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Innovative ICT pedagogy for English language teaching by trainees in Andaman & Nicobar Islands

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ABSTRACT

Integrating ICT-based pedagogy in English language teaching is essential for improving educational outcomes, particularly in remote regions like the Andaman and Nicobar Islands. Existing studies primarily focus on urban settings, leaving a gap in understanding how ICT enhances instructional methods and student learning in rural contexts. This study investigates the effectiveness of ICT-based pedagogy in improving English language proficiency through the training of teacher trainees in the Andaman and Nicobar Islands. A total of 400 students from Grades 6 to 9 across eight government schools in both urban and rural areas participated. A Digital Literacy and Pedagogical Advancement Program was developed to train the teacher trainees in using ICT tools, who then conducted ICT-based English classes over two months using CBSE-aligned content. To assess student progress, Grade-Specific Linguistic Proficiency Assessment (GLPA) tests were designed to evaluate reading, writing, listening, and speaking skills. Pre- and post-tests were conducted, and the data were analysed using Kolmogorov-Smirnov, paired t-tests, and independent t-tests. Results showed significant improvements in post-test scores across all grades, confirming the effectiveness of ICT-based pedagogy. The findings support the scalability and adaptability of ICT-integrated teaching methods, advocating for their broader adoption to improve English language proficiency and modernize instructional practices in remote educational settings.

Contribution/ Originality: This study contributes by uniquely applying ICT-based English teaching in the remote Andaman & Nicobar Islands, evaluating its impact across grades, gender, and residential location, and developing a tailored intervention program to enhance teacher training and improve student learning outcomes in an underserved educational context.

1. INTRODUCTION

In today's educational world, Information and Communication Technology (ICT) is a catalyst for change in what and how we teach and learn everywhere. The use of ICT in education has challenged traditional ways of employing pedagogy, while also offering new opportunities for student engagement, collaboration, and learning. The impact of ICT on expanding interactive, student-centered learning in English language teaching (ELT), for example, has been acknowledged worldwide (Adzhari, Din, Othman, & Gabarre, 2023; Nazarov, 2023). As the world moves increasingly toward digital connectivity, ICT will have an increasing role in ELT. In the context of rural India, teaching English effectively faces several challenges due to limited technological support and resources. Charania, Paltiwale, Sen, Sarkar, and Bakshani (2023) emphasize that innovative use of technology and proactive teaching methods can bridge

this gap and enhance English language learning. So, equipping teachers-in-training, especially in less accessible areas such as the Andaman & Nicobar Islands, to include ICT in their teaching is important. Integrating ICT tools into English language teaching significantly enhances teachers' knowledge, skills, and classroom practices. Warioba, Machumu, Kulunga, and Mtweve (2022) found that targeted ICT training led to measurable improvements in secondary school English teachers' use of technology in Ethiopia. Teachers-in-training are the first agents of change in their classrooms, and if they incorporate ICT into their practice, then their students will greatly benefit. Including ICT-based pedagogical practices in the teacher preparation program is promising as a way to help bridge the educational access and quality divide in English language teaching for underserved populations (Abraham, Arficho, & Habtemariam, 2022; Rahim & Chandran, 2021; Rizkiani, 2021).

Research conducted over the last 20 years has demonstrated that using ICT to help students learn English benefits them. Students utilize English in a genuine, conversational, and stress-free environment due to the usage of ICT. Through interactions between teachers and students, it also promotes student-centered learning. The findings of earlier research also showed that students' English competence and abilities improved when ICT was used in the classroom. ICT not only provides students with a more technologically rich learning experience but also offers a much wider range of authentic web resources to improve students' reading, writing, and vocabulary skills (Paudel, 2021; Tütüniş, Ünal, & Babanoğlu, 2022; Utami, Prihantoro, Apriani, Hidayah, & Handrianto, 2021). Pedagogy that uses ICT helps to address the issues mentioned above because it provides students with tools that enable interactive, personalized learning and communication with authentic real-world audiences. For example, combinations of multimedia resources such as videos (e.g., on YouTube and Vimeo), podcasts, and interactive apps can engage students in explanatory ways that do not exist with even the best face-to-face methods. ICT enables online communication among trainees and students, gestures toward a more interactive and dynamic educational experience. Therefore, ICT allows K-12 trainers/developers and trainees to create lesson plans that consider many student learning styles through the use of the range of learning styles available via ICT in the social environment (Jie & Sunze, 2023; Nguyen, 2021; Samoylenko, Zharko, & Glotova, 2022).

Thus, it must be recognized that the digital literacy for teacher trainees is not only about preparing to use technology but also about preparing them as lifelong learners who will continually re-learn to adapt to a rapidly changing educational landscape. Much earlier research has focused on online learning orientation but not on the usage of ICT tools. For example, an earlier study found that online learning was extensively employed in a variety of educational institutions across several nations. Online learning, with appropriate methods, tools, and concepts, may make learning more accessible to everybody, eliminating physical obstacles to classroom learning. Previous studies indicate that online learning has downsides and contradicting perspectives. The National Education Policy 2020 highlights the critical role of integrating technology in education and the need to equip teachers with digital pedagogical skills. However, studies show that most ICT training remains inadequate for transforming classroom practices (Rathnabai, 2024). More than anywhere else, teacher trainees in the Andaman & Nicobar Islands need pedagogical methods that will empower them to teach in their diverse, often isolated, and resource-limited environments (Fang, Hwang, & Chang, 2022; Kumar, Akhter, Yunus, & Shamsy, 2022; Poudel, 2022). Various analysis methods are employed to evaluate the effectiveness of ICT integration in ELT, particularly in teacher training contexts. Quantitative methods include surveys and standardized tests that assess improvements in students' English language skills, such as reading comprehension, vocabulary acquisition, and writing proficiency. Statistical techniques like t-tests, ANOVA, and regression analysis are used to measure the significance of differences between control and experimental groups.

