ENHANCING ORNITHOLOGICAL SKILLS THROUGH INNOVATIVE TEACHING APPROACHES

RESEARCH PROJECT REPORT

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DECLARATION

I hereby declare that the project entitled **"ENHANCING ORNITHOLOGICAL SKILLS THROUGH INNOVATIVE TEACHING APPROACHES"** Submitted to **STATE COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING CHENNAI-6** is our original work, and that it has not previously formed the basis of the award of any Degree, Diploma, Fellowship or any other similar title of any University or Institution.

RESEARCHER

CERTIFICATE

PRINCIPAL

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This is to certify that the project entitled, **"ENHANCING ORNITHOLOGICAL SKILLS THROUGH INNOVATIVE TEACHING APPROACHES"** Submitted by, **Mr M. MAYILSAMY,** Vice Principal of this institution for the Research Project is purely a record of research work done under my supervision and the project has not formed the basis of the award of any Degree, Diploma, Fellowship or any other similar title of any University or Institution.

Principal

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CHAPTER-I

INTRODUCTION

1.1 INTRODUCTION

Ornithology, the scientific study of birds, is a captivating and vital branch of biology. Birds, as one of the most diverse and widely distributed groups of animals, have long attracted the attention of naturalists, ecologists, and conservationists. Research in ornithology not only enhances our understanding of biodiversity and ecosystem functioning but also informs conservation strategies, habitat management, and assessments of climate change impacts on wildlife. Despite its significance, ornithology is often underrepresented in many educational curricula, where traditional teaching methods tend to limit student engagement and the depth of learning. Educators frequently rely on lecture-based instruction and textbook materials, which restrict opportunities for students to participate in active, hands-on, and technology-driven learning experiences.

Recently, there has been increased recognition of the need to support teachers in adopting innovative instructional approaches that can improve student learning, particularly in specialized fields such as ornithology. Such approaches aim to overcome persistent challenges, including low engagement, minimal exposure to fieldwork, and limited opportunities to apply theoretical knowledge in practical settings. Modern pedagogical innovations such as inquiry-based learning, project-based activities, digital tools, and interdisciplinary teaching enable educators to promote critical thinking, active participation, and experiential learning among their students.

The primary goal of this study is to examine how innovative teaching methods can help educators enhance ornithological skills in formal learning environments. By investigating the integration of strategies like bird identification applications, virtual field trips, collaborative research projects, and hands-on learning activities, the study seeks to identify effective techniques that allow teachers to provide more engaging and comprehensive ornithology instruction. This includes not only reinforcing students' conceptual understanding but also developing essential practical skills such as bird identification, behavioral observation, and systematic data collection.

The need to strengthen ornithology education is further highlighted by the increasing demand for professionals equipped to tackle global environmental challenges. Careers in wildlife conservation, environmental education, and ecological research require individuals with both theoretical knowledge and practical competencies. Therefore, it is crucial that teachers are equipped with modern tools and instructional strategies that make ornithology education relevant, interactive, and applicable to real-world contexts. While traditional teaching approaches lay the foundation, they often fall short in cultivating the field-based expertise necessary for these careers. This study aims to address that gap by exploring how innovative teaching practices can better prepare educators, enhance student engagement, and inspire the next generation of professionals to contribute meaningfully to bird conservation and ecological sustainability.

BACKGROUND OF THE STUDY

Ornithology, a key branch of biology, plays an essential role in advancing knowledge of biodiversity, ecosystem dynamics, and environmental health. Birds, as integral components of many ecosystems and sensitive indicators of environmental change, provide valuable insights for research in conservation biology, climate science,

and ecological monitoring. Despite the growing importance of ornithology in addressing global environmental issues, teaching methods in this field often remain rooted in traditional approaches, such as lectures and textbook-based instruction. While these methods convey foundational theoretical knowledge, they frequently lack the experiential and hands-on learning opportunities necessary for developing practical skills, especially for teachers striving to deliver effective and engaging instruction.

In recent years, education has increasingly embraced innovative teaching strategies to enhance student engagement and learning outcomes. For educators of ornithology and related disciplines, methods such as inquiry-based learning, fieldwork, collaborative projects, and technology integration offer opportunities to make instruction more interactive and meaningful. These approaches not only improve content delivery but also cultivate critical thinking, problem-solving, and observational skills competencies essential in a discipline that relies heavily on analysis, field observation, and practical application.

The introduction of digital tools and platforms, including bird identification apps like Merlin and citizen science initiatives such as eBird, has expanded possibilities for ornithology teaching. These technologies allow students to engage with real-time data, participate in global birdwatching networks, and conduct both virtual and in-person fieldwork. By incorporating such resources, educators can provide enriched, multi-sensory learning experiences that connect theoretical knowledge to practical application. Despite these advances, the adoption of innovative teaching methods in ornithology, particularly at the tertiary level, remains limited. Many educators lack the training and support needed to implement technology-enhanced and experiential approaches effectively. This gap highlights the need for research exploring how modern

pedagogical strategies can empower teachers, improve classroom practices, and enhance student learning in ornithology.

This study seeks to address this need by examining the role of innovative teaching methods in strengthening educators' ornithological competencies. By investigating the integration of active learning techniques, experiential exercises, and digital tools, the research aims to provide evidence-based recommendations for delivering more engaging, skill-oriented, and impactful ornithology education. The ultimate goal is to support teachers in preparing students with both the practical knowledge and critical thinking skills required to address contemporary environmental challenges.

ORNITHOLOGICAL SKILLS

Meaning

Ornithological skills are the knowledge and practical abilities required to study, observe, and understand birds in their natural habitats. These skills encompass both theoretical understanding such as bird behaviour, ecology, physiology, and classification and practical expertise, including bird identification, field observation, data collection, and the use of tools like binoculars, GPS devices, and bird identification apps.

Developing ornithological skills is essential for professionals in wildlife conservation, ecological research, and environmental education, as these abilities enable effective monitoring of bird populations, analysis of their ecological roles, and implementation of conservation strategies. Such skills are typically cultivated through a combination of academic study, hands-on fieldwork, and the integration of modern

technological tools, allowing individuals to engage meaningfully with both the scientific and practical aspects of ornithology. In essence, ornithological skills bridge theoretical knowledge and practical application, equipping learners and professionals to study birds comprehensively, contribute to ecological research, and support conservation initiatives.

Benefits of Ornithological Skills:

1. **Conservation of Birds and Habitats:** Ornithological skills are crucial for the protection of bird species and their ecosystems. By understanding bird populations, behaviours, and ecological roles, conservationists can make informed decisions to safeguard endangered species.
2. **Monitoring Ecosystems:** Birds often serve as indicators of environmental health. Skilled ornithologists can detect changes in ecosystems, providing early warnings of habitat degradation or climate impacts.
3. **Scientific Research and Education:** These skills are essential for conducting ecological and wildlife research. They also enable educators to raise awareness about birds, their ecological importance, and conservation needs.
4. **Career Opportunities:** Proficiency in ornithology opens pathways in wildlife management, environmental education, ecological research, and conservation organizations.
5. **Connection with Nature:** Developing ornithological skills fosters a deeper appreciation of biodiversity. Activities like birdwatching and field studies enhance understanding of ecosystems and encourage personal engagement with the natural world.

In summary, ornithological skills not only advance scientific knowledge, conservation efforts, and environmental education but also strengthen the human connection to nature and biodiversity.

Types of Ornithological Skills

Bird Identification Skills: The ability to recognize bird species by observing their physical characteristics such as size, shape, coloration, behavior, and vocalizations. This skill often involves using field guides, noting key field marks, and employing tools like binoculars or bird identification apps.

Field Observation Skills: The capacity to watch birds in their natural habitats and systematically record their behaviors, movements, and interactions with the environment. These skills are essential for studying population dynamics, migration patterns, and ecological roles.

Bird Banding/Marking: Involves capturing birds safely and applying unique identifiers, such as bands or tags, to track their movements, lifespan, and behavior over time. This skill requires specialized training and careful handling techniques.

Data Collection and Analysis: The ability to gather accurate field data, including population counts, breeding behaviors, and migration trends, and to analyze this information to draw meaningful conclusions that inform research or conservation strategies.

Ecological and Behavioral Study: Skills in examining how birds interact with their ecosystems, including feeding habits, nesting behaviors, and roles in ecological processes. These skills support effective conservation and habitat management efforts.

Use of Technology in Ornithology: Proficiency in applying modern tools such as GPS devices, drones, birdwatching apps, and remote sensing equipment for monitoring and studying birds. It also includes the ability to use online databases and platforms for data collection, sharing, and analysis.

Conservation and Management Skills: Knowledge and practical skills to protect bird populations and their habitats, including species management, habitat restoration, and the implementation of conservation plans. This also involves collaborating with communities and organizations to promote sustainable practices.

Advantages of Ornithological Skills

Ornithological skills enable professionals to observe and safeguard bird species, supporting effective conservation strategies based on accurate research and field data.

Studying birds and their behaviours provides insights into wider ecological processes, including habitat use, food chains, and ecosystem health, which aids in better environmental management.

Acquiring ornithological skills opens up diverse career opportunities in wildlife conservation, ecological research, education, environmental consulting, and policy-making, all of which contribute to global biodiversity preservation.

These skills foster a stronger connection with nature, helping individuals understand the environment better and raising awareness about biodiversity and ecological issues.

Ornithological expertise supports research in fields like ecology, evolution, and climate change, as observations of bird populations offer important data on environmental trends and species adaptation.

Educators and ornithologists can use these skills to engage the public and students through outreach programs, citizen science projects, and birdwatching activities, promoting environmental stewardship.

Field-based ornithology provides practical, hands-on experience, allowing learners to apply theoretical knowledge while developing critical thinking, problem-solving, and observation skills.

INNOVATIVE TEACHING APPROACHES

Innovative teaching approaches are contemporary methods and strategies designed to actively engage students, enhance learning outcomes, and promote critical thinking, problem-solving, and practical experience. Unlike traditional lecture- or textbook-based instruction, these approaches emphasize student participation, collaboration, and the integration of technology to enrich the learning process. In the field of ornithology, such teaching methods help students grasp theoretical concepts while also developing the hands-on skills required to study birds and their natural habitats effectively.

Key Innovative Teaching Approaches

In ornithology education, innovative teaching approaches enable teachers to go beyond conventional lecture-based methods and adopt interactive, student-centered strategies that encourage engagement, inquiry, and practical application. These methods not only improve the effectiveness of teaching but also support students in developing a deeper understanding and essential skills. The following strategies illustrate a variety of approaches that educators can use to enrich ornithology learning experiences:

Inquiry-Based Learning:

This method casts teachers in the role of facilitators, guiding students to ask questions, investigate topics, and engage in research-based learning. In ornithology, educators can support students in designing and conducting field studies on bird behavior, habitat selection, or nesting habits, promoting curiosity, observation skills, and scientific thinking.

Project-Based Learning (PBL):

In project-based learning, teachers mentor students as they engage in long-term, real-world projects that combine research, fieldwork, and teamwork. Within ornithology, this might include students collaborating to create local conservation plans, track bird migration patterns, or assess avian biodiversity, while the teacher offers guidance, support, and constructive feedback throughout the process.

Technology-Enhanced Learning:

By integrating digital tools like the Merlin Bird ID and eBird apps, GPS mapping, and virtual field experiences, teachers can create a more engaging and hands-on ornithology learning environment. These technologies enable students to access global birdwatching data, participate in citizen science initiatives, and observe real-time bird activity, bridging the gap between classroom learning and field experiences

Flipped Classroom:

In a flipped learning model, teachers assign preparatory content—such as videos, readings, or tutorials before class, allowing class time to be used for active, participatory learning. For ornithology, this means students might study bird anatomy or vocalization patterns at home, then engage in guided identification exercises, discussions, or field activities during class time under teacher supervision.

Experiential Learning:

Teachers who implement experiential learning immerse students in practical, real-world activities. In ornithology, this could involve leading birdwatching trips, engaging students in habitat restoration efforts, or coordinating internships with conservation groups, enabling learners to gain knowledge and skills through direct, guided experience.

