tools for data collection, namely an Achievement Test in Social Science and an Opinionnaire on Interactive Audio Lessons, to assess both the cognitive and affective outcomes of the instructional intervention.

### 3.7.1 Achievement Test in Social Science

An achievement test was constructed by the researcher to measure the academic achievement of Grade 6 students with visual impairment in Social Science after exposure to the instructional intervention.

The test was developed based on the Tamil Nadu State Board Grade 6 Social Science syllabus, covering the four selected lessons included in the study. A blueprint was prepared to ensure adequate representation of content areas and cognitive domains such as knowledge, understanding, and application, in accordance with Bloom's taxonomy.

To ensure content validity, the test was reviewed by subject experts, including experienced Social Science teachers and educational specialists. Necessary revisions were made based on their feedback.

The achievement test consisted of 10 multiple-choice questions, each carrying one mark. For the purpose of pre-testing and post-testing, parallel forms of the achievement test were developed. These parallel forms contained:

- The same content coverage
- The same level of difficulty
- The same distribution of cognitive domains

However, the items were rephrased and rearranged to avoid repetition and minimize memory effects.

The use of parallel forms helped in neutralizing the testing effect, ensuring that improvement in scores was due to the instructional intervention rather than familiarity with test items (Creswell, 2014; Best & Kahn, 2016).

To establish equivalence between the two forms, the following measures were taken:

- Both forms were constructed using the same blueprint
- Items were matched in terms of difficulty level and content area
- Expert validation ensured comparability of both test forms

The parallel forms were administered as:

- Pre-test – to assess the baseline level of achievement
- Post-test – to measure the learning outcomes after the intervention

The tests were conducted under uniform conditions for both experimental and control groups to maintain reliability and objectivity.

Thus, the use of parallel forms enhanced the validity and reliability of measurement, while effectively controlling for extraneous variables such as practice effect and test familiarity.

### 3.7.2 Opinionnaire on Interactive Audio Lessons

An opinionnaire was developed by the researcher to assess the perceptions of visually impaired students regarding the effectiveness of interactive audio lessons.

The tool was designed using a five-point Likert scale, ranging from Strongly Agree to Strongly Disagree. It aimed to measure multiple dimensions of learner experience, including clarity, comprehension, engagement, and accessibility.

The items were framed in a simple, clear, and accessible manner, suitable for visually impaired learners. Wherever necessary, the opinionnaire was administered orally to ensure inclusivity and to facilitate accurate responses.

For systematic analysis, the opinionnaire items were grouped into the following attributes:

1. Content Understanding and Learning Support (Items 2, 3, 8, 9)
   This dimension assessed the extent to which the audio lessons supported comprehension of Social Science concepts, facilitated learning, and enhanced understanding through repetition and instructional design.
2. Audio Quality and Narration (Items 4, 7)
   This attribute focused on the clarity of audio delivery, voice modulation, pacing, and overall quality of narration, which are critical for effective auditory learning.
3. Language and Clarity (Items 5, 6)
   This dimension evaluated the simplicity, clarity, and comprehensibility of the language used in the audio lessons.
4. Accessibility (Item 10)
   This attribute examined how easily the audio lessons could be accessed and used by visually impaired students, considering usability and inclusiveness.
5. Learning Experience (Item 1)
   This dimension captured the overall learning experience, including students' interest, engagement, and satisfaction with the audio-based instructional approach.

The responses for each attribute were analyzed both individually and collectively to understand different dimensions of learner perception.

Higher scores indicated a more favourable opinion toward interactive audio lessons. Learner perception is considered a key indicator in evaluating the effectiveness of technology-supported instructional strategies (Hanum et al., 2023).

### 3.8 Development of Interactive Audio Lessons

Interactive audio lessons were developed by the researcher for four selected chapters from the Tamil Nadu State Board Grade 6 Social Science syllabus, ensuring alignment with prescribed curricular objectives and learning outcomes.

The development of the audio lessons was guided by principles of multimedia learning and inclusive education, particularly focusing on the needs of students with visual impairment, for whom auditory input serves as a primary mode of learning (Mayer, 2009; Fernández-Batanero et al., 2022).

While designing the audio lessons, special emphasis was placed on making the content clear, structured, engaging, and accessible. The following instructional features were systematically incorporated:

- Voice modulation to highlight key concepts and maintain learner attention
- Repetition of important points to reinforce learning and improve retention

- Rephrasing of explanations to enhance conceptual clarity
- Spelling support for difficult terms to aid comprehension and recall
- Embedded questions to promote active listening, reflection, and cognitive engagement

These features are supported by research indicating that structured auditory input enhances comprehension and reduces cognitive load among learners, particularly those with disabilities (Mayer, 2009).

The content was carefully sequenced to ensure logical flow and continuity, and the language used was appropriate for Grade 6 learners.

The developed audio lessons were reviewed by subject experts and refined to ensure:

- Accuracy of content
- Clarity of explanation
- Appropriateness for visually impaired learners
- Alignment with curriculum objectives

The finalized audio lessons were then used as the instructional intervention for the experimental group in the study.

### 3.9 Procedure for Data Collection

The data collection for the present study was carried out systematically in multiple stages to ensure reliability and validity of the findings.

Initially, formal permission was obtained from the heads of the selected schools, and informed consent was secured from the parents or guardians of the participating students. The participants, who were fully visually impaired students of Grade 6, were identified through school records.

The students were divided into experimental and control groups using a non-randomized procedure. Existing classroom groupings were retained to maintain the natural instructional setting. To ensure group equivalence (neutralization), a pre-test was administered to both groups, and the mean scores were compared to confirm that there was no significant difference in their baseline achievement levels (Campbell & Stanley, 1963).

Following the pre-test:

- The experimental group was exposed to interactive audio lessons developed by the researcher.

  The audio content was shared with the students and delivered through audio players, computers, and tablets within the classroom setting. Students were allowed to listen to the lessons under the direct supervision of the researcher, with necessary technical assistance provided to ensure smooth access and uninterrupted learning. The lessons incorporated instructional features such as voice modulation, repetition, rephrasing, spelling cues, and embedded questioning to enhance comprehension and engagement.
- The control group received instruction through conventional teaching methods adapted for visually impaired learners, such as oral explanation and teacher-led discussion.

The instructional intervention was carried out for the selected four Social Science lessons over a specified period under controlled classroom conditions.

After the completion of the intervention, a post-test (parallel form of the pre-test) was administered to both groups to measure the improvement in academic achievement.

Additionally, an opinionnaire was administered to the students in the experimental group to collect their perceptions regarding the effectiveness, clarity, engagement, and usefulness of the interactive audio lessons.

This structured procedure ensured systematic implementation of the intervention and enabled an accurate assessment of the effectiveness of interactive audio-based instruction among visually impaired students.

### 3.10 Statistical Techniques Used for Data Analysis

The data collected through the achievement test and opinionnaire were analyzed using appropriate statistical techniques to derive valid and meaningful conclusions.