Despite the recognized benefits of ICT in enhancing English language education, there is a lack of comprehensive research focusing on the specific challenges and effectiveness of ICT-based pedagogy in the unique context of the Andaman & Nicobar Islands. The present research investigation aims to determine how well ICT-based pedagogy

enhances teacher candidates' English language instruction by influencing their ability to engage students, incorporate technology into the classroom, and improve learning outcomes.

1.1. Research Objectives of the Study

The primary objective of utilizing ICT-based pedagogy in teaching English to teacher trainees in the Andaman & Nicobar Islands is to enhance the quality of English education, ensuring that teacher trainees effectively utilize ICT tools for teaching purposes. The goal is to empower trainees with the skills to engage with modern educational technologies and improve student learning outcomes in English across different grade levels.

- To develop an intervention program for teacher trainees about ICT-based teaching for teaching English.
- To construct achievement tests for 6^{th}, 7^{th}, 8^{th}, and 9^{th} grade students, based on the prescribed CBSE English textbooks, to assess their learning progress.
- To evaluate the effectiveness of ICT-based pedagogy in enhancing English teaching at different grade levels.
- To investigate the differential influence of gender on the effectiveness of ICT-based pedagogy across different grade levels.
- To study the impact of residential location on the effectiveness of ICT-based pedagogy for teaching English at various grade levels.

The study will contribute to bridging educational gaps and developing strategies for integrating ICT into teaching practices. The research work includes a Literature Survey in section 2, and the proposed research methodology along with various analyses carried out to identify the effectiveness of ICT pedagogy and the outcomes attained are also discussed in section 3. Besides, section 4 deals with the findings and interpretations, while section 5 concludes the research work and suggests future work.

2. RELATED WORKS

Abraham et al. (2022) investigated the impact of training in ICT-based English teaching on pedagogical knowledge and English language teaching proficiency among secondary school English language teachers. The impact of the independent variable on the dependent variable was tested through a single-group quasi-experimental design. Using comparable examples, Kendall's coefficient of concordance, also known as effect size, was computed using the same non-parametric test as Friedman's to gauge the impact's size. The findings showed that teachers' pedagogical knowledge and English language skills were greatly affected by ICT-supported education practice. Additionally, their pedagogical knowledge and English language proficiency were significantly impacted by the independent variable. The results' generalizability is hampered by their exclusive emphasis on the South Nations, Nationalities, and Peoples Regional State of Ethiopia.

Kundu and Bej (2020) investigated the integration of Information and Communication Technologies (ICT) in private high schools in India, challenging the common perception that these schools are well-equipped and proficient in ICT-based pedagogy. Through a survey of forty teachers across twenty purposively selected schools, the study revealed that despite teachers' recognition of ICT's importance in education, several significant barriers hinder effective integration. These include inadequate ICT infrastructure, insufficient institutional support, weak policy frameworks, and a pervasive lack of technological, pedagogical, and integrative skills among teachers. The findings highlight that private schools in India face substantial challenges in embedding ICT into classroom practice. To address these challenges, the authors proposed a 3E-Model (Engage, Equip, Enable) supported by establishing dedicated school authorities such as Working School Governing Bodies (WSGBs) to oversee ICT integration and promote technology-enhanced teaching methodologies.

Sahoo and Behera (2022) examined the use of ICT in the teaching-learning process at elementary level Teacher Education Institutions (TEIs) in Odisha. Their study focused on the availability of ICT resources, the implementation of ICT in theoretical and field-based activities, and the perspectives of teacher educators and student teachers. The

research, involving six DIETs, revealed that while ICT infrastructure such as computer labs and internet connectivity was generally available, many teacher educators lacked sufficient computer literacy. This gap posed significant challenges to the effective integration of ICT in teaching practices. Additionally, poor network connectivity further hindered the smooth use of ICT in classrooms. The findings emphasize the need for improved digital skills training and infrastructure enhancement to optimize ICT utilization in teacher education.

Nazari, Nafissi, Estaji, and Marandi (2019) studied the Technological Pedagogical and Content Knowledge (TPACK) of both novice and veteran EFL teachers located in Tehran, Iran. The study also investigated how the participants learned the three TPACK knowledge elements, and whether their learning impacted their educational development. The authors noted the need for further research to better understand the influence of the course on teachers' knowledge base. More specifically, the authors called for an investigatory experiment that studied the impact of TPACK-based professional development for novice and veteran EFL instructors. Following many of the recommendations of other authors, this research study is an investigation into the impact of ICT-supported workshops on English language professional development. The dimensions of motivation in a teacher's personality (technology in this research) need further exploration.