Collaborative Learning:

By organizing structured group activities, teachers encourage collaboration, peer learning, and joint problem-solving. In ornithology, this could include group research projects, collaborative bird surveys, or co-preparing field reports, with the teacher guiding teamwork and ensuring that learning objectives are achieved.

Gamification:

Teachers can boost student engagement by using game-based learning techniques. In ornithology, this might involve friendly competitions to identify bird species, earning points through bird ID apps, or interactive quizzes that reward careful observation and accuracy.

Interdisciplinary Teaching:

Teachers can adopt an interdisciplinary approach by combining knowledge from biology, ecology, environmental science, geography, and technology to give students a comprehensive understanding of birds and their roles in ecosystems. For instance, studying bird migration can involve mapping routes (geography), examining the effects of climate and weather patterns (climate science), and exploring physiological adaptations (biology), providing students with a richer and more connected learning experience.

Emerging Innovative Methods in Teaching and Learning

E-Textbooks

E-textbooks provide an opportunity to expand traditional textbook content by incorporating hyperlinks to additional resources such as videos, audio clips, readings, and slide presentations. They can also connect students to live datasets or sensor data, allowing the use of graphical software, statistical tools, and other methods for analyzing and interpreting information.

The goal of e-textbooks is to create a more interactive and collaborative learning environment where both students and teachers actively participate in the learning process. They offer advantages like portability and cost-effectiveness compared to printed textbooks. Although their adoption has been gradual, e-textbooks are increasingly being embraced in educational settings.

Simulation Technology

Simulation technology as an educational tool first emerged in the aviation industry to improve safety training. Simulation-based education (SE) uses software, digital tools, and serious games to enhance teaching and learning experiences.

Recent advances in hardware and software have allowed the development of sophisticated SE techniques, greatly enriching the learning process. Moreover, the expansion of e-learning has made these practices accessible to students worldwide, promoting collaboration not only between countries but also across universities, thereby broadening the reach and impact of education.

Computerized Grading

Computerized grading has a long history, beginning with Scantron “bubble sheet” systems for multiple-choice tests. More recently, the focus has shifted to automating the evaluation of free-form responses, including short answers and essays, which is an area of growing interest.

This approach uses artificial intelligence and machine learning to mimic the grading process of human evaluators. The software examines elements such as word count, grammar, sentence structure, and the use of sources to assign accurate and consistent grades.

Flipped Classroom

A flipped classroom is a blended learning approach in which students first encounter new material at home and then apply their knowledge through active learning and problem-solving during class sessions. Unlike traditional teaching, where instruction occurs in class and homework is completed independently, this model reverses the sequence to maximize interactive learning time.

Teachers often use online videos, PowerPoint presentations, and other digital resources to deliver lessons, allowing students to access content at their own pace. These materials are especially helpful for students who need to review concepts or who miss class. In-class time is then dedicated to discussions, collaborative projects, hands-on activities, and other interactive exercises. This approach shifts the teacher's role from a traditional "lecturer" to a facilitator, encouraging personalized learning and greater student engagement.

Active Learning Classrooms

Active Learning Classrooms (ALCs) are specially designed to encourage active participation in in-person learning, regardless of the course size or subject. These classrooms foster engagement by promoting collaboration among students and facilitating meaningful discussions with instructors.

To support this interactive approach, ALCs are equipped with features such as round tables with computers and network access for small groups, mobile teaching stations that allow instructors to move around and interact with students, and multiple screens placed strategically to enhance visual learning. These elements create a dynamic environment that encourages teamwork, communication, and hands-on learning.

MOOCs (Massive Open Online Courses)

Massive Open Online Courses (MOOCs) emerged from the educational model of the Open University combined with the technology used in traditional online learning programs. These courses are freely available with open enrollment and leverage digital platforms such as wikis, blogs, discussion forums, and social media to create global learning communities.

MOOCs provide a flexible and affordable way for learners to acquire new skills, enhance their careers, or pursue lifelong learning. Today, millions of people around the world participate in MOOCs for purposes such as professional development, career transitions, college preparation, corporate training, and personal growth.

Collaborative Distance Learning Environments

Collaborative Distance Learning Environments share similarities with Active Learning Classrooms and MOOCs but aim to take these concepts further by fostering active learning among geographically distributed students.

Active Learning Forum

An Active Learning Forum is an interactive platform that promotes engagement, collaboration, and critical thinking among learners. It allows students to discuss ideas, solve problems together, and receive feedback in real time, transforming them from passive listeners into active participants. By encouraging peer interaction and practical application of knowledge, such forums enhance understanding, foster deeper learning, and support the development of problem-solving and analytical skills.

Benefits of Innovative Teaching Approaches

- Makes learning more engaging and enjoyable, increasing student participation and interest.
- Promotes better knowledge retention through active, hands-on experiences.

- Encourages critical thinking, problem-solving, and inquiry skills.
- Allows students to apply learning to real-world situations, making education more relevant.
- Enhances communication and teamwork skills through collaborative activities.
- Provides access to digital tools and online resources, supporting flexible and up-to-date learning.

ENHANCING ORNITHOLOGICAL SKILLS THROUGH INNOVATIVE TEACHING APPROACHES

Innovative teaching methods are reshaping how ornithology is taught, allowing educators to deliver lessons that are more engaging, practical, and effective. By blending traditional ornithological knowledge with modern instructional strategies, teachers can help students develop essential skills such as bird identification, behavioral observation, and ecological analysis. Educators play a key role in making learning interactive and field-focused, using tools like mobile bird identification apps, citizen science platforms, and inquiry-based field projects.

Through fieldwork, digital technologies like Merlin and eBird, and collaborative project-based learning, students can connect theoretical concepts with real-world applications. These approaches not only enhance ornithological skills but also promote critical thinking, teamwork, and problem-solving—abilities that are vital for scientific research and conservation efforts. By bridging classroom instruction with hands-on experiences, teachers make ornithology education more meaningful and impactful.

Ultimately, equipping educators with innovative teaching strategies strengthens their ability to inspire curiosity in bird science and environmental stewardship. Such methods foster student-centered learning and prepare a generation of learners who are

knowledgeable in ornithology and ready to actively contribute to conservation, ecological research, and environmental education.

1.2 NEED AND SIGNIFICANCE OF THE STUDY

Ornithology plays a crucial role in understanding ecosystems, biodiversity, and conservation science. Birds act as key indicators of environmental changes and overall ecosystem health, making them essential for monitoring and preserving natural habitats. With the growing threats of habitat destruction, climate change, and declining species populations, there is an increasing demand for educators who can effectively train students in ornithology and related disciplines. Yet, many teaching methods continue to rely heavily on traditional lectures, which often fail to engage students or develop the practical, field-based skills needed for research and conservation work.

There is an urgent need to provide teachers with innovative, interactive, and technology-supported teaching strategies that not only enhance instructional effectiveness but also create engaging and meaningful learning experiences for students. Conventional approaches often lack hands-on experiences and seldom utilize modern digital tools, limiting opportunities for students to develop skills such as bird identification, behavioral observation, ecological assessment, and data interpretation. In today's context of pressing environmental challenges, empowering teachers with effective instructional methods is vital for cultivating students who possess both theoretical knowledge and practical abilities to address ecological issues.

This study is significant because it seeks to modernize ornithology education by focusing on innovative teaching strategies. Approaches such as inquiry-based learning, experiential fieldwork, and the use of digital resources like Merlin and eBird apps,

virtual field trips, and collaborative research activities can enhance teacher effectiveness while improving student learning outcomes.

Additionally, the research underscores the role of teachers as facilitators in inspiring student interest in ecology, conservation, and environmental science. Strengthening teacher skills and confidence in delivering ornithology content contributes to broader goals of scientific literacy and environmental stewardship. The findings are valuable for teachers, students, curriculum developers, conservation agencies, and education policymakers looking to advance science education. Ultimately, this study aims to provide a framework for integrating interdisciplinary, technology-driven, and field-based approaches, preparing students to become knowledgeable, skilled, and environmentally responsible citizens.

1.3 OBJECTIVES

1. To assess the existing level of ornithological knowledge and awareness among science and mathematics teachers.
2. To introduce innovative teaching approaches and digital tools (e.g., Merlin Bird ID, eBird) to enhance ornithological skills.
3. To measure the effectiveness of innovative teaching methods in improving bird identification and observation skills.
4. To compare pre- and post-intervention knowledge levels to determine the impact of the treatment.

1.4 HYPOTHESES OF THE STUDY

1. There is no significant difference between the pre-test and post-test scores of teachers' ornithological knowledge after the intervention.

2. There is a significant improvement in teachers' ornithological knowledge after the implementation of innovative teaching approaches.
3. There is no significant relationship between teachers' demographic variables and their ornithological skill enhancement.
4. There is a significant relationship between teachers' demographic variables and the improvement in their ornithological skills after the intervention.

1.5 **DELINEATION AND DELIMITATION OF THE STUDY**

Delineation

1. This study aims to improve ornithology teaching skills among educators by promoting innovative instructional methods.
2. It explores how modern teaching strategies—such as the use of digital tools, field-based learning, inquiry-driven instruction, and collaborative research—can help teachers deliver more engaging and effective ornithology education.
3. The study examines the influence of these approaches on teachers' ability to develop students' theoretical knowledge and practical skills in areas like bird identification, behavioral observation, and ecological understanding.
4. The research focuses on formal educational settings, primarily targeting biology and environmental science educators at undergraduate and graduate levels, as well as instructors of specialized ornithology courses.

Delimitations

1 The study is limited to the use of the eBird and Merlin apps only.

2 The study is limited to a sample size of 30 participants only.

3 The study is limited to 10 blocks within the Dharmapuri District.

4 The study is limited to 30 schools only.

1.6 ORGANISATION OF THE RESEARCH

The study is organized as follows:

- Chapter 1: Introduction, providing the background, problem statement, objectives, need and significance, scope, and operational definitions.
- Chapter 2: Literature Review, discussing relevant theories, previous research, and contextual background.
- Chapter 3: Research Methodology, detailing the research design, data collection methods, and analysis procedures.
- Chapter 4: Data Analysis and Findings, presenting the results of the study.
- Chapter 5: Findings, Conclusions, and Recommendations, interpreting the findings and offering practical recommendations based on the study.

CHAPTER -II

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

The review of literature enables the researcher to broaden their understanding and perspective on the chosen topic. It helps refine the focus of the study while opening avenues for further research. A literature review provides a comprehensive summary and analysis of existing studies on a specific subject, offering context, identifying gaps in current knowledge, and situating the present study within the wider academic discourse. By critically evaluating and synthesizing previous research, the review establishes the significance of the research problem, justifies the chosen methodology, and informs potential directions for future studies. It ensures that the investigation builds upon a solid foundation of existing knowledge rather than merely replicating prior work.

2.2 RELATED STUDIES (International, Nation)

Dr. T. Jagadeeshwara Chari (2025) carried out a study titled *"Identification of Birds Using the Merlin App in and Around Siddipet."* Accurate identification of bird species is essential for the conservation of biodiversity. The Merlin Bird app, created by the Cornell Lab of Ornithology, leverages a comprehensive database of images, audio clips, and other relevant information to assist in bird identification. Users can provide photographs, sound recordings, or details such as location, size, and color to facilitate the process. The study emphasizes the app's effectiveness in correctly identifying bird species and showcases how technological innovations can be applied to ornithology. By integrating artificial intelligence, the Merlin app not only supports ecological research

but also fosters a closer connection between humans and nature, enabling precise identification of birds in targeted areas.

Dr. Rajkumar Singh (2024) emphasizes that capturing students' attention and presenting material in memorable ways is essential for meaningful learning. He argues that traditional classroom methods need to evolve by incorporating creative and interactive teaching strategies. Such approaches not only enhance the effectiveness of education but also empower students, contribute to better governance, and support broader national development objectives. Singh's work provides actionable strategies for making lessons more engaging and helping students understand concepts more deeply, highlighting the need to move beyond conventional teaching methods toward more dynamic learning environments.