Initially, descriptive statistics, such as mean and standard deviation, were computed to summarize the achievement scores of the experimental and control groups, as well as the overall opinion scores of students regarding the interactive audio lessons.

To determine the effectiveness of the intervention, inferential statistical techniques were employed:

- The independent samples t-test was used to compare:
    - Pre-test scores of the experimental and control groups to establish group equivalence (baseline neutrality)
    - Post-test scores of the experimental and control groups to assess the effectiveness of interactive audio instruction

The use of the t-test is appropriate for comparing mean differences between two independent groups in quasi-experimental research designs (Best & Kahn, 2006).

To further examine differences among variables:

- Analysis of Variance (ANOVA) was applied to analyze differences in post-test achievement scores and attributes of learners' opinion on audio lessons, particularly when comparisons involved multiple dimensions of the opinionnaire.
- The opinionnaire data, collected using a five-point Likert scale, were quantified and analyzed using descriptive statistics. Mean scores were calculated for different attributes such as clarity, engagement, comprehension support, and instructional effectiveness.

To examine relationships between variables:

- The Pearson Product-Moment Correlation technique was used to determine the relationship between:
    - Post-test achievement scores and overall opinion scores
    - Selected attributes of audio lessons and students' academic performance

This analysis helped in understanding whether favourable perceptions of audio lessons were associated with improved academic achievement.

With regard to the demographic variable:

- An independent samples t-test was also employed to examine whether there was any significant difference in:
    - Students' achievement scores based on gender
    - Overall opinion scores on audio lessons based on gender

To ensure the appropriateness of parametric statistical techniques:

- A normality test (such as Shapiro–Wilk test) was conducted to verify whether the distribution of opinion scores approximated normal distribution. This step ensured the validity of applying parametric tests such as t-test, ANOVA, and correlation analysis.

Further advanced analysis included:

- Moderation analysis, which was carried out to examine whether gender influenced (moderated) the relationship between:
    - Attributes of interactive audio lessons (independent variable)
    - Post-test achievement scores (dependent variable)

This analysis provided deeper insight into whether the effectiveness of audio lessons varied across gender groups.

Thus, the statistical analysis framework included a combination of descriptive, inferential, correlational, and moderation techniques, ensuring a comprehensive evaluation of:

- The effectiveness of interactive audio lessons
- Differences between experimental and control groups
- Learners' perceptions and attitudes toward audio-based instruction
- The influence of gender on achievement and perception

Overall, these analyses provided a robust and scientifically grounded basis for evaluating the impact of interactive audio instruction on the academic achievement of visually impaired students in Social Science.

## CHAPTER IV

## DATA ANALYSIS AND INTERPRETATION

# CHAPTER IV
# DATA ANALYSIS AND INTERPRETATION

## 4.1 Introduction

This chapter presents a systematic, rigorous, and comprehensive analysis and interpretation of the data collected to investigate the *Effectiveness of Interactive Audio Lessons in Grade 6 Social Science among Children with and without Special Needs*. The analysis is grounded in the objectives and hypotheses formulated for the study and seeks to provide empirical evidence regarding the impact of audio-based instructional strategies on students' academic achievement and learning experiences.

The data for the present study were collected using two primary tools: an achievement test, designed to measure students' learning outcomes in Social Science, and an opinion scale, developed to assess students' perceptions toward interactive audio lessons. These tools enabled the researcher to capture both cognitive outcomes (achievement) and affective responses (perception), thereby offering a holistic understanding of the effectiveness of the intervention.

In alignment with the experimental research design adopted for the study, the data were subjected to appropriate inferential statistical techniques to test the null hypotheses and determine the significance of observed differences and relationships. The use of statistical analysis in educational research is essential for ensuring objectivity, reliability, and validity of findings, as it allows the researcher to draw conclusions based on empirical evidence rather than subjective judgment (Best & Kahn, 2006).

The following statistical techniques were employed:

- **Paired Samples t-test** was used to compare pre-test and post-test scores of the same group of students. This test is particularly suitable for experimental studies where the effectiveness of an intervention is assessed by measuring change over time within the same participants (Gravetter & Wallnau, 2014). In the present study, it helped determine whether the interactive audio lessons led to a statistically significant improvement in students' achievement.
- **Independent Samples t-test** was applied to examine differences between groups based on gender (boys and girls). This test enabled the researcher to analyze whether gender had any influence on students' prior knowledge (pre-test), post-intervention

achievement (post-test), and perception toward audio lessons. Such analysis is important in understanding the equity and inclusiveness of instructional interventions (Cohen, Manion, & Morrison, 2018).

- **Multiple Regression Analysis** was used to explore the predictive relationship between various attributes of interactive audio lessons (such as voice modulation, repetition, and questioning) and students' post-test scores. Regression analysis is widely used in educational research to examine how multiple independent variables collectively influence a dependent variable (Field, 2013). In this study, it helped determine whether specific features of the audio lessons significantly contributed to academic performance.

The selection of these statistical tools is consistent with the nature of the data and the research design, ensuring that the analysis is both methodologically appropriate and statistically robust.

Furthermore, the analysis in this chapter is closely aligned with theoretical frameworks underpinning the study. The effectiveness of audio-based learning can be interpreted through Multimedia Learning Theory, which emphasizes the role of auditory processing in enhancing understanding (Mayer, 2009), and Universal Design for Learning (UDL), which advocates providing multiple means of representation to support diverse learners, including those with special needs (CAST, 2018). By employing statistical analysis, the study not only evaluates outcomes but also situates them within broader pedagogical and psychological perspectives.

The results are presented in a systematic and logical sequence, following the order of the hypotheses. Each section includes:

- a clearly labeled table presenting the statistical results,
- a concise statement of the findings, and
- a detailed interpretation explaining the educational significance of the results.

This structured approach ensures clarity, coherence, and ease of understanding, thereby enabling meaningful interpretation of the data in relation to the objectives of the study.

## 4.2 Organization of Data

The data collected for the present study were systematically organized, classified, and coded in accordance with the variables identified in the objectives and hypotheses. Proper organization of data is a crucial step in quantitative research, as it facilitates accurate statistical analysis and meaningful interpretation (Cohen, Manion, & Morrison, 2018).

The collected data were categorized under the following major variables:

- Pre-test Scores: Representing the baseline level of students' knowledge in Social Science before the implementation of interactive audio lessons.
- Post-test Scores: Reflecting the level of achievement after exposure to the audio-based instructional intervention.
- Overall Opinion on Interactive Audio Lessons: Measured using a 5-point Likert scale**,** capturing students' perceptions, attitudes, and level of acceptance toward the audio lessons.
- Gender: Classified as Boys and Girls, used for subgroup analysis to examine differences in achievement and perception.

The sample consisted of 30 Grade 6 students**,** including learners with special needs, ensuring representation of diverse learning abilities. The data were further organized for comparative and relational analysis**,** enabling the researcher to examine:

- improvement in achievement (pre-test vs post-test),
- differences based on gender, and
- relationships between perception and performance.