Zubković, Pahljina-Reinić, and Kolić-Vehovec (2022) aimed to investigate the use of ICT in learning and teaching in three areas: STEM, language instruction, and other social and human sciences. Targeted almost all of the teachers in seven high schools and thirteen middle schools with an online survey methodology. Perceived impediments at the school level, teachers' attitudes towards ICT use, their self-efficacy in using ICT, and domain-specific variations in these aspects were the main objectives of the study. ICT use in STEM and language instruction was adversely affected by perceived school-level obstacles; however, these effects were not substantially different across domains.

Assylzhanova, Uzakbaeva, Rakhimbekova, and Ramashov (2024) determined the impact of ICT-based interaction in foreign language instruction on fourth-grade Kazakh students' attitudes and academic achievement. The students' academic achievement and attitudes were measured previously and after the 12-week intervention. Participating in foreign language classes using interactive ICT-based resources like the DynEd software program and the electronic book "English for Fun. Play & Learn." The control group received the same amount of time in traditional, non-interactive foreign language instruction. The t-test technique was performed to compare preliminary test, post-test, and retention grades between the two groups to establish significant differences in performance and attitudes. The results show that the use of interactive ICT tools improved the quality of foreign language teaching enormously, and this has implications for curriculum design at all levels of education. The post-test scores, although statistically significant, fall short of portraying the whole level of students' learning and participation.

Pasaribu, Daulay, and Saragih (2023) studied the different forms of technology used by English instructors at MTS Swasta Al-Amin, as well as the many types of ICT used by those teachers. In this study, two seventh- and eighth-grade instructors who used ICT in their English classes were examined. According to this survey, teachers of English employ a range of technology resources in their classes, including. The introduction of ICT enables students to participate more actively in their education, such as by submitting assignments online, accessing multimedia content, and engaging with digital platforms. ICT pedagogy restricts the equitable use of ICT in learning by giving teachers inadequate training in effectively integrating technology and uneven access to digital resources.

Luo, Zuo, and Wang (2022) investigated the longitudinal transformations of four rural schools following ICT programs in 2014 through the extended case method. According to the research, ICTs changed the status quo of rural education by upending pedagogical standards for curriculum, educational environments, and perceived school and educators' identities. These positive changes included improved learning performance, social and emotional development for children left behind, and teacher professional growth. The study tracked these changes over several years to find out the long-term impact ICT has on the quality of education. The findings, however, are limited to four rural schools in China and are likely not representative of larger rural education environments.

He and Li (2023) used the integrated theory of technology acceptance and use of technology (UTAUT) to examine the factors that influence Chinese college students' adoption of ICT tools for learning English. Sample data from 223 students at Zhaoqing University and Guangdong University of Finance in China were analyzed using structural equation modeling. The study discovered that social influence, performance expectations, and effort expectations all had a significant impact on behavioral intention. The study enhanced ICT tool adoption in language learning by providing user-friendly tools and encouraging the sharing of successful experiences among students. These measures aim to foster a more supportive and effective learning environment. However, this study only looked at students in higher education; its conclusions do not hold for students at other educational levels. A more comprehensive view of the use of ICT tools in language acquisition is obtained by broadening the study to include students from different educational levels.

Various studies on ICT in education highlight diverse challenges and limitations. Research in Ethiopia focused narrowly, limiting applicability, while in Nepal, limited technology access hindered outcomes. Iranian studies emphasized the need for more experimental research on ICT's role in teacher development. In other regions, domain-specific differences in ICT usage, as observed in Europe, failed to address broader institutional challenges. Studies in Kazakhstan and Indonesia faced challenges related to small sample sizes and unequal digital access, respectively. Research in rural China also suffered from limited sample sizes, and studies in China's higher education overlooked broader educational contexts. Additionally, assessments of ICT self-efficacy lacked a comprehensive analysis of other influencing factors. These findings underline the need for broader research to address varied ICT implementation challenges in education.

2.1. Motivation of the Study

In the current educational landscape, especially in remote regions like the Andaman & Nicobar Islands, there is a growing need to enhance the quality of education through modern teaching methodologies. The integration of ICT-based pedagogy in teaching English to teacher trainees in remote areas like the Andaman & Nicobar Islands presents a unique set of challenges and opportunities. While ICT has proven to enhance educational practices globally, there is limited research on its specific impact on English language teaching within the context of teacher training in these regions, especially considering factors like gender and residential locale.

The majority of research on ICT use for English learning has been conducted in urban settings, leaving no comprehensive insights into its use in the unique contexts of rural or isolated areas for improving English learning results. Furthermore, little research or frameworks are evaluating the relevance of ICT tools concerning teacher training and their impact on student success across various demographic variables. In addressing these gaps, this research will develop an intervention geared towards teacher trainees and evaluate the effectiveness of ICT-related pedagogy for English across governmental grade levels, whilst considering the significance of gender and location on learning outcomes.

3. RESEARCH DESIGN

In consideration of the above conventional studies, an investigation is carried out regarding the effectiveness of ICT-based pedagogy in teaching English by teacher trainees in the Andaman and Nicobar Islands. The study aims to analyze how ICT influences the teaching-learning process, focusing on both teachers' instructional methods and students' learning outcomes. Students from eight different government schools across the region are selected as participants for the analysis. The selected schools are as follows: GSSS Bambooflat, GSSS Bathubasti, Government Secondary School Dairy Farm, Government Secondary School Delanipur, Government Senior Secondary School Mannarghat, GSSS School Line, and PM Shri Government Senior Secondary School Prothrapur from Andaman and Nicobar Islands.