In a similar vein, Bijan Sarkar and Souvik Chakraborty (2024) explore the challenge of maintaining student engagement and propose approaches to foster active participation. Their research synthesizes contemporary teaching techniques and empirical studies to identify methods that stimulate critical thinking, sustained interest, and deeper learning. They examine strategies such as integrating technology, using collaborative learning models, differentiating instruction, and applying gamification. The study also underscores the value of personalized learning experiences and ongoing formative assessments in keeping students engaged. By combining insights from multiple educational contexts, the authors highlight that fostering engagement is a continuous and adaptive process that requires attention to students' diverse needs.

Nida Sharif Qureshi (2023) examined the influence of innovative teaching strategies on student participation and engagement. Using a quantitative approach, the study surveyed 66 female teachers from private schools in Dera Ismail Khan to understand their perspectives on the effectiveness of these methods. The findings

indicate that approaches such as problem-based learning, inquiry-based learning, and collaborative learning significantly increase active student involvement in the classroom. Teachers reported favorable perceptions of these strategies, noting their positive effects on student learning outcomes. Qureshi concludes that the implementation of innovative teaching methods fosters a more engaged and dynamic learning environment and recommends that educational institutions provide teachers with the necessary resources and training to apply these methods effectively.

Madhukar Gampala (2023) highlights the growing significance of innovative teaching approaches in contemporary education. The study discusses methodologies that are reshaping traditional pedagogical models, including project-based learning, flipped classrooms, gamification, personalized learning, and collaborative techniques. Gampala emphasizes the positive impact of these strategies on student engagement, comprehension, and overall academic performance. The paper also explores the theoretical foundations underlying these methods and provides practical examples of their application across diverse educational contexts. By reviewing empirical evidence, literature, and case studies, the study demonstrates how these approaches accommodate different learning styles, encourage critical thinking, and promote deeper understanding. It further addresses the challenges associated with adopting innovative practices and suggests strategies to overcome them, underscoring the importance of educators, institutions, and policymakers embracing these methods to meet the needs of 21st-century learners.

Temjentoshi Ozukum (2023) stresses the urgent need for a transformation in educational practices, particularly to enhance teaching quality. Recognizing the increasing complexity and dynamism of modern education, Ozukum advocates for adopting innovative teaching methods to address emerging challenges and cultivate

well-informed, thoughtful students. The study explores a variety of techniques that can be integrated into classroom instruction to boost student engagement and improve learning outcomes. Ozukum aims to provide a deeper understanding of effective teaching practices and inspire educators to implement these methods, ultimately enhancing the overall quality of education.

Anitha Kaluvoya (2022) examined the effectiveness of innovative teaching methods implemented by educators in India. The study highlights that in the 21st century, teachers need to be not only knowledgeable but also creative and innovative to engage students effectively. Kaluvoya investigated the challenges teachers face, particularly in integrating digital technology into classrooms. Using a self-administered questionnaire distributed via Google Forms, the study surveyed 150 teachers across various educational levels in India. Analysis with SPSS indicated a pressing need for reforms in both curriculum design and teaching practices. The study concludes that teaching should be more interactive and engaging, and teachers must continuously enhance their technological skills to meet the demands of contemporary learners.

Dr. Pravin H. Ghosekar (2022) explored the impact of innovative teaching strategies on student engagement. He argues that modern teaching methods allow educators to connect with students' minds and inspire them, a level of engagement that was rarely seen in classrooms in the past. With advances in technology, teachers now have access to numerous tools and strategies that enhance teaching effectiveness. Ghosekar's study emphasizes that these innovative approaches significantly improve student participation and learning outcomes, demonstrating how thoughtfully applied strategies can make classrooms more engaging and impactful.

Ms. Indu Bala (2021) focused on the role of innovative teaching-learning practices in teacher education. She highlights that in an era of rapid technological and scientific advancement, incorporating innovative methods is crucial for developing reflective, knowledgeable, and adaptable educators. Bala emphasizes that such practices are particularly important in skill-based education, ensuring that future teachers gain both theoretical understanding and practical expertise. The study also addresses the challenges encountered when implementing innovative approaches, underlining the importance of adopting these methods to prepare effective educators capable of navigating a constantly evolving educational landscape.

Henriette Manishimwe (2021) reviewed the role of innovative teaching and learning methods in improving the classification of living things in biology. She notes that students often struggle with this topic due to misconceptions, which are largely attributed to traditional teaching methods, leading to poor academic performance. The review emphasizes the benefits of active teaching strategies, particularly Inquiry-Based Learning (IBL) using the 5Es instructional modelEngage, Explore, Explain, Elaborate, and Evaluate. Findings indicate that this approach allows students to learn through hands-on activities, correct misconceptions, and develop essential skills and competencies, ultimately enhancing performance in assessments. Manishimwe recommends the 5Es model as an effective strategy for teaching complex biology content, especially the classification of plants and animals.

Rustico Y. J. (2020) conducted a study to develop a scale for measuring teachers' innovative teaching strategies, employing both qualitative and quantitative exploratory methods. Interviews with nine school heads and seven teachers helped identify key constructs and indicators of innovative teaching, which were then tested with 309 public elementary teachers across ten school districts in Iligan City. The study

identified four main dimensions: critical thinking, creativity, social skills, and ICT skills. Results revealed that teachers generally demonstrated lower levels of innovation in critical thinking and ICT skills. Rustico suggests that the developed scale is a useful tool for assessing innovative teaching practices, though further validation through confirmatory factor analysis (CFA) is recommended to ensure reliability and accuracy.

P.C. Naga Subramani (2018) explored the adoption of innovative teaching and learning methods to enhance educational effectiveness. The study emphasizes the growing use of hybrid teaching models that combine face-to-face instruction with e-learning, as well as the integration of technology and multimedia in classroom settings. Smart devices are widely used to facilitate teaching, assessment, feedback, and research. Subramani highlights that innovative approaches, including short lectures, simulations, role-playing, portfolio development, and problem-based learning (PBL), are particularly effective for engaging students from diverse cultural and linguistic backgrounds. These methods enhance understanding, motivation, and readiness for professional environments increasingly shaped by technological advancements.

R. Jayashree (2017) examined innovative teaching and learning methods for undergraduate students, emphasizing that education goes beyond literacy to foster creativity, critical thinking, and workforce readiness. The study argues that the success of students largely depends on teachers and the innovative strategies they employ in the classroom. Jayashree highlights various methods that can enhance knowledge acquisition and student engagement, suggesting that thoughtfully implemented innovative practices are essential for effective learning outcomes.

Dr. Paras Jain (2017) explored the transformative potential of innovation in education. He contends that purposeful and well-implemented innovation can significantly reform the educational system, benefiting both teachers and students. Jain

underscores the central role of teachers as the backbone of learning, capable of guiding and shaping future generations. The study examines a range of innovative teaching tools and demonstrates their positive effects on students' knowledge, interest, and confidence. Jain further emphasizes the need for educational reforms, particularly at the grassroots level, to harness human potential through the integration of innovation in teaching practices.

Carmen Gache (2016) highlighted the importance of incorporating ornithology into environmental education for primary and secondary students. The study notes that while students are naturally curious about animals, traditional biology curricula often neglect complex ecological relationships and behaviors. Gache advocates for optional ornithology classes, pointing out that birds' diverse behaviors, songs, plumage, breeding patterns, and migratory habits make them ideal subjects for ecological study. Observing birds allows students to understand their role in ecosystems, including their position in food chains, and to use them as bio-indicators for assessing environmental health.

Mohini Rasal (2015) investigated the use of innovative teaching methods in undergraduate education, specifically within Hotel Management colleges. The study aimed to determine whether faculty members employed creative approaches to make classes more engaging and positively impact student learning. Observations revealed that innovative teaching methods not only enhance the learning experience but also strengthen students' skills and comprehension. The research supports the broader view that integrating innovative practices in higher education improves educational quality and student outcomes.

Dr. John A. Marshall (2003) provides a comprehensive review of teaching tools and techniques aimed at improving teaching effectiveness for both novice and experienced educators. The study is organized into two main sections: the learning

process and innovative teaching methods. In the learning-focused section, Marshall emphasizes prioritizing student learning over traditional teaching, highlighting strategies such as problem-based learning, collaborative group activities, and fostering student accountability. He also discusses approaches to influence learning behavior outside the classroom and offers guidance on preparing for effective instruction. In the section on teaching methods, the study outlines essential practices, including the Seven Good Practices for Teachers, teaching with hospitality, active listening, and using assessment tools like the Minute Paper. Marshall presents these strategies as practical, enjoyable, and easily applicable, providing examples and case studies to illustrate their implementation. The overarching goal is to offer educators practical techniques that can be effectively integrated into their teaching to enhance learning outcomes.

Synthesis of Review

Author & Year	**Title**	**Method**	**Location of Study**	**Key Findings**
Dr. T. Jagadeeshwara Chari (2025)	Identification of Birds Using Merlin App in & Around Siddipet	Case study / Application analysis	India	The Merlin Bird app effectively identifies bird species using AI analysis of photos, sounds, and inputs like location and color. Supports biodiversity conservation and enhances ecological studies by enabling accurate and accessible bird identification.
Dr. Rajkumar Singh (2024)	Innovative Teaching and Learning Methods: A Vital Need for the Current Educational Scenario	Review / Theoretical analysis	India	Emphasizes capturing students' attention and presenting content in an engaging manner. Suggests that innovative teaching methods improve

				learning, empower students, and support national development goals. Advocates for transforming traditional teaching approaches.
Bijan Sarkar & Souvik Chakraborty (2024)	Innovative Teaching Strategies for Enhancing Student Engagement in the Classroom	Comprehensive review / Empirical studies	Abroad	Identifies strategies such as technology integration, collaborative learning, differentiated instruction, and gamification to enhance engagement and critical thinking. Highlights the need for continuous innovation and adaptability.
Nida Sharif Qureshi (2023)	Impact of Innovative Teaching Strategies on Student's Active Participation in Learning	Quantitative survey (66 female teachers)	Abroad	Problem-based, inquiry-based, and collaborative learning strategies increase student participation and improve outcomes. Recommends providing resources and training to teachers for effective implementation.
Madhukar Gampala (2023)	Innovative Approaches to Teaching and Learning: Transforming Pedagogy for 21st Century Learners	Literature review / Case studies / Empirical evidence	Abroad	Highlights the impact of project-based learning, flipped classrooms, gamification, and personalized learning on engagement and outcomes. Discusses challenges and the importance of adopting modern teaching practices.

Temjentoshi Ozukum (2023)	Innovative Teaching Methods for Enhancing the Quality of Education	Conceptual review	Abroad	Advocates for innovative teaching methods to address educational challenges, improve student engagement, and enhance learning outcomes.
Anitha Kaluvoya (2022)	Effectiveness of Innovative Teaching Methods in India	Survey (150 teachers, SPSS analysis)	India	Found a strong need for interactive and engaging methods. Teachers should upgrade technological skills to meet modern learners' demands.
Dr. Pravin H. Ghosekar (2022)	Study of Innovative Teaching Strategies and Its Impact on Student Engagement	Review of innovative strategies	India	Innovative teaching strategies improve student engagement and learning, with technology serving as a key enabler.
Ms. Indu Bala (2021)	Innovative Teaching-Learning Practices in Teacher Education	Review / Conceptual analysis	India	Emphasizes the importance of innovative practices in teacher education and highlights implementation challenges. Calls for adaptation to modern educational trends.
Henriette Manishimwe (2021)	The Role of Innovative Teaching Methods Toward the Classification of Living Things	Review of active teaching methods	Abroad	Active learning methods, such as Inquiry-Based Learning with the 5Es model, help alleviate misconceptions and enhance understanding of biological classification.
Rustico Y. J (2020)	Teachers' Innovative Teaching Strategies: Scale Development Using	Mixed-method (interviews + scale development)	Abroad	Identified four key factors: Critical Thinking, Creativity, Social Skills, and ICT Skills. Teachers showed lower

	Exploratory Factor Analysis			innovation in critical thinking and ICT. Recommends further validation of the scale.
P.C. Naga Subramani (2018)	Innovative Teaching and Learning Methods: A Shift Towards Hybrid Models	Review of hybrid models & technology integration	India	Focuses on hybrid models combining face-to-face and e-learning, multimedia, and technology integration. Highlights problem-based learning, simulations, and engagement for diverse students.
R. Jayashree (2017)	A Study on Innovative Teaching Learning Methods for Undergraduate Student Education	Review of innovative methods	India	Explores methods enhancing creativity, critical thinking, and workforce readiness among undergraduates.
Dr. Paras Jain (2017)	The Transformative Power of Innovation in Teaching	Conceptual exploration	India	Highlights how innovation can empower teachers and students, transform education, and improve learning outcomes. Stresses teachers' central role in the learning system.
Carmen Gache (2016)	Environmental Education Through Ornithology in Primary and Secondary Schools	Review / Conceptual analysis	Abroad	Advocates integrating ornithology into curricula to spark students' curiosity. Uses birds as bio-indicators to teach ecology and environmental awareness.
Mohini Rasal (2015)	To Study the Various Innovative Methods of Teaching for	Survey study	India	Investigates innovative teaching methods in hotel management colleges, showing

	Undergraduate Level			improvement in engagement and learning outcomes.
Dr. John A. Marshall (2003)	Innovative Teaching and Learning Strategies	Literature review / Case study analysis	Abroad	Presents practical methods like problem-based learning, group learning, and formative assessments. Emphasizes active participation and real-world problem solving.