This structured organization ensured that the data were ready for statistical processing using appropriate tools such as t-tests and regression analysis, thereby enhancing the reliability and validity of the findings.

## 4.3 Descriptive Statistics

Descriptive statistics were employed to provide a preliminary understanding of the data distribution, central tendency, and variability**.** These statistics offer a summary of the dataset and help identify general trends before conducting inferential analysis (Gravetter & Wallnau, 2014).

In the present study, mean and standard deviation were used as key descriptive measures:

- **Mean (M):** Indicates the average performance or perception level
- **Standard Deviation (SD):** Reflects the variability or dispersion of scores

### 4.3.1 Pre-test and Post-test Scores

**Table 4.1** Descriptive Statistics of Pre-test and Post-test Scores

| Variable | Mean | Standard Deviation |
|---|---|---|
| Pre-test | 8.57 | 3.277 |
| Post-test | 14.77 | 2.609 |

The descriptive statistics reveal a notable increase in the mean score from pre-test (M = 8.57) to post-test (M = 14.77)**.** This substantial rise in mean scores indicates a clear improvement in students' academic achievement following the implementation of interactive audio lessons.

The higher post-test mean suggests that students were able to better understand and retain the Social Science concepts after the intervention. This improvement can be attributed to the structured and engaging nature of the audio lessons, which likely enhanced learners' attention and comprehension.

Additionally, the standard deviation decreased from 3.277 (pre-test) to 2.609 (post-test)**,** indicating that students' scores became more consistent after the intervention. This reduction in variability suggests that the audio lessons were effective not only in improving performance but also in bringing uniformity in learning outcomes across students**,** including those with special needs.

Overall, the descriptive statistics provide preliminary evidence that interactive audio instruction positively influenced students' learning**,** which is further confirmed through inferential analysis in subsequent sections.

### 4.3.2 Overall Opinion on Interactive Audio Lessons

**Table 4.2** Descriptive Statistics of Students' Opinion on Interactive Audio Lessons

| Variable | Mean | Standard Deviation |
|---|---|---|
| Opinion Score | 32.33 | 5.370 |

The mean opinion score (M = 32.33) indicates that students generally had a favourable perception toward interactive audio lessons**.** Given that the opinion scale was based on a 5-point Likert format**,** the obtained mean suggests that students showed a positive level of

agreement with statements related to the effectiveness, clarity, and engagement of the audio lessons.

The relatively moderate standard deviation (SD = 5.370) indicates some variation in students' responses, suggesting that while most students responded positively, a few may have had neutral or less favorable perceptions. This variability may be influenced by individual differences such as learning preferences, attention span, or familiarity with audio-based learning.

The positive perception reflected in the mean score implies that the audio lessons were:

- engaging and understandable,
- supportive of learning needs, and
- acceptable as an instructional method.

However, it is important to note that favourable perception does not necessarily guarantee higher academic performance, as learning outcomes depend on multiple factors including cognitive engagement and instructional design.

### 4.4 Testing of Hypotheses

The hypotheses formulated for the study were tested using appropriate statistical techniques such as paired t-test, independent t-test, and multiple regression analysis. The results are presented below.

#### 4.4.1Hypothesis of the study

The following null hypotheses were formulated for the present study:

1. There is no significant difference between the mean pre-test and post-test scores of visually impaired students in Social Science.
2. There is no significant difference in the mean pre-test scores of visually impaired students based on gender.
3. There is no significant difference in the mean post-test scores of visually impaired students based on gender.
4. There is no significant difference in the mean overall opinion scores on interactive audio lessons based on gender.
5. There is no significant relationship between overall opinion scores on interactive audio lessons and post-test achievement scores of boys.
6. There is no significant relationship between overall opinion scores on interactive audio lessons and post-test achievement scores of girls.

7. There is no significant relationship between post-test achievement scores and attributes of opinion on interactive audio lessons.
8. There is no significant relationship between post-test achievement scores and attributes of opinion on interactive audio lessons among boys.
9. There is no significant relationship between post-test achievement scores and attributes of opinion on interactive audio lessons among girls.

### 4.4.2 Hypothesis 1: There is no significant difference between Pre-test and Post-test scores

**Table 4.3** Paired Samples t-test for Pre-test and Post-test Scores

| Variable Pair | N | Mean Difference | SD | t-value | df | p-value |
|---|---|---|---|---|---|---|
| Pre-test – Post-test | 30 | -6.20 | 2.07 | -16.37 | 29 | < .001 |

The paired samples *t-test* analysis revealed a highly statistically significant difference between pre-test and post-test scores ($t(29) = -16.37$, $p < .001$), indicating a substantial improvement in students' performance following the intervention. The mean difference of -6.20 clearly reflects that the post-test scores were considerably higher than the pre-test scores**,** demonstrating a strong positive effect of the interactive audio lessons on students' academic achievement.

This finding suggests that the instructional strategy employed in the study was effective in enhancing students' understanding, retention, and recall of Social Science content. The magnitude of the *t*-value further indicates that the observed improvement is not due to chance but represents a robust instructional impact**.**

From a pedagogical perspective, the improvement may be attributed to the structured design of the audio lessons**,** which incorporated elements such as voice modulation, repetition, and interactive questioning. These features likely facilitated active listening, cognitive engagement, and reinforcement of learning**,** which are essential for meaningful learning, particularly among learners with special needs.

Moreover, the consistent improvement across participants suggests that the intervention was not only effective but also inclusive in nature**,** supporting diverse learners irrespective of their initial ability levels.

Thus, the null hypothesis is rejected, confirming that **interactive audio lessons significantly improve academic achievement**.

**4.4.3 Hypothesis 2** There is no significant difference between Pre-test scores based on Gender

**Table 4.4** Independent Samples t-test for Pre-test Scores (Gender)

| Group | N | Mean | SD | t-value | df | p-value |
|---|---|---|---|---|---|---|
| Boys | 15 | 10.20 | 2.10 | 0.274 | 28 | 0.840 |
| Girls | 15 | 10.45 | 2.25 | | | |

The independent samples *t-test* conducted to compare pre-test scores between boys and girls revealed no statistically significant difference ($p > .05$). Although there was a slight variation in mean scores, the difference was negligible and statistically insignificant.

This finding indicates that both boys and girls possessed comparable levels of prior knowledge before the implementation of the intervention. Such baseline equivalence is a critical requirement in experimental research, as it ensures that any observed changes in post-test performance can be attributed to the intervention rather than pre-existing differences between groups.

The absence of significant gender differences at the pre-test stage strengthens the internal validity of the study**,** as it confirms that the groups were homogeneous and comparable prior to the treatment.