Initially, the study employed *Cluster-Based Convenience Sampling (CBCS)* to select 400 participants from eight government schools in the Andaman & Nicobar Islands. *Digital Literacy and Pedagogical Advancement Program in developed* to structure and equip teacher trainees with essential ICT skills and pedagogical techniques over 6 weeks. *Grade-Specific Linguistic Proficiency Assessment Tests* are created to evaluate students' English proficiency before and after the ICT-based pedagogy. Pre-tests and post-tests are administered to measure baseline and progress in English proficiency. Quantitative data from achievement tests are analyzed using *t-tests*, and based on the findings and interpretations, it provides a comprehensive understanding of the impact of ICT-based pedagogy on English language proficiency among students, as well as insights into the experiences of teacher trainees.

3.1. Participant Selection

Based on the ICT-based training programs conducted in selected schools, the participants in this study were chosen using Cluster-Based Convenience Sampling (CBCS). Initially, participants were clustered based on their residential locale (urban and rural), followed by convenience sampling across different grades and gender categories. The total number of participants selected for the analysis is 400 from eight different government schools in the Andaman & Nicobar Islands.

Table 1. Demographic characteristics of the selected participants.

Categories		Frequency	Percentage (%)
Residential locale	Rural	200	50.0
	Urban	200	50.0
Grade level	Grade 6	100	25.0
	Grade 7	100	25.0
	Grade 8	100	25.0
	Grade 9	100	25.0
Gender	Boys	200	50.0
	Girls	200	50.0

The demographic characteristics of the participants selected from eight government schools are illustrated in Table 1. In total, 400 participants have been considered and categorized based on residential locale, grade level, and gender. Out of the total participants, 200 belong to rural areas and 200 to urban areas. Concerning grade levels, there was an equal number of participants from each of Grades 6, 7, 8, and 9, with 100 participants (25%) from each grade. The sample was also balanced in gender, with 200 boys (50%) and 200 girls (50%) participants.

3.2. Develop a Digital Literacy and Pedagogical Advancement Program for Teacher Trainees

The Digital Literacy and Pedagogical Advancement Program (DLPAP) is a systemic and holistic intervention program aimed at preparing teacher trainees in the Andaman and Nicobar Islands with the necessary ICT skills and pedagogical ICT practices for effective English language teaching. The principal objective is to support the teacher trainees in their ability to integrate and utilize digital technologies in their classroom practices, thereby providing potential for student engagement and improvement in learning achievement. The program was implemented over 6 weeks and divided the intervention period into 3 progressive phases.

Phase 1: The first phase of the intervention program provides the fundamental ICT skills needed for the purposes of teaching English. Over a two-week period, the teacher trainees were exposed to basic and advanced ICT tools, including MS Office, Google Suite, multimedia editing tools, and interactive tools. This phase of the program ensures confidence and proficiency in the use of technology in the classroom, as well as knowledge of the multitude of digital resources available to develop quality teaching and learning. The activities in this phase include face-to-face workshops where teacher trainees practiced creating lesson plans, digital resources for English language teaching,

and active materials. Additionally, teacher trainees engaged in peer reviews and collaborative activities to refine their ICT skills. At the completion of this phase, the teacher trainees will feel confident.

Phase 2: In this phase, teacher trainees will learn more about integrating ICT tools alongside effective English Language Teaching (ELT) methods. Phase 2 allows teacher trainees to understand some of the principles of ELT, such as communicative language teaching, task-based learning, and content-based instruction, within ICT integration. Trainee teachers learn to contextualise pedagogical principles to different language skills (the four skills of listening, speaking, reading, and writing) using ICT. A considerable amount of time in this phase will be dedicated to lesson planning. Trainees will learn how to create ICT lesson plans that encourage active learning and student engagement, as well as how to incorporate ICT convincingly to build upon students' different learning styles (to ensure that they support students with differing needs). Additionally, this phase will also facilitate collaborative lesson planning workshops where trainees will work together to develop and present ICT lesson plans. Finally, trainees will not only be able to describe the theory associated with effective ICT-based pedagogy but also provide evidence of having implemented it in Phase 2.

Phase 3: The final phase, lasting two weeks, involves teacher trainees applying the ideas and skills learned in Phase 2 within real classroom settings. During this phase, trainees utilize their pedagogical knowledge to prepare and deliver an English lesson supported by ICT in an actual classroom environment. Trainees work in small groups to conduct microteaching sessions, where they deliver ICT-enhanced lessons and subsequently receive constructive feedback from mentors and peers. These sessions are video recorded to facilitate reflective analysis of their teaching practices, enabling trainees to evaluate and improve their ICT-based pedagogy. Additionally, teacher trainees engage in reflective journal writing and group discussions to analyze their teaching experiences, address challenges faced, and collaboratively develop solutions. This comprehensive approach aims to enhance their practical teaching skills and foster continuous improvement through reflection and peer support.