2.3 CONCLUSION

The review of related studies enabled the investigator to gain a clearer understanding of the problem addressed in the present study. By examining existing research, the investigator was able to identify effective methodologies and strategies, which informed the development of an appropriate and well-structured approach for conducting the current investigation. The methodology adopted for this study is detailed in the following chapter.

CHAPTER-III

METHODOLOGY

3.1 INTRODUCTION

Research methodology outlines the researcher's planned approach for conducting their study, offering a structured and systematic strategy to tackle a research problem. It lays out the steps taken to achieve reliable and valid results aligned with the study's objectives. This chapter elaborates on the specific methodological procedures employed in the current investigation, providing a comprehensive overview of the researcher's methodology throughout the study phases.

3.2 RESEARCH DESIGN

Research methods are the strategies, processes, or techniques utilized in the collection of data or evidence for analysis to uncover new information or create a better understanding of a topic. Research methods involve the conduct of experiments, tests, surveys, and the like. On the other hand, research methodology involves learning the various techniques that can be used in the conduct of research and in the conduct of tests, experiments, surveys, and critical studies. There are different types of research methods that use different tools for data collection.

In the present study, the investigator used the single-group experimental method.

3.3 SAMPLING TECHNIQUES AND SAMPLE

Purposive sampling technique was adopted in this study. The present study was conducted among 30 Schools in 10 blocks from Darmapuri District. A sample of 30 graduate teachers in Darmapuri District was selected for the study.

3.4 RESEARCH TOOLS

The following tools were used in the present study

- eBird App
- Merlin
- Pre test post test questionnaire
- Observation Schedule

3.5 DESCRIPTIONS OF TOOLS

The research tool titled *"Enhancing Ornithological Skills Through Innovative Teaching Approaches"* is systematically constructed in two main sections to gather relevant data from school teachers. The first section is a Teacher Profile Sheet designed to collect demographic and professional details such as name, designation, subject taught, teaching experience, gender, age, type and location of school, etc. The second section is a structured questionnaire consisting of 25 multiple-choice questions, which assess teachers' factual knowledge, attitudes, and practical understanding of ornithology. These questions cover topics like bird species, behavior, habitat, migratory patterns, conservation issues, and educational applications. Each question has four options, with only one correct answer, facilitating objective data analysis. The tool is designed to

ensure clarity, relevance, and alignment with the research objectives, enabling effective assessment of the existing ornithological awareness among teachers and identifying areas for pedagogical improvement.

Use of eBird and Merlin Apps in Enhancing Ornithological Skills for Teachers

In this study, the **eBird** and **Merlin** apps serve as essential technological tools that teachers can integrate into their instructional practices to enrich the teaching and learning of ornithology. These apps not only facilitate bird identification and data collection but also provide opportunities for active, outdoor learning that benefits both teachers and students.

eBird App:

Teachers can use the eBird app as a platform to engage students in real-time birdwatching and citizen science projects. For example, during field activities or nature walks, teachers can guide students to record bird sightings using eBird, helping them contribute data to a global database. This encourages observational skills, scientific recording, and data analysis. For teachers, actively participating in these walks while using the app encourages physical movement and outdoor engagement, which can improve mental and physical health by reducing stress and promoting well-being. The app also helps teachers manage time efficiently during field sessions by providing a structured way to log observations and track progress, making ornithological fieldwork more organized and impactful.

Merlin App:

Merlin serves as an accessible, user-friendly bird identification tool that teachers can use both in and out of the classroom. Teachers can demonstrate how to use Merlin to identify birds by their appearance, calls, and behaviors, thereby supporting students' visual and auditory learning. This app's interactive features allow teachers to model inquiry-based learning, encouraging students to explore and identify species independently or in groups. Using Merlin helps teachers bridge the gap between theory and practice, offering immediate feedback and enhancing students' confidence in bird identification. Moreover, engaging with the app during outdoor activities keeps teachers active and mentally stimulated, contributing positively to their own health while enriching the learning environment.

By integrating these apps into their teaching, educators promote a hands-on, technology-enhanced approach that fosters student curiosity, strengthens ornithological skills, and supports teachers' well-being through active participation in field-based learning.

Orientation Program for Teachers

To effectively implement innovative teaching approaches in ornithology education, the investigator conducted a comprehensive orientation program designed specifically for teachers. This program provided both theoretical and practical training on integrating modern pedagogical tools, including the use of technology like the eBird **and** Merlin **apps**, alongside field-based learning strategies.

The orientation program was delivered through a blended model, combining online workshops**,** offline **classroom sessions**, and hands-on field visits.

Online Orientation:

The online component included interactive webinars and tutorial sessions where teachers were introduced to the concepts of innovative teaching methods, inquiry-based learning, and technology integration in ornithology. Demonstrations on how to navigate and utilize the eBird and Merlin apps for bird identification, data collection, and student engagement were provided. Teachers also participated in virtual discussions and collaborative activities to share ideas and clarify doubts, ensuring they were comfortable with the digital tools before practical application.

Offline Classroom Sessions:

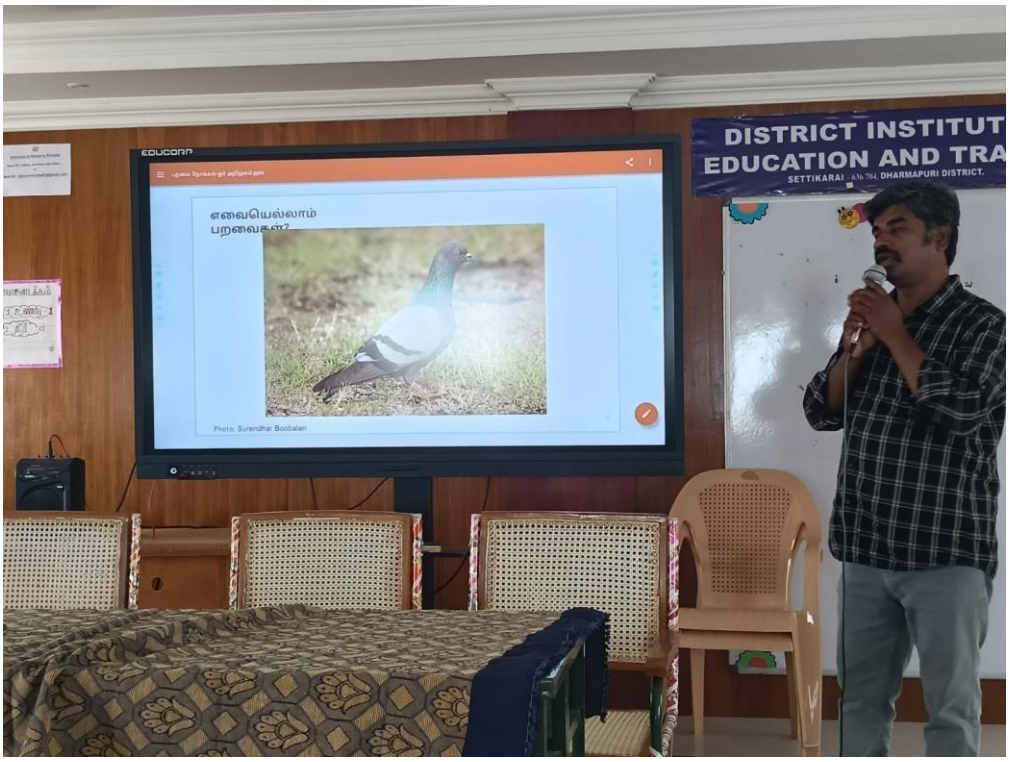
Offline sessions focused on face-to-face training where teachers received hands-on guidance on lesson planning, designing field activities, and integrating collaborative and project-based learning approaches. These sessions aimed to build teachers' confidence in applying innovative teaching strategies within their own classrooms and institutions. Practical exercises included simulated bird identification tasks using the apps, group discussions, and problem-solving activities tailored to ornithology education.

Field Visits:

A key part of the orientation program was supervised field visits where teachers applied their learning in real-world settings. During these visits, teachers conducted guided birdwatching using the eBird app to log observations and

practiced using Merlin for on-the-spot identification. These field experiences helped teachers develop their practical ornithological skills, understand how to manage outdoor learning effectively, and experience the benefits of active teaching approaches firsthand. The field visits also promoted physical well-being and mental rejuvenation by encouraging outdoor engagement with nature.

Through this blended orientation program, the investigator aimed to equip teachers with the necessary knowledge, skills, and confidence to adopt innovative teaching approaches, thereby enhancing the overall quality of ornithology education and fostering more active and skilled learners.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Observation Schedule

The observation schedule focused on evaluating 30 teachers' use of the eBird and Merlin apps in enhancing ornithological skills through 10 key areas of guided questions. It assessed familiarity with the apps, clarity of instruction, and effective integration into both classroom and field settings. Specific attention was given to how teachers guided students in logging birdwatching data with eBird and using Merlin for live identification through sound or photo. The schedule also measured the duration and meaningfulness of birdwatching sessions, physical engagement through walking, and whether birdwatching was modeled as a personal habit or hobby. Additionally, it considered the mental and physical well-being benefits reported or observed during activities, the level of student engagement, and the effectiveness of post-activity reflections linking observations to course content. Ratings on a scale from 1 (not observed) to 5 (consistently observed) were used to quantify these aspects, with fields for date, observer and teacher names, location, watching time, and walking distance to provide a comprehensive view of teaching practices using these innovative tools.

3.6 SCORING OF RESEARCH TOOLS

The study utilizes a pre-test/post-test questionnaire in an open-ended format with multiple-choice questions. A scoring system is employed where each correct answer is assigned 1 mark, contributing to a maximum total score of 25 marks.

3.7 PILOT STUDY

To ensure the reliability and validity of the research instruments and methodology before full implementation, a pilot study was conducted involving a small, representative sample of 10 teachers. This preliminary phase allowed for the identification of potential ambiguities in the questionnaires, assessment of the clarity of the innovative teaching approach instructions, and verification of data collection procedures. The feedback gathered from these participants was crucial for refining the research tools and logistical framework, ensuring a smoother execution of the main study on enhancing ornithological skills. The successful completion of the pilot study confirmed the feasibility of the research design and provided essential insights for necessary adjustments.

3.8 STANDARDIZATION OF RESEARCH TOOLS

Validity

To establish the validity of the research tool, the questionnaire was developed with guidance from subject matter experts in biology, environmental science, and pedagogy. Each item was carefully designed to align with the objectives of enhancing ornithological knowledge, attitudes, and field-related skills among teachers. Content validity was ensured by covering a wide range of

relevant topics, including bird species, identification techniques, migratory patterns, and conservation practices. The tool was reviewed for clarity, language appropriateness, and conceptual alignment, and revisions were made based on expert feedback to eliminate ambiguity and improve focus.