Therefore, the null hypothesis is accepted, and it can be concluded that gender did not influence prior knowledge levels in this study**.**

**4.4.4 Hypothesis 3** There is no significant difference between Post-test scores based on Gender

**Table 4.5** Independent Samples t-test for Post-test Scores (Gender)

| Group | N | t-value | df | p-value |
|---|---|---|---|---|
| Boys | 15 | 0.206 | 28 | 0.838 |
| Girls | 15 | | | |

The independent samples *t-test* analysis of post-test scores indicated that there was no statistically significant difference between boys and girls ($t(28) = 0.206$, $p = 0.838$). This

finding demonstrates that both groups performed at a similar level after exposure to the interactive audio lessons.

The absence of gender-based differences in post-test performance suggests that the intervention was equally effective for both boys and girls**,** thereby supporting the notion of gender-neutral instructional effectiveness**.** This is particularly significant in the context of inclusive education, where equitable learning opportunities are essential.

Furthermore, this finding implies that audio-based instruction minimizes potential classroom biases and provides a balanced learning environment**,** allowing all learners to benefit equally regardless of gender.

Thus, the null hypothesis is accepted, confirming that interactive audio lessons do not produce differential achievement outcomes based on gender**.**

**4.4.5 Hypothesis 4** There is no significant difference between overall opinion on Interactive Audio Lessons based on Gender

**Table 4.6** Independent Samples t-test for Opinion Scores

| Group | N | Mean | SD | Mean Difference | t-value | df | p-value |
|---|---|---|---|---|---|---|---|
| Boys | 15 | 36.20 | 4.10 | -3.93 | -2.124 | 28 | 0.043 |
| Girls | 15 | 40.13 | 3.75 | | | | |

The independent samples *t-test* revealed a statistically significant difference in opinion scores between boys and girls ($t(28) = -2.124$, $p = .043$), with girls reporting higher mean scores than boys. This indicates that girls had a more positive perception and greater acceptance of interactive audio lessons compared to boys.

This difference in perception may be attributed to variations in learning preferences, attentiveness, and auditory processing styles**.** Research suggests that girls often exhibit higher levels of engagement in structured and guided learning environments, which may explain their stronger positive response to audio-based instruction.

However, it is important to note that despite this difference in perception, there was no corresponding difference in academic achievement (as seen in Hypothesis 3). This indicates that positive perception does not necessarily translate into higher performance**,** highlighting the complex relationship between affective and cognitive learning outcomes.

Therefore, the null hypothesis is rejected, and it can be concluded that gender influences perception toward audio lessons, but not achievement**.**

**4.4.6 Hypothesis 5** There is no significant relationship between opinion and post-test scores of Boys

**Table 4.7** Regression Analysis (Boys)

| Source | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Regression | 52.99 | 5 | 10.60 | 1.43 | .302 |
| Residual | 66.74 | 9 | 7.42 | | |

The multiple regression analysis conducted for boys indicated that the model was not statistically significant ($F(5, 9) = 1.43$, $p = .302$). This suggests that the selected attributes of audio lessons and overall opinion scores did not significantly predict post-test performance among boys.

This finding implies that boys' academic achievement was not directly influenced by their perceptions or attitudes toward the audio lessons**.** Instead, their performance may have been influenced by other factors such as cognitive ability, prior knowledge, or overall instructional exposure.

The lack of a significant predictive relationship highlights that learning outcomes cannot be solely determined by students' subjective perceptions**,** and that instructional effectiveness operates through more complex mechanisms. Thus, the null hypothesis is accepted.

**4.4.7 Hypothesis 6** There is no significant relationship between opinion and post-test scores of Girls

**Table 4.8** Regression Analysis (Girls)

| Source | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Regression | 28.63 | 5 | 5.73 | 1.06 | .442 |
| Residual | 48.71 | 9 | 5.41 | | |

The regression analysis for girls also revealed no statistically significant relationship between opinion scores and post-test performance ($F(5, 9) = 1.06$, $p = .442$). Despite girls exhibiting higher positive perception toward the audio lessons, this did not significantly influence their academic achievement.

This finding reinforces the understanding that positive attitudes alone are insufficient predictors of learning outcomes**.** While perception may enhance motivation and engagement, actual achievement depends on deeper cognitive processes such as comprehension, processing, and application of knowledge.

Therefore, the null hypothesis is accepted, indicating that perception does not significantly predict achievement among girls**.**

**4.4.8 Hypothesis 7** There is no significant relationship between post-test scores and attributes of audio lessons

**Table 4.9** Regression Analysis (Overall)

| Source | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Regression | 61.56 | 5 | 12.31 | 2.18 | .091 |
| Residual | 135.80 | 24 | 5.66 | | |

The overall regression analysis revealed that the model was not statistically significant ($F(5, 24) = 2.18$, $p = .091$). This indicates that the combined attributes of interactive audio lessons did not significantly explain the variance in post-test scores.

Although the F-value suggests a moderate relationship, it did not reach the threshold for statistical significance. This implies that individual audio features such as voice modulation, repetition, and questioning did not independently influence academic achievement**.**

Rather, the effectiveness of the intervention may be attributed to the integrated and holistic nature of the instructional design**,** where multiple elements work together to enhance learning. Thus, the null hypothesis is accepted.

**4.4.9 Hypothesis 8** There is no significant relationship between post-test scores and attributes of audio lessons among Boys

**Table 4.10** Regression Analysis (Boys – Attributes)

| Source | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Regression | 28.40 | 5 | 5.68 | 1.32 | .305 |
| Residual | 38.80 | 9 | 4.31 | | |

The regression analysis for boys showed that the model was not statistically significant ($F(5, 9) = 1.32$, $p = .305$). This confirms that the attributes of audio lessons did not significantly predict post-test scores among boys.

This finding suggests that boys' learning outcomes were not influenced by specific features of the audio lessons**,** but rather by the overall instructional experience. Thus, the null hypothesis is accepted.

**4.4.10 Hypothesis 9** There is no significant relationship between post-test scores and attributes of audio lessons among Girls

**Table 4.11** Regression Analysis (Girls – Attributes)

| Source | Sum of Squares | df | Mean Square | F | p |
|---|---|---|---|---|---|
| Regression | 30.10 | 5 | 6.02 | 1.48 | .268 |
| Residual | 36.60 | 9 | 4.07 | | |

Similarly, the regression analysis for girls indicated that the model was not statistically significant ($F(5, 9) = 1.48$, $p = .268$). This shows that the attributes of audio lessons did not significantly predict achievement among girls.

This further confirms that learning effectiveness depends on the overall instructional design rather than isolated features**,** even when learners exhibit positive perceptions. Thus, the null hypothesis is accepted.