In order for this program to be successful, the teacher trainees were given several resources - training manuals, video tutorials, and access to ICT tools, such as laptops, projectors, and smartboards (e.g., trailboards). The program also included a robust evaluation mechanism. This intervention program not only prepares the teacher trainees for the future of teaching in contemporary classrooms but also allows them to explore the ever-changing nature of technology in education. The program equips the teacher trainees with ICT skills and knowledge to integrate ICT in their English language teaching; the program purposefully targets innovative pedagogies that will hopefully enhance student learning performance.

3.3. Development of Grade-Specific Linguistic Proficiency Assessment Tests for Students

Following the completion of training, teachers implemented ICT-enabled English lessons for two months, utilizing the content prescribed from the CBSE English curriculum. To objectively measure students' learning progress from Grade 6 to Grade 9, a Grade-Specific Linguistic Proficiency Assessment (GLPA) was created. This assessment measured students' proficiency in reading, writing, listening, and speaking, aligned with the CBSE curriculum goals. The GLPA was developed as both a post-test and a pre-test to measure the effectiveness of ICT-enabled pedagogy. The pre-test was conducted before the ICT-enabled lessons to create a baseline of students' English language proficiency. The post-test was then conducted after the two months of instruction to measure the students' progress in all four language skills. For comparability, the assessment tests took the same format. The teachers constructed the assessment tests as aligned with the CBSE guidelines; the test items were reflective of the required language competencies to be addressed in each grade level. Each grade-level test consisted of five sections, and different cognitive and linguistic skills were evaluated, as illustrated in Figure 1: Model Test Structure. The following describes the modules:

3.3.1. Test Structure

Each grade-level test was divided into five sections, assessing different cognitive and linguistic skills:

- Module 1: Reading Comprehension Proficiency (RCP) – Assessed through multiple-choice questions (MCQs), short-answer questions (SAQs), and inferential reasoning tasks based on grade-appropriate passages.
- Module 2: Lexical and Syntactic Competency (LSC) – Included vocabulary matching, fill-in-the-blanks, sentence transformation, and error correction to evaluate lexical knowledge and syntactic accuracy.

Module 2: Lexical and syntactic competency (LSC)

1. **Vocabulary Matching:** Match the words with their meanings:
   a. Vibrant - i. Full of life and energy
   b. Biodiversity - ii. Variety of living organisms
   c. Coral reef - iii. Underwater ecosystem
2. **Fill-in-the-blanks:**
   The _____ beaches of Andaman attract many tourists.
3. **Sentence transformation:**
   Rewrite: Tourists visit the islands to explore coral reefs (Change to passive voice)
4. **Error correction:** The islands **has** a rich history.

Figure 1. Model test structure.

- Module 3: Written Expression Aptitude (WEA) - Involved students in paragraph writing, essay writing, and letter writing, which were assessed with a standardized rubric that scored coherence, grammar, and vocabulary used.
- Module 4: Auditory Comprehension and Interpretation (ACI) – Utilized audio recordings of dialogues and narratives, followed by comprehension questions to assess listening skills.
- Module 5: Oral Communication Fluency (OCF) – Assessed through tasks such as picture description and short oral presentations, focusing on fluency, pronunciation, and coherence.

The assessment was scored out of 100 points for each module in equal proportions. A scoring rubric was developed to evaluate subjects, especially writing and speaking, objectively to provide a consistent assessment for respondents. The careful development of the scoring instrument ensured a measure of students' English language proficiency before and after ICT-based teaching, which generated reliable data to be used to evaluate the impact of the teaching on students.

3.4. Data Collection Tools

Data collection tools in this study were pre-tests and post-tests, designed to assess English language proficiency for students across 6th, 7th, 8th, and 9th grades based on the CBSE curriculum.

Pre-Test: The researcher administered a GLPA test of students' knowledge of English to all students before the ICT pedagogy. The main goal of the pre-test was to help each student establish a prior level of knowledge and skills in reading, writing, listening, and speaking in English.

Post Test: Upon completion of the two-month ICT-based instruction, the researcher administered a similar GLPA test to the students to evaluate student knowledge retention and overall improvement in English proficiency. The primary outcome was to measure students' improvement in English language learning, as well as the effectiveness of the ICT-based pedagogy over traditional means of teaching.

The scores from the pre-test and post-test were used as our primary outcome measures for reviewing the impact of ICT-based pedagogy in comparison to traditional means.

3.5. Data Analysis

To evaluate the effectiveness of ICT-based pedagogy, multiple statistical tests were conducted using Python. Descriptive statistics (DS) were also employed to obtain frequencies, percentages, standard deviations, and mean scores. We confirmed that our data was normally distributed using the Kolmogorov-Smirnov Test (KST), which permitted the use of parametric tests. The paired t-test analyzed the changes in students' performance pre- and post-ICT-based pedagogy, while independent t-tests examined the potential influence of male/female and urban/rural participants. The results enhanced understanding of possible changes in performance and confirmed the overall efficacy of ICT-based pedagogy across different grades and backgrounds.

3.5.1. Kolmogorov-Smirnov Test (KST)

The Kolmogorov-Smirnov Test (KST) is used to determine if the data is normally distributed. The D value represents the largest difference between the two distributions, and the significance level of this difference is expressed by the p-value. A p-value greater than 0.05 indicates that the data is normally distributed, marginally supporting the null hypothesis.

Table 2. Kolmogorov-Smirnov test.