Reliability

Reliability of the tool was assessed through a pilot test conducted with a representative sample of teachers. The responses were analyzed to determine internal consistency, and necessary modifications were made to improve question structure and eliminate inconsistencies. Statistical methods, including the calculation of Cronbach's alpha, were used to evaluate the reliability of the questionnaire. The alpha value indicated a high level of internal consistency, confirming that the tool is reliable and capable of producing stable and consistent results when administered to a broader group. The reliability value is found 0.79

3.9 RESEARCH PROCESS

Pre-Test Phase:

Before implementing any intervention, **a pre-test** was administered to the selected group of science and mathematics teachers to assess their existing level of ornithological knowledge and awareness. The pre-test consisted of the same 25 multiple-choice questions included in the validated questionnaire. This phase helped establish a baseline for comparison and provided insights into the participants' initial understanding of bird identification, behavior, conservation, and observation skills.

Treatment Phase:

Following the pre-test, the participants underwent a treatment phase, where innovative teaching approaches were introduced to enhance their ornithological skills. This included the use of digital tools such as the Merlin Bird App and eBird App, interactive multimedia presentations, hands-on birdwatching activities, group discussions, and guided nature walks. Teachers were also given access to bird identification guides, sound recordings, and regional bird packs. The treatment was conducted over a 2–4 weeks through workshops or structured training sessions aimed at building both content knowledge and field skills.

Post-Test Phase:

At the end of the treatment period, **a post-test** identical to the pre-test was administered to evaluate the effectiveness of the intervention. The same 25-item questionnaire was used to measure any improvement in the participants' ornithological knowledge, attitudes, and observation skills. The pre-test and post-test scores were statistically analyzed to determine the impact of the innovative teaching methods. The difference in scores provided measurable evidence of learning gains and the success of the treatment strategies employed.

3.10 STATISTICAL TECHNIQUES

The following statistical techniques were used in this study:

- Percentage Analysis
- Descriptive Analysis
- Differential Analysis

- Effect Size

Percentage analysis

Percentage analysis is a statistical method used to interpret and present data in terms of proportions or percentages, making it easier to understand patterns and comparisons among different variables. The primary purpose of percentage analysis in this study is to determine the distribution of responses across various categories such as correct answers, awareness levels, or demographic factors and to highlight trends in ornithological knowledge and skill development among teachers. By converting raw data into percentages, it becomes more meaningful and visually clear, allowing researchers to assess the effectiveness of the intervention, identify strengths or gaps in understanding, and make data-driven conclusions with greater accuracy.

Descriptive Analysis:

Descriptive Analysis is a type of data analysis that helps describe, show, or summarize data points in a constructive way, allowing patterns to emerge that fulfill the conditions of the data. Descriptive statistics are used to describe the basic features of the data in a study, providing simple summaries about the sample and the measures. It provides information about the nature of a particular group of individuals. Mean and Standard Deviation were calculated for the pre-test and post-test.

Differential Analysis:

Differential Analysis is attempted to find out how the scores of one test and assessment differ from another set of scores in the variables. This can be

found out by comparing the mean scores obtained in different tests of the same variable. The 't' test is a statistical test used to compare the means of two groups, often used in hypothesis testing to determine whether a process or treatment has an effect on the population of interest, or whether two groups are different from each other.

Effect Size:

The absolute effect size is the difference between the average and mean outcomes in two different intervention groups. Effect size measures the strength of the relation between two variables, computed as the fraction of the difference between two groups' means and the standard deviation.

$$\textbf{Effect Size} = \frac{\mu_1 - \mu_2}{\sigma}$$

Here,

μ_1 is the mean of the first population group,

μ_2 is the mean of the second population group, and

σ is the standard deviation

3.11 CONCLUSION

In this chapter, the rationale of the study was discussed, including operational definition of key terms, objectives of the study, hypotheses of the study, research method, research tools, constructions of tools, validation of tools. The next chapter focused on data analyse and the interpretation of data.

CHAPTER-IV

DATA ANALYSES AND INTERPRETATION

4.1 INTRODUCTION

Best and Kahn (2012) define statistics as "a body of mathematical techniques or processes for gathering, organizing, analyzing, and interpreting numerical data." Analysis involves computing specific measures and identifying patterns of relationships among data sets. Therefore, one significant task for researchers is to analyze the collected data. The data are subsequently analyzed statistically, and interpretations are provided accordingly.

4.2 ANALYSIS AND INTERPRETATION

Table 1
Pre test and Post test Scores

Sl.No	Name and address of the Teacher	Pre Test Score	Post Test Score
1	P.Gunasekaran, BT Asst PUMS, Pallappatti	48	80
2	T.Anbarasu, ST Asst PUMS, Veppalahalli	44	76
3	E.Devika, BT Asst PUMS Krishnapuram	48	84
4	P.Shanmugapriya, BT Asst GGHSS, Marandahalli	52	84
5	K.Ragunath, BT Asst PUMS, Rajathoppu	36	64
6	K.Karikalan, BT Asst PUMS, Pulikkal	52	88
7	R.Aravinth, BT Asst PUMS, Periyathabbai	32	72
8	M.Veeramani, BT Asst PUMS, Balinjirahalli	32	76
9	M.Ponnusamy, BT Asst PUMS, Konankihalli	44	80

10	P.Tamilvaani, BT Asst GGHSS, Periyampatti	56	84
11	T.Janma, BT Asst PUMS, Bikkampatti	40	80
12	M.Kalaivani, BT Asst PUMS, Thotlanahalli	32	72
13	T.Vijaya, BT Asst GHSS, Kalapampaadi	32	76
14	A.Mohan, Bt Asst GHS, Kolasanahalli	48	80
15	G.Javakar, BT Asst PUMS, Chinnaiyanur	68	88
16	J.Stella, BT Asst MMS, Mathikonpalayam	28	72
17	K.Shaliha, BT Asst PUMS, P.Gettur	36	76
18	S.Jayalakshmi, BT Asst PUMS, K.Agraharam	36	80
19	R.Reena, BT Asst PUMS, Kaatukkottai	36	76
20	R.Surya, BT Asst GHSS, Kalappampaadi	40	76
21	J.Punitha, BT Asst PUMS, Kanaappatti	40	80
22	V.Parimaladevi, Bt Asst PUMS,Errahalli	56	84
23	G. Vishnu kumar, BT Asst GHSS, R.Gopinathampatti	48	88
24	V.Rajkumar, BT Asst PUMS, Ranimookanur	52	88
25	R.Govindaraj, BT Asst PUMS, Samandahalli	40	76
26	R.Sangeetha, BT Asst Model School	44	88
27	K.Muniyappan, Bt Asst GHSS, Nallampalli	64	92
28	M.Saravanan, BT Asst PUMS, Ajjampatti	40	76
29	K.Narayanasamy, BT Asst PUMS, Kumparahalli	48	88
30	M.Loganathan, BT Asst GHS, Gettuhalli	60	92

The table shows that the overall pre test and post test scores

Table 2

The level of ornithological knowledge

Overall	%
Pre test	35.53%
Post test	64.46%

The overall ornithological knowledge of participants increased significantly after the intervention, with an improvement from 35.53% to 64.46%. This indicates that the innovative teaching approaches were effective in enhancing teachers' awareness and understanding of ornithology**.**

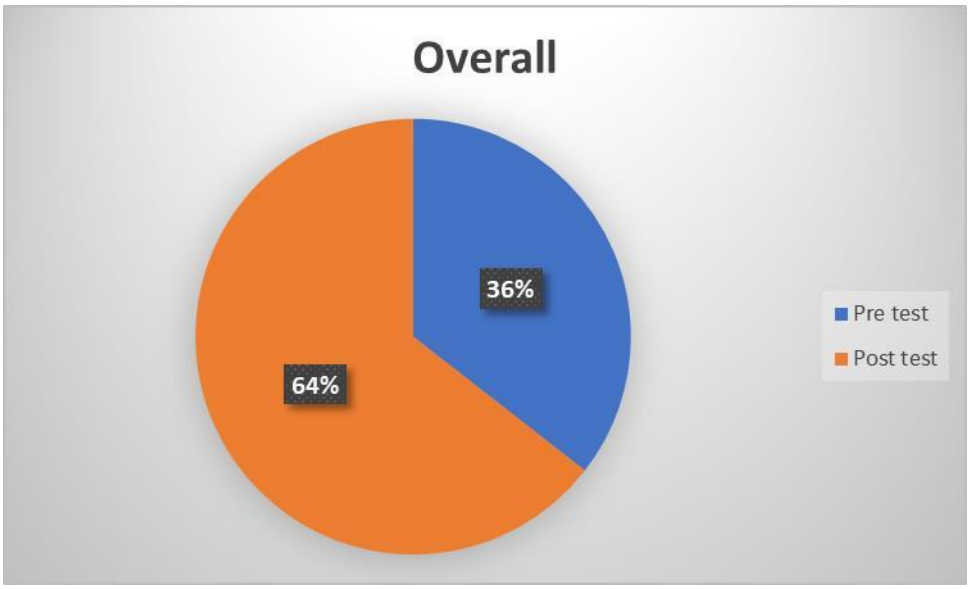

Fig 1. The level of ornithological knowledge

Table 3

Mean , SD T test Scores of Pre test and Post test

	N	Mean	SD	't' value	Level of Significance
Pre Test	30	44.40	10.09	33.05	S
Post Test	30	80.53	6.70		

The mean score increased significantly from 44.40 (pre-test) to 80.53 (post-test). The t-value of 33.05 is statistically significant, indicating that the treatment innovative teaching methods had a strong positive impact on improving ornithological skills among teachers.

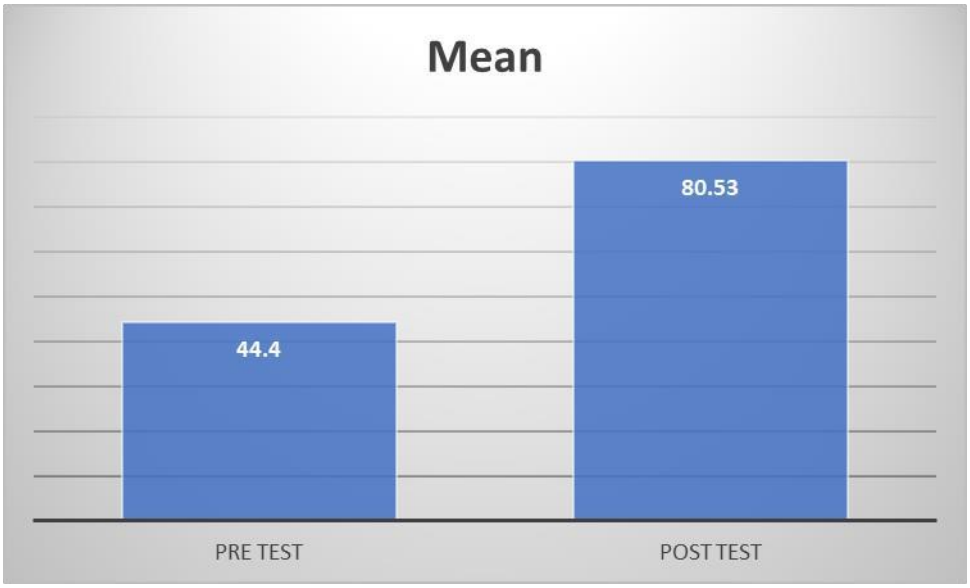

Fig.2 Mean , SD Scores of Pre test and Post test

Table 4

Mean , SD and T test scores of Male and Female in Pre test and post test

	Gender	N	Mean	SD	't' value	Level of Significance
Pre Test	Male	16	47.2500	10.45307	1.725	NS
	Female	14	41.1429	8.93444		
Post test	Male	16	81.5000	7.98332	0.866	NS
	Female	14	79.4286	4.92582		

The t-values for male and female teachers in both pre-test (1.725) and post-test (0.866) were found to be not significant, indicating that gender had no significant influence on the improvement in ornithological skills. Both male and female teachers showed similar progress. Though both male and female teachers showed improvement from pre- to post-test, the t-values were not significant, indicating no statistically meaningful difference between genders in terms of ornithological skill development.