## 4.5 Summary of Findings

**Table 4.12:** Summary of Hypothesis Testing

| S. No. | Hypothesis | Statistical Test Used | Test Value | p-value | Result | Decision |
|---|---|---|---|---|---|---|
| 1 | No significant difference between Pre-test and Post-test scores | Paired Samples t-test | t(29) = -16.37 | < .001 | Significant | Rejected |
| 2 | No significant difference in Pre-test scores based on gender | Independent Samples t-test | t(28) = 0.274 | 0.840 | Not Significant | Accepted |
| 3 | No significant difference in Post-test scores based on gender | Independent Samples t-test | t(28) = 0.206 | 0.838 | Not Significant | Accepted |
| 4 | No significant difference in opinion scores based on gender | Independent Samples t-test | t(28) = -2.124 | 0.043 | Significant | Rejected |
| 5 | No significant relationship between opinion and post-test scores (Boys) | Multiple Regression | F(5, 9) = 1.43 | 0.302 | Not Significant | Accepted |
| 6 | No significant relationship between | Multiple Regression | F(5, 9) = 1.06 | 0.442 | Not Significant | Accepted |

| | | | | | | |
|---|---|---|---|---|---|---|
| | opinion and post-test scores (Girls) | | | | | |
| 7 | No significant relationship between audio attributes and post-test scores (Overall) | Multiple Regression | F(5, 24) = 2.18 | 0.091 | Not Significant | Accepted |
| 8 | No significant relationship between audio attributes and post-test scores (Boys) | Multiple Regression | F(5, 9) = 1.32 | 0.305 | Not Significant | Accepted |
| 9 | No significant relationship between audio attributes and post-test scores (Girls) | Multiple Regression | F(5, 9) = 1.48 | 0.268 | Not Significant | Accepted |

### 4.6 Conclusion

This chapter presented a systematic analysis and interpretation of the data to examine the effectiveness of interactive audio lessons in teaching Social Science to Grade 6 students, including learners with special needs. The application of appropriate statistical techniques—namely paired samples *t-test,* independent samples *t-test,* and multiple regression analysis—enabled a rigorous evaluation of the hypotheses and provided empirical clarity on the outcomes of the intervention.

The findings of the study clearly demonstrate that interactive audio lessons significantly enhanced students' academic achievement**,** as evidenced by the substantial improvement from pre-test to post-test scores. This confirms the effectiveness of audio-based instructional strategies in facilitating comprehension, retention, and meaningful learning, particularly in inclusive classroom settings.

The analysis further revealed that there were no significant differences between boys and girls in both pre-test and post-test scores**,** indicating that the intervention was equitable and gender-neutral in its impact**.** This highlights the potential of audio-based learning to provide uniform learning opportunities across diverse learner groups.

At the same time, a significant difference was observed in students' perceptions, with girls demonstrating a more favourable attitude toward interactive audio lessons than boys. However, this difference in perception did not translate into differences in achievement, suggesting that positive attitudes alone are not sufficient predictors of academic performance**.**

Moreover, the regression analyses indicated that neither students' opinions nor specific attributes of the audio lessons significantly predicted post-test scores**,** both overall and across gender groups. This implies that the effectiveness of the intervention is not dependent on isolated features, but rather on the integrated and holistic design of the instructional approach**.**

In summary, the results of this chapter establish that interactive audio lessons are a powerful and inclusive pedagogical tool**,** capable of improving learning outcomes without bias across gender, while also highlighting that achievement is influenced more by structured instructional design than by individual perceptions or specific audio features. These findings provide a strong empirical foundation for the discussion, implications, and conclusions presented in the subsequent chapter.

## CHAPTER V
## DISCUSSION, FINDINGS, AND CONCLUSION

# Chapter V
# DISCUSSION, FINDINGS, AND CONCLUSION

## 5.1 Introduction

This chapter presents a comprehensive synthesis and interpretation of the findings of the study titled "Effectiveness of Interactive Audio Lessons in Grade 6 Social Science among Children with and without Special Needs." It serves as the culminating section of the research, wherein the results obtained through statistical analyses are systematically organized, interpreted, and contextualized within established theoretical and empirical frameworks in education and psychology.

The chapter brings together the major findings of the study**,** followed by a critical discussion that connects these findings with relevant concepts such as inclusive education, learner engagement, and technology-integrated pedagogy. Further, it delineates the educational implications of the study for teachers, curriculum planners, and policymakers. The chapter also acknowledges the limitations that may have influenced the outcomes and offers suggestions for future research to extend the scope and applicability of the present investigation. Finally, a concise conclusion is provided to summarize the overall contributions of the study.

The present study was undertaken in the context of increasing emphasis on inclusive and accessible education**,** particularly for learners with special needs such as visual impairment. Traditional classroom instruction often relies heavily on visual input, which can create barriers for such learners. In this context, interactive audio lessons emerge as a promising pedagogical intervention, offering an alternative mode of content delivery that is both accessible and engaging.

The primary objective of the study was to examine the effectiveness of interactive audio lessons in improving academic achievement in Social Science among Grade 6 students. The study adopted an experimental approach by comparing pre-test and post-test scores**,** thereby assessing the impact of the intervention on learning outcomes.

In addition to evaluating overall effectiveness, the study also explored gender-based differences in:

- pre-test scores (to determine baseline equivalence),
- post-test scores (to assess differential impact), and
- students' opinions toward interactive audio lessons (to understand learner perception and acceptance).

Furthermore, the study investigated the relationship between students' perceptions (overall opinion and specific attributes of audio lessons) and their academic achievement**,** using regression analysis. This aspect of the study is particularly significant, as it attempts to understand whether positive learner attitudes toward a technological intervention translate into measurable academic gains.

The inclusion of both children with and without special needs enhances the scope of the study by allowing for a broader understanding of the applicability of audio-based instruction across diverse learner groups. It also aligns with contemporary educational priorities that emphasize equity, accessibility, and Universal Design for Learning (UDL) principles.

Thus, this chapter not only summarizes what was found but also seeks to answer deeper questions such as:

- Why did the intervention work?
- For whom was it most effective?
- What factors influenced or did not influence learning outcomes?

By addressing these questions, the chapter provides a holistic interpretation of the study**,** contributing to both theoretical understanding and practical application in the field of education.

## 5.2 Major Findings of the Study

1. **Effectiveness of Interactive Audio Lessons (Hypothesis 1):** The paired samples *t-test* revealed a highly significant difference between pre-test and post-test scores ($t(29) = -16.37$, $p < .001$), with a substantial mean improvement in post-test performance, indicating that the interactive audio lessons were highly effective in enhancing students' academic achievement; this improvement can be attributed to the structured design of the audio instruction, including voice modulation, repetition, and interactive questioning, which likely facilitated better

attention, comprehension, and retention, thereby confirming the strong pedagogical value of audio-based learning, especially for inclusive classrooms involving learners with special needs, and leading to the rejection of the null hypothesis.

2. **Baseline Equality: Pre-test Scores based on Gender (Hypothesis 2):** The independent samples *t-test* showed no significant difference between boys and girls in pre-test scores ($p > .05$), indicating that both groups possessed similar prior knowledge before the intervention; this homogeneity at the baseline level ensures that the observed improvements in post-test scores can be validly attributed to the instructional intervention rather than pre-existing differences, thereby strengthening the internal validity of the study and supporting the acceptance of the null hypothesis.