Analyzation	Comparison	KST (D-value)	p-value
A1	Grade 6 vs grade 7	0.1309	0.5863
A2	Grade 6 vs grade 8	0.1167	0.7231
A3	Grade 7 vs grade 8	0.1429	0.4755

Table 2 shows the data normality test analysis of responses from students in different grades. D-values range from 0.1167 to 0.1429, and the p-values are greater than 0.05, indicating that it cannot be said that the data distributions are significantly different from a normal distribution. Therefore, the null hypothesis of data normality is accepted, which indicates that it is appropriate to use parametric tests.

3.5.2. Paired T-Test

The paired t-test compares students' performance before and after the introduction of ICT-based pedagogy. It tests whether the difference in mean scores is statistically significant. A significant result indicates that the new teaching method has led to improved performance. This test is particularly useful for analyzing data from the same group of students over time.

Table 3. Paired t-test for pre- and post-test scores.

Grade	Tests	Mean	T-statistic	P-value
6	Pre-test	53.87	-23.79	9.82e-43
	Post-test	67.69		
7	Pre-test	54.60	-25.74	1.18e-45
	Post-test	66.47		
8	Pre-test	53.87	-27.66	2.23e-48
	Post-test	66.08		
9	Pre-test	54.64	-27.66	8.85e-49
	Post-test	66.81		

To evaluate the efficacy of ICT-based pedagogy, students in grades 6 to 9 completed pre- and post-tests. Their results were compared using paired t-tests to assess any significant improvements in learning outcomes, as detailed in Table 3. For each grade, the mean post-test scores are significantly higher than the pre-test scores, indicating substantial improvement in English language proficiency. The negative t-statistics suggest a positive shift from the

pre-test to the post-test, with all p-values being extremely low ($p < 0.05$), confirming that these improvements are statistically significant. Grade 6 shows the highest post-test mean (67.69), followed closely by Grade 9 (66.81), indicating consistent effectiveness across grades. Overall, the results show that ICT-based pedagogy improves students' English ability. For all grades, the p-values are extremely low ($p < 0.05$), indicating that ICT-based pedagogy significantly improved students' performance.

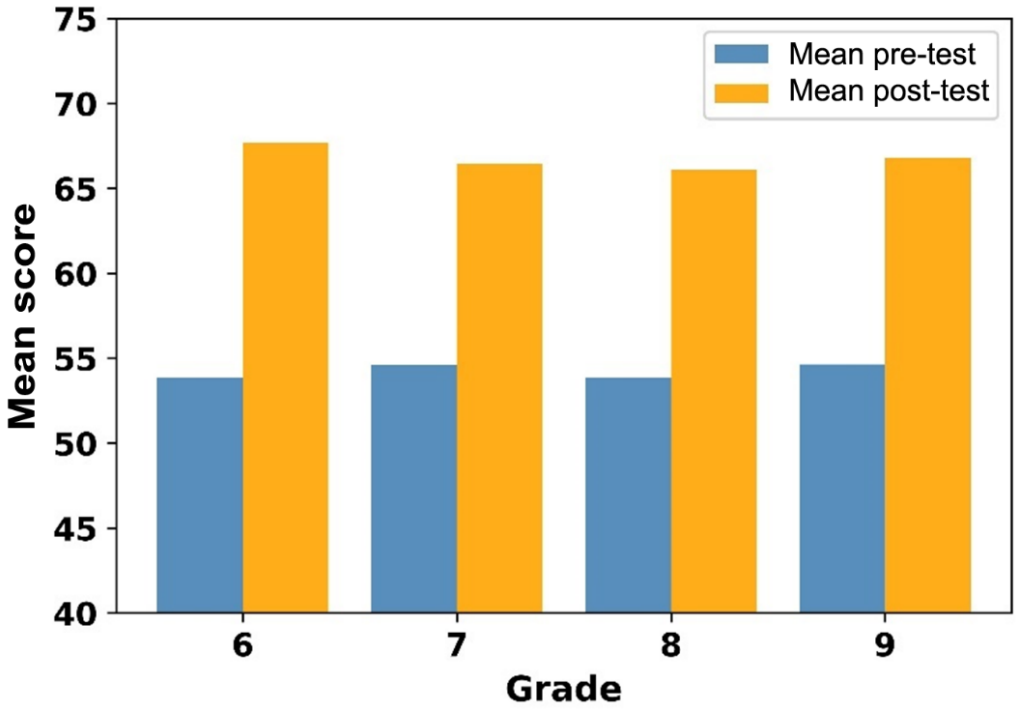

Figure 2. Mean for pre- and post-test scores.

To assess the efficacy of ICT-based pedagogy, students from Grades 6 to 9 were administered tests both before and after the intervention. The pre- and post-test scores were analyzed using paired t-tests to determine if there were statistically significant improvements. This analysis helped measure the impact of ICT integration on student learning outcomes. The detailed results of the paired t-tests are presented in Figure 2.

The mean scores of all grades show a substantial increase from pre-test to post-test, indicating improvement in English language proficiency after the ICT-based teaching. Specifically, Grade 6 shows an increase from 53.87 to 67.69, while Grade 7 improves from 54.60 to 66.47. Similarly, Grade 8 increases from 53.87 to 66.08, and Grade 9 from 54.64 to 66.81.