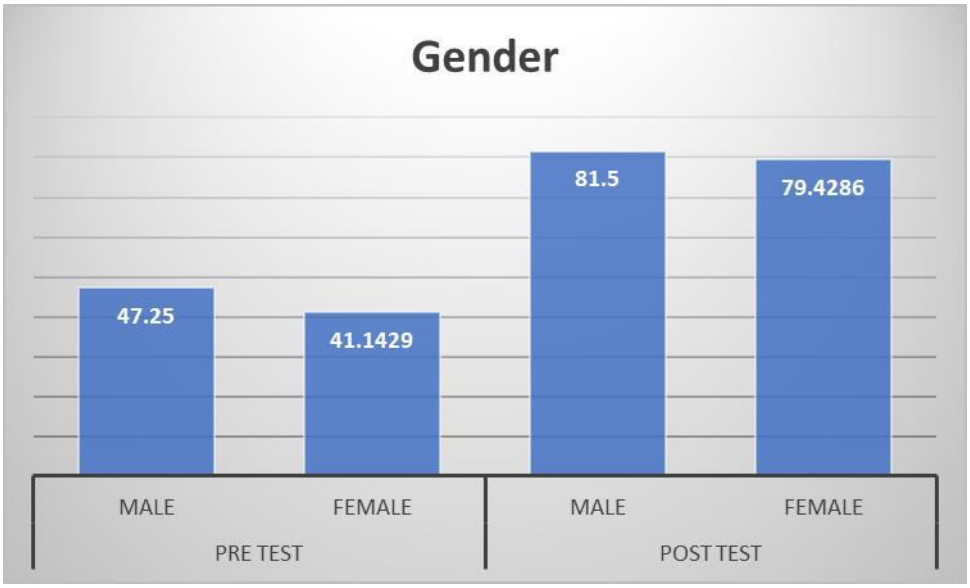

Fig.3 Mean , SD scores of Male and Female in Pre test and post test

Table 5

Mean , SD and T test scores of Science and Maths Subjects in Pre test and post test

	Subject	N	Mean	SD	't' value	Level of Significance
Pre Test	Science	10	48.80	9.39	1.780	NS
	Maths	20	42.20	9.92		
Post test	Science	10	84.00	9.39	2.238	S
	Maths	20	78.80	9.92		

Science teachers outperformed Maths teachers in the post-test with a significant t-value of 2.238. This shows that subject background had an influence, with Science teachers benefiting more from the ornithology-related content and methods. Science teachers performed better than Maths teachers in both pre- and post-tests. The post-test difference was statistically significant, suggesting that subject background may influence how effectively teachers acquire ornithological knowledge.

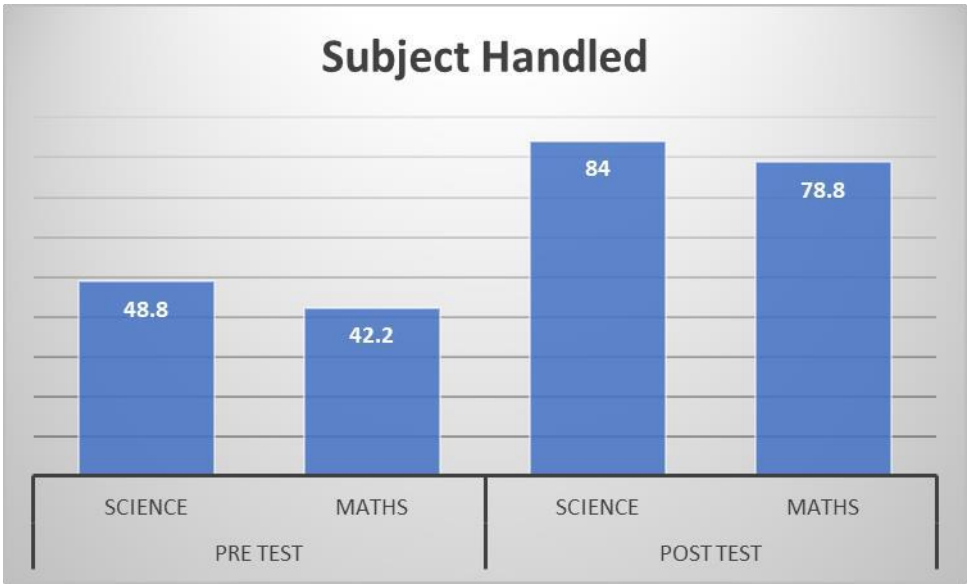

Fig.4 Mean , SD scores of Science and Maths Subjects in Pre test and post test

Table 6

Mean , SD and T test scores of Below 40 and Above 40 years of age in Pre test and post test

	Age	N	Mean	SD	't' value	Level of Significance
Pre Test	Below 40 years	6	43.33	11.14	0.267	NS
	Above 40 years	24	44.66	10.054		
Post test	Below 40 years	6	82.00	7.042	0.575	NS
	Above 40 years	24	80.16	6.722		

Teachers below and above 40 years of age did not differ significantly in either pre-test (t = 0.267) or post-test (t = 0.575). Thus, age was not a determining factor in learning outcomes. There was no significant difference in ornithological skill development between younger and older teachers. Both age groups benefited equally from the innovative teaching approaches.

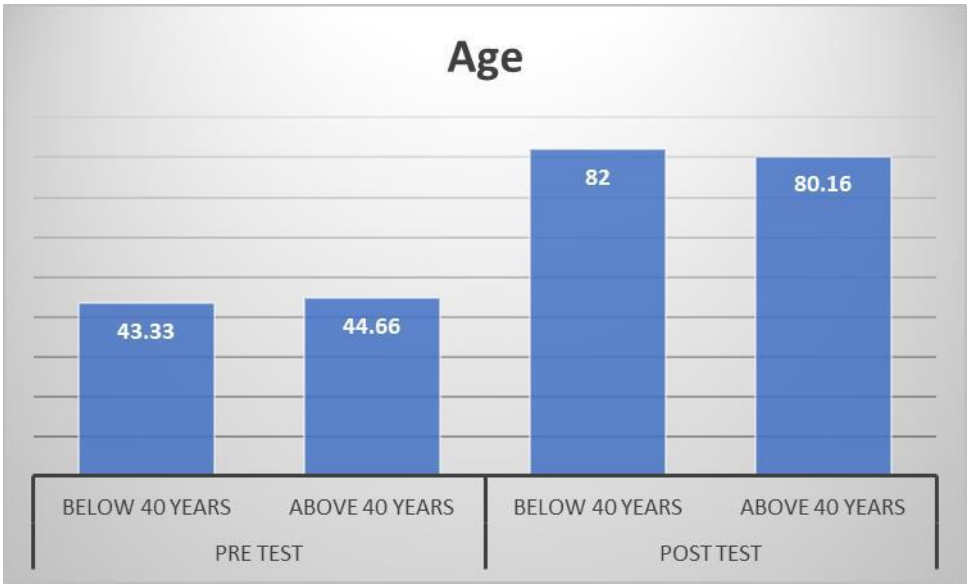

Fig. 5 Mean , SD scores of Below 40 and Above 40 years of age in Pre test and post test

Table 7

F test scores of Teaching Experience in Pre test and post test

ANOVA						
Teaching Experience		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Pre test	Between Groups	249.011	2	124.505	1.242	.305
	Within Groups	2706.189	27	100.229		
	Total	2955.200	29			
Post test	Between Groups	75.761	2	37.881	.833	.446
	Within Groups	1227.705	27	45.471		
	Total	1303.467	29			

The F-values for both pre-test (1.242, p = .305) and post-test (0.833, p = .446) showed no significant difference across varying years of teaching experience. This suggests that experience level did not impact the effectiveness of the intervention. The ANOVA results indicate no significant difference in ornithological knowledge across different teaching experience levels, both in pre- and post-tests. Experience did not play a major role in learning outcomes in this study.

Table 8

F test scores of type of School in Pre test and post test

ANOVA						
Type of School		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Pre test	Between Groups	649.295	3	216.432	2.440	.087
	Within Groups	2305.905	26	88.689		
	Total	2955.200	29			
Post test	Between Groups	317.181	3	105.727	2.787	.061
	Within Groups	986.286	26	37.934		
	Total	1303.467	29			

Although the F-values in both pre- and post-tests are approaching significance, they are not statistically significant at the 0.05 level. This suggests that type of school (GHSS, GHS, PUMS) had a limited influence on the improvement in ornithological skills.

Table 9

Effect size (d)

	Mean	**SD**	σ	**E.S (d)**
Pre Test	44.40	10.09	8.56	4.22
Post Test	80.53	6.70		

The table shows that the effect size of the difference between the means of the pre test scores and post test scores for innovative teaching methods in the experimental group is found to be 4.22, a level given by Cohen (1988) that indicates a large effect size.

Table 10

Correlation

Variables	Pre Test R value	Post Test R value	Level of Significant
Gender	0.307	0.157	NS
Subject	0.313	0.372	S
Age	0.054	0.111	NS
Teaching Experience	0.049	0.123	NS
Type of School	0.083	0.167	NS

Gender showed a low positive correlation with both pre-test and post-test scores. This suggests a slight, but not meaningful, association between gender and ornithological knowledge levels.

Subject specialization (Science and Maths) had a moderate positive correlation with both pre- and post-test performance. This implies that subject background had some influence on learning, with science teachers likely benefiting more.

Age had a very weak correlation with both pre- and post-test scores, indicating that age had little to no impact on ornithological skill development.

Teaching Experience also showed a negligible correlation with learning outcomes, suggesting that years of teaching did not influence the improvement in ornithological skills.

Type of School had a weak correlation with both pre- and post-test performance, showing only a minimal association with the results.

None of the background variables (gender, age, teaching experience, school type) showed a strong correlation with learning outcomes. However, subject specialization had a moderately stronger influence, pointing to the importance of academic background in assimilating ornithological content effectively.

Table 11

Observation Schedule: Teacher Use of Ebird And Merlin Apps

Sl. No.	Observation Area	%
1	Familiarity with Apps	86.67%
2	Integration into Teaching	90.00%
3	eBird App Usage	83.33%
4	Merlin App Usage	80.00%
5	Watching Time	93.33%
6	Walking and Physical Engagement	88.00%
7	Birdwatching as Habit or Hobby	76.67%
8	Health & Well-being Benefits	90.00%
9	Student Engagement	86.67%
10	Post-Activity Reflection	83.33%

- 86.67% of teachers demonstrated strong familiarity with the eBird and Merlin apps, indicating successful orientation and app training.

- 90.00% effectively integrated the apps into their teaching, aligning birdwatching activities with educational objectives.
- 83.33% guided students in using the eBird app for logging bird data, showing practical application in real-time environments.
- 80.00% of teachers used the Merlin app consistently for bird identification, both through audio and visual features.
- 93.33% of teachers engaged in meaningful birdwatching time, making use of extended observation sessions to enhance learning.
- 88.00% participated in physical activities such as walking during birdwatching, contributing to both pedagogical and health benefits.
- 76.67% of teachers showed or encouraged birdwatching as a habit or hobby, fostering long-term engagement with nature.
- 90.00% displayed signs of improved mental and physical well-being, including stress relief, mindfulness, and enjoyment of the activity.
- 86.67% maintained high levels of student engagement during sessions, effectively managing questions and interactions.
- 83.33% conducted post-activity reflections or discussions, helping students connect field observations to classroom concepts.

4.3 CONCLUSION

This chapter deals with analysing data, and their interpretations are provided. A summary of findings, recommendations, educational implications, and suggestions for further research are discussed in the next chapter.

CHAPTER-V

SUMMARY OF FINDINGS AND CONCLUSION

5.1 INTRODUCTION

This chapter primarily focuses on summarizing findings, engaging in discussions, exploring educational implications, providing recommendations, suggesting for further research, and presenting the conclusions outlined in the research report.