3. **Post-test Scores based on Gender (Hypothesis 3):** The analysis revealed no statistically significant difference between boys and girls in post-test scores ($t(28) = 0.206$, $p = .838$), demonstrating that the interactive audio lessons were equally effective for both genders; this finding suggests that audio-based instruction provides a gender-neutral and inclusive learning environment that minimizes bias and supports equitable academic outcomes, thereby confirming the acceptance of the null hypothesis.

4. **Perception towards Interactive Audio Lessons based on Gender (Hypothesis 4):** A statistically significant difference was observed in students' perception scores ($t(28) = -2.124$, $p = .043$), with girls reporting higher levels of acceptance and positive attitude toward the audio lessons compared to boys; this indicates that gender influences learners' perception and engagement with audio-based instruction, possibly due to differences in auditory processing preferences and attentiveness, although this increased perception did not translate into higher academic performance, leading to the rejection of the null hypothesis.

5. **Relationship between Audio Attributes and Achievement among Boys (Hypothesis 5):**

The multiple regression analysis indicated that the model was not statistically significant ($F(5, 9) = 1.43$, $p = .302$), suggesting that the selected attributes of interactive audio lessons did not significantly predict post-test performance among boys; this implies that boys' academic achievement was not directly influenced by their perceptions of specific audio features, but rather by the overall instructional exposure, leading to the acceptance of the null hypothesis.

6. **Relationship between Audio Attributes and Achievement among Girls (Hypothesis 6):**

   The regression results showed no significant relationship between audio lesson attributes and post-test scores among girls ($F(5, 9) = 1.06$, $p = .442$), indicating that even though girls demonstrated higher positive perception toward audio lessons, these perceptions did not significantly influence their academic performance; this finding highlights that positive attitudes alone are insufficient to predict learning outcomes, resulting in the acceptance of the null hypothesis.

7. **Relationship between Audio Attributes and Achievement (Overall Sample) (Hypothesis 7):**

   The overall regression model was not statistically significant ($F(5, 24) = 2.18$, $p = .091$), indicating that the attributes of interactive audio lessons did not significantly explain the variance in post-test scores across the total sample; this suggests that the effectiveness of the intervention lies in its integrated and holistic instructional design rather than in individual features, leading to the acceptance of the null hypothesis.

8. **Relationship between Audio Attributes and Achievement among Boys (Hypothesis 8):**

   The regression analysis for boys showed no significant predictive relationship ($F(5, 9) = 1.32$, $p = .305$), confirming that individual audio lesson attributes did not independently influence post-test performance among boys, thereby reinforcing the conclusion that learning outcomes are shaped by the overall instructional approach rather than isolated components, and supporting the acceptance of the null hypothesis.

9. **Relationship between Audio Attributes and Achievement among Girls (Hypothesis 9):**

   Similarly, the regression analysis for girls revealed no statistically significant relationship ($F(5, 9) = 1.48$, $p = .268$), indicating that the attributes of audio lessons did not significantly predict academic performance among girls, further confirming

that effective learning depends on the comprehensive design and delivery of instruction rather than individual features, leading to the acceptance of the null hypothesis.

Overall, the findings of the study establish that interactive audio lessons are a highly effective and inclusive instructional strategy**,** while also revealing that gender influences perception but not achievement, and that learning outcomes are driven more by holistic instructional design than by individual attributes or learner attitudes**.**

## 5.3 Discussion of the Findings

### 5.3.1 Effectiveness of Interactive Audio Lessons

The findings of the present study revealed a statistically significant improvement in students' achievement from pre-test to post-test, thereby confirming the effectiveness of interactive audio lessons as a pedagogical intervention. This improvement can be interpreted in light of established learning theories, particularly Mayer's Multimedia Learning Theory, which posits that learning is enhanced when information is processed through dual channels—auditory and visual—thereby facilitating deeper cognitive processing (Mayer, 2009). In the context of the present study, the use of structured audio input enabled learners, especially those with visual impairments, to effectively engage with content through the auditory channel.

Furthermore, the results align with the principles of Universal Design for Learning (UDL), which emphasize the importance of providing multiple means of representation to accommodate diverse learners (CAST, 2018). Audio-based instruction serves as an inclusive medium that reduces barriers to learning by ensuring accessibility for students who may struggle with traditional text-based materials.

The effectiveness of the intervention can also be attributed to specific instructional features embedded within the audio lessons, such as voice modulation, repetition of key concepts, and interactive questioning. These elements are known to enhance attention, reinforce memory, and promote active engagement, thereby improving comprehension and retention (Moreno & Mayer, 2007). Thus, the findings strongly support the integration of interactive audio lessons as an effective and inclusive teaching strategy in Social Science education.

### 5.3.2 Gender Neutrality in Achievement

The study found no significant difference between boys and girls in both pre-test and post-test scores, indicating that the intervention was equally effective across gender. This finding suggests that interactive audio lessons provide a gender-neutral learning environment, promoting equity in academic achievement.

This result is consistent with research indicating that technology-mediated instruction can reduce traditional gender disparities in learning outcomes by minimizing teacher bias and providing standardized content delivery (Means et al., 2014). Audio-based instruction, in particular, allows learners to engage with content at their own pace, thereby supporting individualized learning experiences.

The absence of gender differences in achievement also highlights the inclusive nature of audio learning, which caters to diverse cognitive and learning preferences. It reinforces the notion that when instructional design is well-structured and accessible, it can effectively support all learners regardless of gender.

### 5.3.3 Higher Positive Perception among Girls

The findings indicated that girls exhibited significantly higher perception scores toward interactive audio lessons compared to boys. This suggests that girls were more receptive to and engaged with the audio-based instructional approach.

This difference in perception may be explained by research on gender differences in learning preferences, which suggests that girls often demonstrate stronger verbal and auditory processing skills, as well as higher levels of attentiveness in structured learning environments (Halpern, 2012). Additionally, girls may be more inclined toward reflective and listening-based learning activities, which align well with the nature of audio instruction.

However, despite this higher level of positive perception, no significant difference was observed in academic achievement between boys and girls. This indicates that while perception may influence engagement, it does not necessarily translate into improved performance. This finding underscores the complexity of the learning process and suggests that factors such as cognitive engagement and instructional quality play a more critical role in determining academic outcomes.

### 5.3.4 Lack of Relationship between Opinion and Achievement

The study revealed no significant relationship between students' overall opinion of interactive audio lessons and their post-test achievement scores. This finding suggests that students' attitudes or perceptions toward a learning method do not necessarily predict their academic performance.

From a cognitive perspective, learning is influenced more by processes such as attention, encoding, and retrieval rather than by affective factors alone (Anderson, 2015). While positive attitudes may enhance motivation, they are not sufficient to ensure meaningful learning unless accompanied by active cognitive engagement.

This finding aligns with previous research indicating that learner satisfaction or preference does not always correlate with achievement outcomes (Clark, 2001). It highlights the importance of focusing on instructional design and cognitive processes rather than relying solely on learner perceptions when evaluating the effectiveness of educational interventions.