This confirms that the intervention program had a positive impact on students' learning outcomes in reading, writing, speaking, and listening skills, which is directly related to the main research goal of improving the quality of English instruction through ICT tools. The steady progress across grades demonstrates the wide range of applications and effectiveness of ICT integration in English instruction.

3.5.3. Independent T-Test: Influence of Gender

This test compares the post-test scores of boys and girls within each grade to determine if gender influences the effectiveness of ICT-based pedagogy. It examines the mean scores of boys and girls across different grades and compares the average scores within each grade to identify significant differences. This analysis helps to identify potential disparities in learning outcomes based on gender.

Table 4. Independent t-test for influence of gender in ICT pedagogy.

Grade	Gender	Mean	St. deviation	T-statistic	P-value
6	Boys	68.58	4.72	0.63	0.5288
	Girls	66.80	5.01		
7	Boys	67.86	5.23	0.97	0.3361
	Girls	65.08	4.89		
8	Boys	69.06	5.67	1.99	0.0496
	Girls	63.10	5.41		
9	Boys	68.80	4.95	1.39	0.1688
	Girls	64.82	5.18		

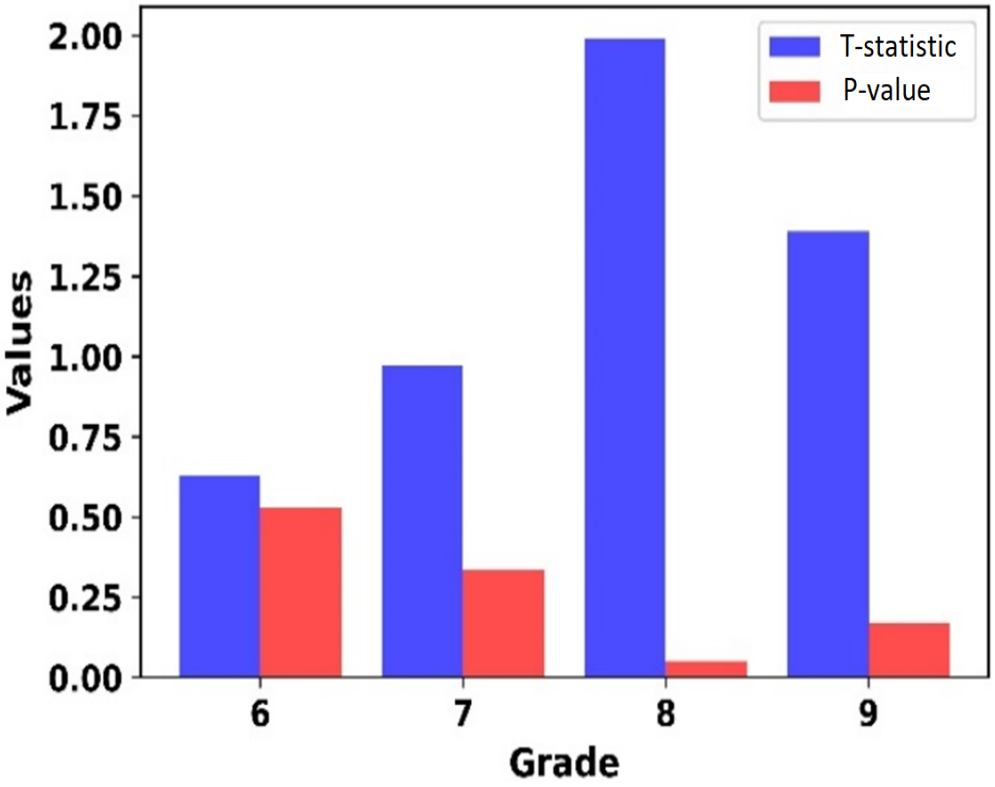

Figure 3. Independent t-test for influence of gender.

Table 4 and Figure 3 display the comparison of post-test scores between boys and girls from Grades 6 to 9. This analysis aims to explore whether gender plays a role in the effectiveness of ICT-based pedagogy. By examining these differences, the study investigates potential variations in learning outcomes between male and female students. The results provide insights into how gender may influence the impact of ICT on academic performance. The mean scores and standard deviations are shown for both groups, with the t-statistic and p-value indicating the significance of differences. The results reveal that only in Grade 8 is the difference statistically significant ($p = 0.0496$), suggesting that boys performed better than girls. In Grades 6, 7, and 9, no significant gender-based differences were found, as their p-values exceeded the 0.05 threshold. This indicates that gender does not generally impact the effectiveness of ICT pedagogy, except for Grade 8.

3.5.4. Independent T-Test: Influence of Residential Locale

The independent t-test was conducted to examine the influence of residential locale (urban vs. rural) within each grade to see if the locale influences the effectiveness of ICT-based pedagogy.

Table 5. Independent t-test for Influence of Residential Locale in ICT-based pedagogy.