5.2 FINDINGS OF THE STUDY

1. There was a clear improvement in teachers' ornithological knowledge after the implementation of innovative teaching approaches.
2. The post-test performance was significantly better than the pre-test, indicating the effectiveness of the intervention.
3. Both male and female teachers showed improvement in their ornithological skills, with no significant difference based on gender.
4. Science subject teachers performed better than Maths teachers in the post-test, suggesting that subject background influenced the learning outcomes.
5. Teachers below and above 40 years of age benefited equally from the innovative teaching, with no major difference in skill acquisition based on age.
6. Teaching experience did not significantly influence the improvement in ornithological knowledge; both experienced and less experienced teachers showed similar gains.

7. Type of school (GHSS, GHS, PUMS) showed a mild trend toward influencing outcomes, though the differences were not statistically significant.
8. The correlation findings revealed that subject specialization showed a moderate relationship with ornithological skill development, while gender, age, teaching experience, and type of school had only weak or negligible associations.
9. The majority of teachers successfully adopted and integrated digital tools like eBird and Merlin into their teaching practices, showing a high level of competence and willingness to embrace innovative, tech-based learning approaches.

- Teachers moved away from traditional lecture-based methods and embraced active, field-based, and student-centered learning, with more than 85% consistently using bird identification and data collection as part of their instructional activities.
- Regular use of these apps during walking and birdwatching activities led to a noticeable reduction in mental and physical stress among teachers. Outdoor engagement, interaction with nature, and movement during sessions contributed to improved well-being and motivation.
- Many teachers began to develop birdwatching as a personal hobby or habit, which further enriched their teaching and increased authenticity and enthusiasm in the classroom.

- The integration of field activities with classroom discussions helped bridge the gap between theoretical concepts and real-world application, making classroom teaching more effective, relevant, and engaging.
- High levels of student engagement were observed when these tools were used, as students responded positively to interactive learning, real-time identification, and collaborative outdoor experiences.
- Overall, thirty teachers have used these apps in their daily classrooms the combination of innovative teaching methods and digital apps enhanced the quality of ornithological education, reduced teacher stress, promoted physical activity, and brought greater effectiveness and creativity to classroom instruction
- In the study examining the impact of innovative teaching approaches on ornithological skills, the findings section would highlight a clear increase in technology adoption and practical observation: specifically, the number of teachers using the application doubled from 15 pre-intervention to 30 post-intervention. Furthermore, these 30 teachers collaboratively watched and recorded a total of approximately 105 distinct bird observations, demonstrating enhanced engagement and practical application of their skills through the use of the platform

5.3 SUMMARY OF MAJOR FINDINGS AND DISCUSSION

The study demonstrated that implementing innovative teaching approaches and digital tools like the eBird and Merlin apps significantly enhanced teachers' ornithological skills and pedagogical practices. A clear improvement was observed in

teachers' post-test performance compared to their pre-test scores, confirming the intervention's effectiveness. These gains were consistent across gender and age groups, though science teachers showed better outcomes than their mathematics counterparts, suggesting prior subject background has a moderate influence on learning specific skills. Notably, the program facilitated a significant pedagogical shift: over 85% of participants moved away from traditional lecture-based methods to adopt active, field-based, and student-centered learning. The integration of outdoor activities using these apps not only improved instruction quality and student engagement but also had the added benefit of reducing teacher stress and promoting personal well-being and hobbies. Overall, the findings indicate that combining innovative teaching methods with accessible digital technology effectively bridges the gap between theoretical concepts and real-world application, making ornithological education more relevant, engaging, and effective.

The study's findings align strongly with existing research that advocates for the integration of innovative teaching methods and technology in education. The observed effectiveness of digital tools is supported by the work of [Dr. T. Jagadeeshwara Chari (2025)], who found that the Merlin app effectively supports biodiversity conservation and enhances ecological studies by enabling accurate and accessible bird identification. The general improvement in engagement and learning outcomes mirrors the findings of [Dr. Rajkumar Singh (2024)], [Bijan Sarkar & Souvik Chakraborty (2024)], and [Nida Sharif Qureshi (2023)], all of whom emphasize that problem-based, inquiry-based, and technology-integrated strategies are vital for capturing student attention and improving active participation.

Furthermore, the study confirms the need for teachers to upgrade technological skills as highlighted by [Anitha Kaluvoya (2022)]. Our findings demonstrate that when

teachers are provided with adequate resources and training, as recommended by Qureshi (2023), they successfully adopt modern, tech-based approaches. The positive impact on both experienced and less experienced teachers supports the idea that innovation can benefit all educators, a sentiment explored by [Dr. Paras Jain (2017)] regarding the transformative power of innovation in teaching. The overall shift toward hybrid models and active learning methods is consistent with the literature reviewed by [P.C. Naga Subramani (2018)] and [Henriette Manishimwe (2021)], suggesting a broader trend in education toward bridging the gap between theoretical knowledge and real-world application, ultimately enhancing the quality of ornithological education.

5.4 RECOMMENDATIONS OF THE STUDY

- Educational institutions should integrate innovative, technology-driven teaching methods, such as interactive quizzes, multimedia resources, and field-based learning, into teacher training programs for better skill acquisition.
- Professional development workshops focusing on ornithology and related ecological subjects should be regularly organized to keep teachers updated and motivated.
- Curriculum designers should consider incorporating differentiated instruction strategies that address the varying needs of science and non-science teachers.

5.5 EDUCATIONAL IMPLICATIONS

The study demonstrates that innovative teaching approaches significantly improve ornithological knowledge among teachers, regardless of gender, age, or

teaching experience. This highlights the importance of adopting creative and interactive instructional methods to enhance subject-specific skills. Subject background plays a moderate role, indicating the need to tailor content delivery to accommodate diverse academic experiences.

This study highlights the crucial role of innovative teaching methods in improving ornithological knowledge among teachers. By integrating interactive tools and technology-based learning, educators can better engage learners and foster deeper understanding, which is essential for effective science education. The findings suggest that educational policymakers and institutions should prioritize such approaches in teacher training programs to enhance overall teaching quality and promote environmental awareness.

5.6 SUGGESTION FOR THE RESEARCH

- Future studies can explore the long-term retention of ornithological skills gained through innovative teaching methods.
- Research can be extended to compare different types of innovative approaches (e.g., gamification, virtual reality) to identify the most effective techniques.
- Studies could investigate student outcomes following teacher training in ornithology to assess the broader impact on classroom learning.

5.7 CONCLUSION

The study concludes that the majority of teachers effectively adopted and integrated digital tools such as eBird and Merlin into their teaching practices, demonstrating strong competence and enthusiasm for innovative, technology-enhanced learning. Moving away from traditional lecture-based approaches, over 85% of teachers incorporated active, field-based, and student-centered methods, using bird identification and data collection regularly as part of their instruction. The consistent use of these apps during walking and birdwatching activities contributed to noticeable reductions in both mental and physical stress among teachers, as outdoor engagement fostered well-being and motivation. Many teachers developed birdwatching as a personal hobby, enriching their teaching with greater authenticity and enthusiasm. The seamless integration of field activities with classroom discussions effectively bridged theoretical knowledge and practical application, making lessons more relevant and engaging. High student engagement was observed, driven by interactive, real-time learning and collaborative outdoor experiences. Overall, the blend of innovative teaching methods and digital technology significantly enhanced the quality of ornithological education, promoted physical health, reduced teacher stress, and brought creativity and effectiveness to classroom instruction.

The innovative teaching approaches employed in this study effectively enhanced the ornithological skills of teachers, leading to a significant increase in knowledge from pre- to post-test. The improvement was consistent across gender, age groups, and teaching experience, emphasizing the broad applicability

of such methods. Subject specialization influenced learning to some extent, suggesting a need for customized instructional strategies. Overall, this study supports the adoption of innovative pedagogical techniques to strengthen teachers' expertise in ornithology and related scientific fields.

The innovative teaching approaches used in this study proved to be effective in significantly enhancing the ornithological skills of teachers across different demographics. The positive outcomes demonstrate that such pedagogical strategies can bridge knowledge gaps and support continuous professional development. Ultimately, these methods can empower teachers to deliver more impactful lessons on ornithology, contributing to better student outcomes and increased interest in biodiversity conservation.

Based on the study's results, a noticeable rise in the use of these apps by teachers was observed, suggesting a boost in both engagement and the practical application of skills. This successful integration of digital tools with new teaching methods ultimately enhanced the overall quality of ornithological instruction. Additionally, the approach was linked to a decrease in teacher stress, an increase in physical activity, and a greater sense of creativity and effectiveness in the classroom.

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Appendix

Personal blank of the respondents

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Contact No.:9786516588

Area of the specialization: Innovative Practice

So far how many projects are done: 02

Some other project in collaboration with others: Yes

Research Tool

Pre Test/Post Test Questionnaire

ENHANCING ORNITHOLOGICAL SKILLS THROUGH INNOVATIVE TEACHING APPROACHES

ஆய்வாளர்: **திரு. மா. மயில்சாமி,** துணை முதல்வர்

மாவட்ட ஆசிரியர் கல்வி மற்றும் பயிற்சி நிறுவனம், செட்டிக்கரை, தருமபுரி மாவட்டம்

அன்புள்ள ஆசிரியர்களுக்கு,

நான் மேற்கண்ட தலைப்பில் ஒரு ஆராய்ச்சி திட்டத்தை 2024 –2025 ஆம் கல்வியாண்டில் மேற்கொண்டு வருகிறேன். ஆராய்ச்சிக்காக வினாக் கருவி ஒன்றை தகவல் சேகரிப்பதற்காக தயாரித்துள்ளேன். இந்த ஆராய்ச்சி கருவியில் வினாத்தாளில் கொடுக்கப்பட்டுள்ள விவரங்களைப் படித்து, உங்கள் சிறந்த பதில்களைத் தேர்வு செய்யலாம் என்றும், உங்கள் கருத்துக்கள் ஆய்வுக்கு மட்டுமே எடுத்துக்கொள்ளப்பட்டு ரகசியம் காப்பேன் என்றும் நான் உங்களுக்கு உறுதியளிக்கிறேன்.

தங்கள் உண்மையுள்ள
மா. மயில்சாமி

Teacher Profile

1	பெயர்:	
2	பதவி:	
3	கல்வித் தகுதி	
4	பள்ளி முகவரி:	
5	ஒன்றியம்:	
6	மாவட்டம்:	**தருமபுரி**
7	பாலினம்	**ஆண்/பெண்**
8	பாடம்	**கணிதம் / அறிவியல்**
9	வயது	**40 வயதுக்கும் குறைவு / 40 வயதுக்கும் அதிகம்**

10	.பணி அனுபவம்	**0-10**	**11-20**	**21-30**
11	பள்ளியின் வகை	GHSS	GHS	PUMS
12	பள்ளி அமைவிடம்	கிராமம் / நகரம்		

ENHANCING ORNITHOLOGICAL SKILLS THROUGH INNOVATIVE TEACHING APPROACHES

அன்புள்ள ஆசிரியர்களுக்கு,

கீழே கொடுக்கப்பட்டுள்ள கேள்விகளைப் படியுங்கள், ஒவ்வொரு கேள்விக்கும் 4 விருப்பங்கள் கொடுக்கப்பட்டுள்ளன, நீங்கள் நினைக்கும் விருப்பத்தைத் தேர்ந்தெடுத்து டிக் செய்யவும். தயவுசெய்து அனைத்து கேள்விகளுக்கும் விடை அளிக்கவும். நன்றி

1. பறவைகள் குறித்து கிடைத்த தொன்மையான தடயங்களுள் ஒன்று எது?

a) ஆர்க்கிமிடிஸ்

b) ஆர்கியாப்டெரிக்ஸ்

c) ஆர்த்ரோபோடா

d) ஆன்தோ சையனின்

2. எந்தப் பறவை மரப்பொந்தில் முட்டைகளை இடும்?