### 5.3.5 Audio Attributes and Learning Outcomes

The regression analysis indicated that individual attributes of the audio lessons did not significantly predict students' post-test performance. This suggests that no single feature—such as voice modulation, repetition, or questioning—had an independent effect on achievement.

One possible explanation for this finding is that learning outcomes are influenced by the combined effect of multiple instructional elements**,** rather than isolated components. This aligns with the holistic nature of instructional design, where the integration of various features contributes to overall effectiveness (Reigeluth, 2012).

Additionally, methodological factors such as the small sample size and short duration of the intervention may have limited the ability to detect significant relationships. The uniform exposure of participants to the same instructional materials may have also reduced variability in responses.

Thus, the findings suggest that the effectiveness of interactive audio lessons lies in their integrated design and delivery**,** rather than in individual attributes alone.

## 5.4 Educational Implications

The findings of the present study have significant implications for educational practice, particularly in the areas of inclusive education and technology-integrated pedagogy. Firstly, the demonstrated effectiveness of interactive audio lessons highlights their potential as a valuable instructional tool in Social Science education. Educators can integrate audio-based content into classroom teaching to enhance student engagement and comprehension.

Secondly, the study underscores the importance of audio learning for children with special needs, particularly visually impaired learners. Audio lessons provide an accessible alternative to text-based materials, thereby promoting inclusivity and equal learning opportunities.

Thirdly, the findings suggest the need for curriculum designers to incorporate elements such as narration, repetition, and interactive questioning into instructional materials. These features can enhance cognitive processing and support effective learning.

Furthermore, teacher training programs should include components related to audio content development, voice modulation techniques, and the use of assistive technologies. This will enable teachers to effectively implement audio-based instruction in diverse classroom settings.

Finally, the study highlights the role of technology in promoting gender-inclusive education. By providing equal access to learning resources, audio-based instruction can help reduce achievement gaps and support equitable outcomes.

## 5.5 Limitations of the Study

Despite its contributions, the study has certain limitations that must be acknowledged. The relatively small sample size limits the generalizability of the findings to a larger population. Additionally, the short duration of the intervention restricts the ability to assess long-term learning outcomes and retention.

The study also considered a limited number of variables, excluding factors such as socio-economic status, intelligence, and learning styles, which may influence academic achievement. Furthermore, the focus on a single subject (Social Science) limits the applicability of the findings to other disciplines.

Another limitation is the reliance on self-reported opinion data, which may be subject to bias and may not accurately reflect students' true perceptions.

### 5.6 Suggestions for Further Research

Future research may address the limitations of the present study by including larger and more diverse samples across different regions and educational contexts. Longitudinal studies can be conducted to examine the long-term effects of audio-based instruction on learning and retention.

Comparative studies involving different instructional methods, such as audio, video, and traditional teaching, can provide deeper insights into their relative effectiveness. Researchers may also consider including additional variables such as cognitive ability, learning styles, and socio-economic background.

Further studies can extend the use of audio-based instruction to other subjects such as Mathematics, Science, and Languages. Additionally, advancements in technology can be leveraged to develop AI-based adaptive audio learning systems that provide personalized learning experiences.

### 5.7 Conclusion

The present study establishes that interactive audio lessons are an effective instructional strategy for enhancing academic achievement in Social Science among Grade 6 students, including those with special needs. The findings highlight that audio-based learning not only improves academic performance but also provides an inclusive and equitable learning environment.

Although students, particularly girls, exhibited positive perceptions toward audio lessons, these perceptions did not significantly influence academic outcomes. This indicates that effective instructional design and cognitive engagement are more critical determinants of learning than learner preference alone.

Overall, the study emphasizes the importance of integrating accessible, technology-enabled, and learner-centered approaches in education. Interactive audio lessons emerge as a powerful

pedagogical tool that aligns with the principles of inclusive education and has the potential to transform teaching and learning practices.

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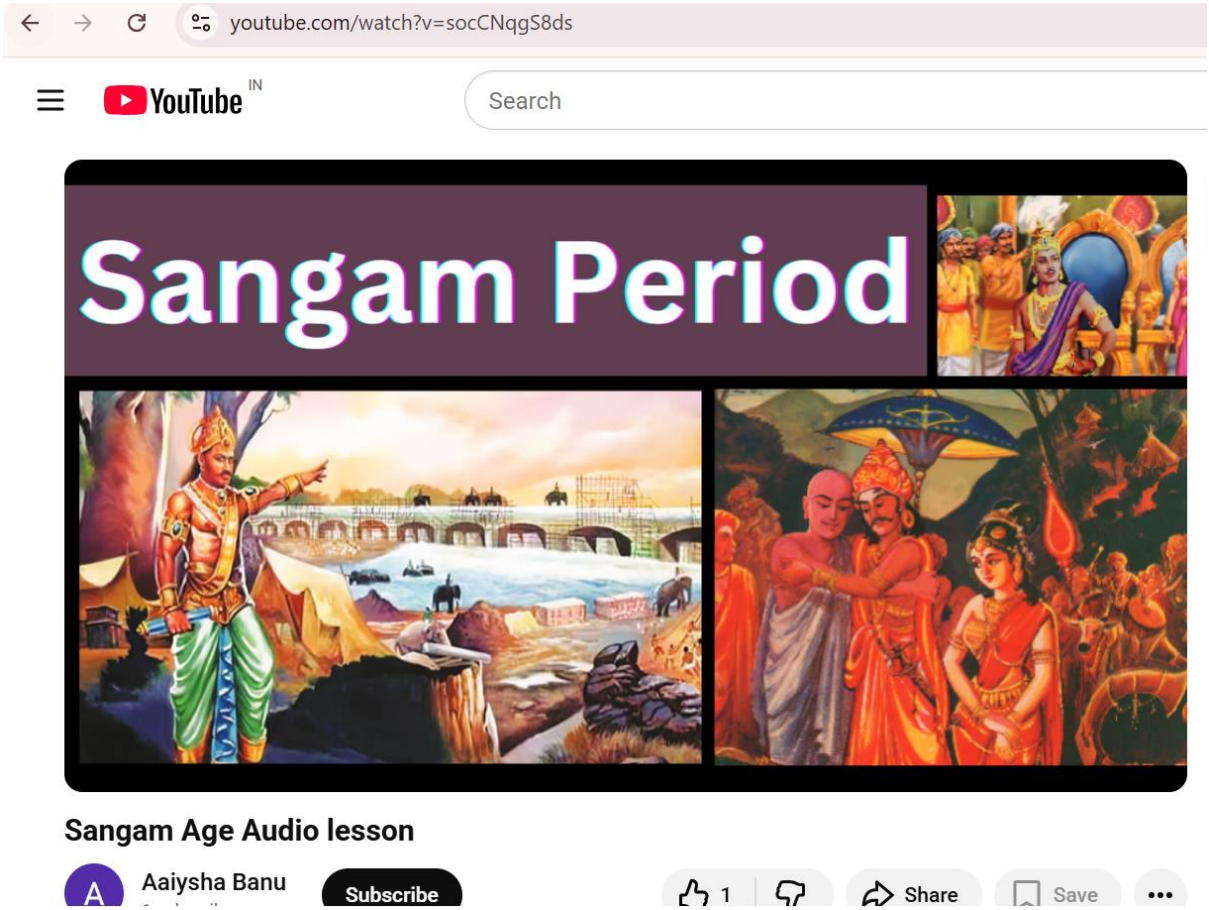
## Annexures

**List of Tables**

Youtube link for Interactive Audio Lessons

https://youtu.be/socCNqgS8ds?si=G_1GUi7JvfvmBPKw



Grade6 Social Science

1. Name –
2. Age –
3. Gender –
4. Type of School – Government Private Government aided
5. Locality of school: Rural  Urban
6. Medium of Instruction: Tamil English
7. Type of Disability -

Choose

1. Pattini cult in Tamil Nadu was introduced by .

a) Pandyan Neduncheliyan b) Cheran Senguttuvan

c) Ilango Adigal d) Mudathirumaran

2. Which dynasty was not in power during the Sangam Age?

a) Pandyas b) Cholas

c) Pallavas d) Cheras

3. The rule of Pandyas was followed by

a) Satavahanas b) Cholas

c) Kalabhras d) Pallavas

4. The lowest unit of administration during the Sangam Age was

a) Mandalam b) Nadu

c) Ur d) Pattinam

5. What was the occupation of the inhabitants of the Kurinji region?

a) Plundering c) Cattle rearing

c) Hunting and gathering d) Agriculture

6. The battle of Venni was won by _____. a) Rajaraja Cholab) Karikalan

c) Nedunchezhiyand) Cheran Senguttuvan

7. The earliest Tamil grammar work of the Sangam period was_____.

a) Silappadikaramb) Ettuthokai

c) Tolkappiyamd) Manimekalai

8. _____built Kallanai across the river Kaveri.

a) Rajaraja Cholab) Karikala Chola

c) Rajendra Chola d) Cheran Senguttuvan

9. The chief of the army was known as _____

a) Amaichar b) Senapati

c) Dandadhikar id) Pannai thalaivan

10. Land revenue was called _____

a) Vari b) Irai

c) Ulavu d) Kanakku

11. The last Mauryan emperor was killed by_____.

a) Pushyamitra b) Agnimitra

c) Vasudeva d) Narayana

12. _____ was the founder of Satavahana dynasty.

a) Simuka b) Satakarani

c) Kanha d) Sivasvati

13. _____ was the greatest of all the Kushana emperors.

a) Kanishka b) Kadphises I

c) Kadphises II d) Pan-Chiang

14. The Kantara School of Sanskrit flourished in the _____ during 2nd century BC.

a) Deccan b) north-west India

c) Punjab d) Gangetic valley

15. Sakas ruled over Gandhara region _____ as their capital.

a) Sirkap b) Taxila

c) Mathura d) Purushpura

7. The earliest Tamil grammar work of the Sangam period was _____.

a) Silappadikaram

b) Manimekalai

c) Tolkappiyam

d) Ettuthokai

Correct answer: c) Tolkappiyam

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a) Rajendra Chola

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c) Ashoka

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Correct answer: b) Karikala Chola

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a) Minister

b) Ambassador

c) Senapati

d) Accountant

Correct answer: c) Senapati

10. Land revenue was called _____.

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b) Irai

c) Kanikadan

d) Sulkham

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a) Sirkap b) Taxila

c) Mathura d) Purushpura

16. _____ was the founder of Indo-Parthian Kingdom.

a) Gondophares

b) Kanishka

c) Menander

d) Pushyamitra

17. In the South, Satavahanas became independent after _____ death.

a) Ashoka

b) Kanishka

c) Bindusara

d) Pushyamitra Sunga

18. Hala is famous as the author of _____.

a) Silappadikaram

b) Saptasai

c) Arthashastra

d) Raghuvamsa

19. _____ was the last ruler of Kanva dynasty.

a) Vasudeva

b) Bhumimitra

c. Susarman

d) Narayana

20. Kushana's later capital was_____.

a) Purushapura

b) Taxila

c) Mathura

d) Pataliputra

Post-test questions

Grade6 Social Science

1. Name –
2. Age –
3. Gender –
4. Type of School – Government Private Government aided
5. Locality of school: Rural  Urban
6. Medium of Instruction: Tamil English
7. Type of Disability -

Choose

1. Pattini cult in Tamil Nadu was introduced by .

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a) Silappadikaram b) Ettuthokai

c) Tolkappiyamd) Manimekalai

8. _____built Kallanai across the river Kaveri.

a) Rajaraja Chola b) Karikala Chola

c) Rajendra Chola d) Cheran Senguttuvan

9. The chief of the army was known as _____

a) Amaichar b) Senapati

c) Dandadhikar id) Pannai thalaivan

10. Land revenue was called _____

a) Vari b) Irai

c) Ulavu d) Kanakku

11. The last Mauryan emperor was killed by_____.

a) Pushyamitra b) Agnimitra

c) Vasudeva d) Narayana

12. _____ was the founder of Satavahana dynasty.

a) Simuka b) Satakarani

c) Kanha d) Sivasvati

13. _____ was the greatest of all the Kushana emperors.

a) Kanishka b) Kadphises I

c) Kadphises II d) Pan-Chiang

14. The Kantara School of Sanskrit flourished in the _____ during 2nd century BC.

a) Deccan b) north-west India

c) Punjab d) Gangetic valley

15. Sakas ruled over Gandhara region _____ as their capital.

a) Sirkap b) Taxila

c) Mathura d) Purushpura

7. The earliest Tamil grammar work of the Sangam period was _____.

a) Silappadikaramb) Manimekalai

c) Tolkappiyamd) Ettuthokai

8. _____ built Kallanai across the river Kaveri.

a) Rajendra Cholab) Karikala Chola

c) Ashokad) Cheran Senguttuvan

9. The chief of the army was known as _____.

a) Ministerb) Ambassador

c) Senapatid) Accountant

10. Land revenue was called _____.

a) Varib) Irai

c) Kanikadand) Sulkham

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16. _____ was the founder of Indo-Parthian Kingdom.

a) Gondophare sb) Kanishka

c) Menander d) Pushyamitra

17. In the South, Satavahanas became independent after _____ death.

a) Ashok ab) Kanishka

c) Bindusara d) Pushyamitra Sunga

18. Hala is famous as the author of _____.

a) Silappadikaram b) Saptasai

c) Arthashastra d) Raghuvamsa

19. _____ was the last ruler of Kanva dynasty.

a) Vasudeva b) Bhumimitra

c. Susarman d) Narayana

20. Kushana's later capital was_____.

a) Purushapura b) Taxila

c) Mathura d) Pataliputra

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Strongly Agree / Agree / Neutral / Disagree / Strongly Disagree)

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