a) காகம்

b) பனங்காடை

c) தேன்சிட்டு

d) மயில்

3. பறவைகள் எந்த உறுப்பினை பயன்படுத்தி இயங்கும் திசையைக் கண்டுபிடிக்கின்றன?

a) இறக்கைகள்

b) கண்கள்

c) மூக்கு

d) காந்த புலத்திற்கு உணர்வளிக்கும் சிறப்பு செல்கள்

4. குயில் பொதுவாக எந்தப் பருவத்தில் அதிகமாகப் பாடும்?

a) கோடைக்காலம்

b) மழைக்காலம்

c) குளிர்காலம்

d) வசந்தகாலம்

5. பனங்காடை எந்தெந்த மாநிலங்களுக்கு மாநில பறவையாக உள்ளது ?

a) ஆந்திரா, கர்நாடகா, தெலுங்கானா

b) ஒடிசா, தெலுங்கானா, கர்நாடகா

c) கர்நாடகா, தெலுங்கானா, கேரளா

d) கர்நாடகா, ஆந்திரா, கேரளா

6. 'ஆந்தைக்கு பகலில் கண் தெரியாது' என்னும் கூற்றை

a) ஏற்றுக்கொள்கிறேன்
b) ஓரளவு ஏற்கிறேன்
c) மறுக்கிறேன்
d) முற்றிலும் மறுக்கிறேன்

7. மீன்கொத்தி தனது கூட்டை எங்கு அமைக்கிறது?

a) நீர்த்தாவரங்கள்
b) மண் பொந்து
c) பாறை இடுக்கு
d) மரக்கிளை

8. பறவைகளைக் கணக்கெடுத்து பதிவு செய்யும் ஒரு செயலி

a) Mybird
b) Ubird
c) Ebird
d) Ourbird

9. வெண் முதுகு பாறுக்கழுகு எந்த வகைப் பட்டியலில் வைத்திருக்கப்பட்டுள்ளதாகக் கூறப்பட்டுள்ளது?

a) மஞ்சள் பட்டியல்
b) சிவப்புப் பட்டியல்
c) நீலப்பட்டியல்
d) கறுப்புப்பட்டியல்

10. பன்னாட்டு இயற்கைப் பாதுகாப்புச் சங்கத்தின் சுருக்கக் குறியீடு என்ன?

a) INFS
b) IUCS
c) IUCN
d) IUFN

11. எந்த மருந்தினை கால்நடைகளுக்கு கொடுப்பதால் பாறுக் கழுகுகள் பாதிக்கப்படுவதாகக் குறிப்பிடப்படுகிறது?

a) Aminopenicillins
b) Diclofenac
c) Cephalosporins
d) Diammonium

12. உருவத்தில் பெரிய இருவாச்சிப் பறவை எது?

a) இந்திய சாம்பல் இருவாச்சி
b) கருப்பு வெள்ளை இருவாச்சி
c) மலை இருவாச்சி

d) கருஞ்சாம்பல் இருவாச்சி

13. உருவத்தை வைத்து கதிர்க் குருவிகளை கண்டறிய முடியவில்லை எனில் கீழ்காணும் எந்தக்கூறு அவற்றை துல்லியமாக அடையாளம் காண உதவும்?

a) வாழிடம்

b) எழுப்பும் ஒலி

c) பறக்கும் முறை

d) உணவு முறை

14. குயில் காக்கையின் கூட்டில் முட்டையிடுகிறது.காகமும் அதனை அடைகாத்து குஞ்சு பொரித்துப் பராமரிக்கிறது. இந்நிகழ்விற்கான ஆங்கிலச் சொல் என்ன?

a) Brood parasitism

b) Blood parasitism

c) Blood parenitism

d) None of the above

15. பறவை நோக்கலை மேற்கொள்ள மிக முக்கியமாக தேவைப்படுவது

a) இரு கண் நோக்கி

b) ஆர்வம்

c) பறவைக் குறிப்பேடு

d) இவை அனைத்தும்

16. தலைப்பகுதியை கொண்டு என்ன வகைக் காடை என கண்டுபிடிங்கள்.

a) Painted– Bushquail

b) Barred Buttonquail

c) Yellow– legged buttonquail

d) Jungle bushquail

17. கிவி பறவை எந்த நாட்டில் காணப்படுகிறது

a) அமெரிக்கா

b) ஆஸ்திரேலியா

c) நியூசிலாந்து

d) ஆப்பிரிக்கா

18. செல்போன் கதிர்வீச்சுக்கள் சிட்டுக்குருவிகளை பாதிக்கின்றன என்னும் கருத்தினை

a) ஏற்கிறேன்
b) மறுக்கிறேன்
c) ஓரளவு ஏற்கிறேன்
d) முழுமையாக மறுக்கிறேன்

19. வலசைப் பறவைகள் பற்றி தெளிவாக அறிய உதவும் ஒரு செயல்பாடு

a) கணக்கெடுத்தல்
b) உற்று நோக்கல்
c) பதிவு செய்தல்
d) வளையம் இடுதல்

20. **உலக பறவைகள் தினம் எப்போது கடைப்பிடிக்கப்படுகிறது?**

a) ஏப்ரல் 22
b) அக்டோபர் 4
c) மே 9
d) ஜூலை 1

21. **இந்தியாவில் பறவைகள் கண்காணிக்க சிறந்த இடமாகக் கருதப்படும் தேசியப் பூங்கா எது?**

a) காஸிரங்கா தேசியப் பூங்கா
b) கேயோலாடியோ (பாரத் பூர்) தேசியப் பூங்கா
c) சுந்தர்பன்ஸ் தேசியப் பூங்கா
d) சிம்லிபால் தேசியப் பூங்கா

22. **பறவைகள் அடிக்கடி இடம்பெயர்வதற்கான முக்கிய காரணம் என்ன?**

a) உணவுக்காக
b) நீண்ட தூரம் பயணிக்க விருப்பமுள்ளதால்
c) பறவைகள் விலங்கு வேட்டையாளர்களிடம் இருந்து தப்பிக்க
d) விளையாடுவதற்கு

23. **பறவைகளை அடையாளம் காண அவற்றின் எது முக்கியமான பங்காற்றும்?**

a) கால்கள் மற்றும் அலகு (Beak & Legs)
b) பரந்த இறக்கைகள்
c) கண்ணின் நிறம்
d) பறவையின் உறுப்பு அமைப்பு

24. **பறவைகள் வானத்தில் பறக்கும் விதத்தைக் கண்காணிப்பதன் மூலம் என்ன கண்டறியலாம்?**

a) அவற்றின் வேகம்

b) அவற்றின் உணவு பழக்கம்
c) அவற்றின் இனத்தை
d) மேலே உள்ள அனைத்தும்

25. **பறவைகளை கண்காணிக்கும் போது முதலில் கவனிக்க வேண்டிய முக்கிய அம்சம் எது?**

a) பறவையின் நிறம்
b) பறவையின் வடிவம் மற்றும் அளவு
c) பறவையின் உணவு பழக்கம்
d) பறவையின் கூச்சல்

Observation Schedule

- **Date: _____**
- **Teacher's Name: _____**
- **Location:** ☐ Classroom ☐ Online ☐ Field Visit
- **Total Watching Time (in minutes): _____**
- **Walking Distance Covered (approx.): _____**km

Sl. No.	Observation Area	Guiding Questions for Observation	Rating (1–5)	Remarks
1	**Familiarity with Apps**	Did the teacher demonstrate a good understanding of the eBird and Merlin apps?		
		Were the instructions clear for students on how to use the apps?		
2	**Integration into Teaching**	Was the activity well-planned and aligned with ornithological learning goals?		
		Were the apps effectively integrated into classroom or field learning?		
3	**eBird App Usage**	Did the teacher guide students to log birdwatching data using eBird?		
		Was species data discussed in terms of ecology and conservation?		
4	**Merlin App Usage**	Did the teacher use Merlin for live identification (sound/photo)?		
		Were students encouraged to use Merlin independently during the activity?		
5	**Watching Time**	How long did the teacher spend observing birds during the session? (in minutes)		
		Was watching time used meaningfully for learning and observation?		
6	**Walking and Physical Engagement**	Did the teacher engage in walking as part of the birdwatching activity?		
		Was the teacher actively involved in exploring the environment with students?		
7	**Birdwatching as Habit or Hobby**	Did the teacher express or model birdwatching as a personal hobby or regular activity?		
		Did the teacher encourage students to view birdwatching as an enjoyable, ongoing learning habit?		
8	**Health & Well-being Benefits**	Did the teacher report or show signs of enjoying the activity (stress relief, enthusiasm, mindfulness)?		

		Did the activity contribute positively to physical or mental well-being (walking, fresh air, calm)?		
9	**Student Engagement**	Were students actively engaged during the use of the apps?		
		Did the teacher respond effectively to student inquiries during the session?		
10	**Post-Activity Reflection**	Did the teacher facilitate a discussion or summary after the fieldwork or app use?		
		Were the observations connected to course content or student reflection tasks?		

Rating Scale:

- **1** – Not Observed
- **2** – Rarely Observed
- **3** – Sometimes Observed
- **4** – Often Observed
- **5** – Consistently Observed

PHOTOS

FIELD VISIT


Shot on vivo Z1x
Vivo AI camera
2025.05.16 07:10


Shot on vivo Z1x
Vivo AI camera
2025.05.16 07:08

ONE DAY ORIENTATION


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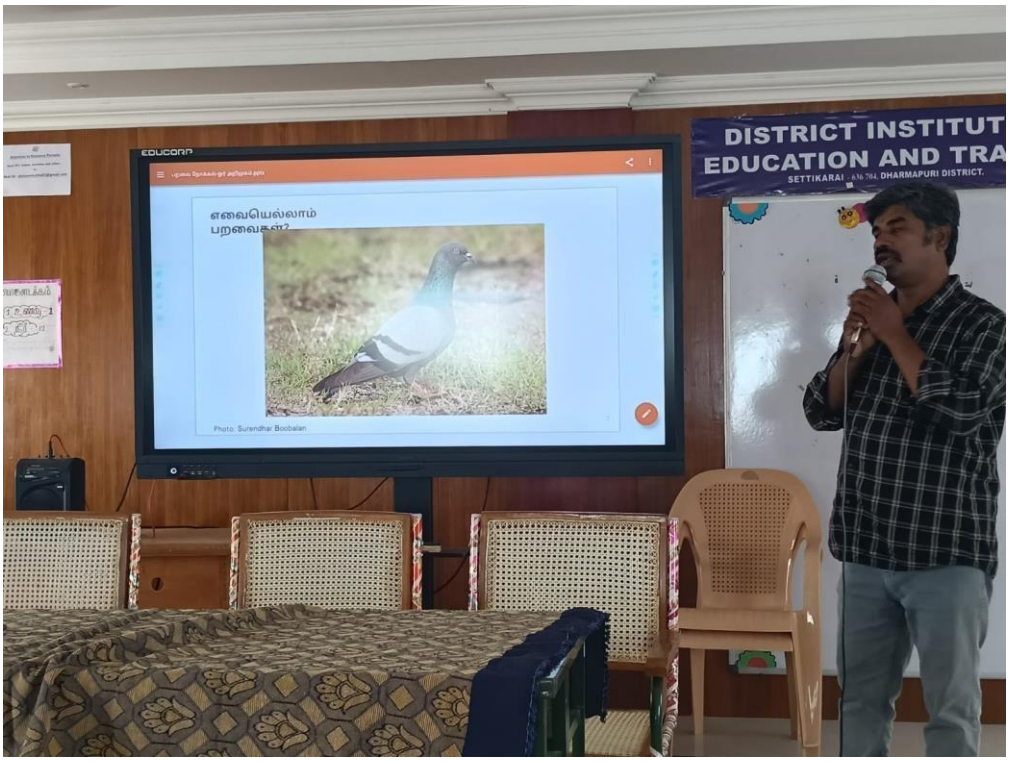
பறவைகளை ஏன் பார்க்க வேண்டும்?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எவையெல்லாம்
பறவைகள்?
Photo: Surendhar Boobalan