Grade	Residential locale	Mean	St. deviation	T-statistic	P-value
6	Rural	68.28	4.52	0.42	0.6765
	Urban	67.10	4.36		
7	Rural	65.48	5.12	0.69	0.4937
	Urban	67.46	4.98		
8	Rural	67.64	4.85	1.03	0.3075
	Urban	64.52	4.73		
9	Rural	68.16	5.03	0.94	0.3518
	Urban	65.46	4.87		

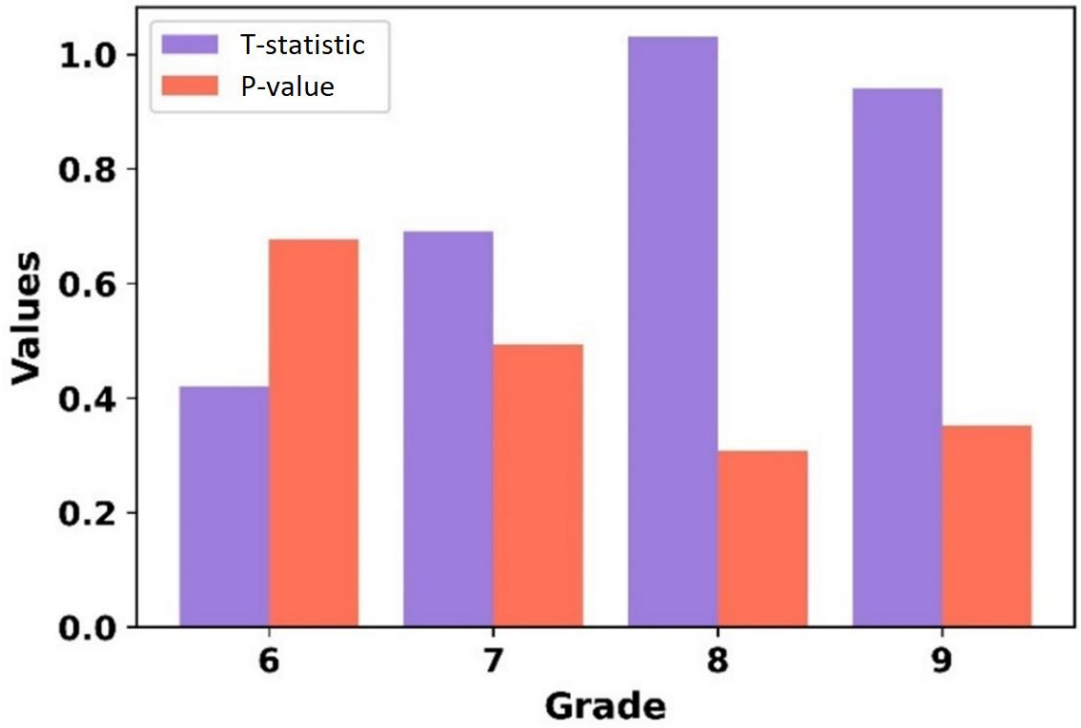

Figure 4. Independent t-test for the influence of residential locale.

Table 5 and Figure 4 present the results of an independent t-test analyzing the impact of students' residential locale on the effectiveness of ICT-based pedagogy in teaching English. This comparison highlights differences between urban and rural students' post-test scores. The findings help determine whether location influences learning outcomes through ICT-based methods. The mean scores and standard deviations are provided for both groups, along with the t-statistic and p-value. The outcomes reveal that in each grade level, there were no statistically significant differences between rural and urban students' scores, given that p-values were higher than .05. This supports the scalability of ICT interventions regardless of students' geographic backgrounds by showing that residential location does not affect the effectiveness of ICT-based pedagogy in teaching English. This is encouraging for fair access to high-quality ICT-based education in a variety of residential settings.

4. FINDINGS AND DISCUSSION

The study of ICT-based pedagogy for value in developing English language skills for teacher trainees in the Andaman & Nicobar Islands received data from 400 students from eight government schools. The researchers purposely selected student data collected from the GLPA (Graduate Level Proficiency Assessment), focused on measuring students' proficiency in the English language through testing before and after ICT-based teaching strategies were introduced into the classrooms. Statistical and paired t-tests, independent t-tests, and mean differences were used to evaluate results of these ICT teaching strategies on engaging students' learning outcomes in English

language skills. The findings of the study regarding the importance of ICT teaching strategies and students' English language proficiency were numerous. First, the Kolmogorov-Smirnov Test assessed the normal distribution of the data undertaken for analysis which led to the validity of the parametric test's procedures. Second, the paired t-test comparison between the pre-test and post-test scores averaged statistically significant (p-value= 0.0480), showing that ICT strategies influence integrated teaching and programming approaches that were proficient and increased students' English language competencies. The analysis (ANOVA) revealed the influence of gender and ICT-based pedagogy worked together variably with different grade levels. The Grade 8 scores revealed statistical significance with boys outperforming girls (p = 0.0496). No significant score differences in Grades 6,7, and 9 were noted about gender as an influence concerning ICT pedagogy on engaging both males and females and their learning English language skills.

These differences between their performance showed that while ICT was capable of providing a program and approach for which all students ultimately benefited, several distinguishing factors contributed to differences in their English language skills acquisition, developing students' proficiencies between males and females.

5. CONCLUSION

In this investigative study, there was extensive analysis of the ICT-based pedagogy within English teaching by trainees in the Andaman and Nicobar Islands. The ongoing research utilized a structured intervention program that sought to improve digital literacy and pedagogy skills of teacher trainees over time (6 weeks). When identifying the effectiveness of ICT-based pedagogy, a total of 400 students were selected based on a sampling technique from the 8 schools. In addition, the scope of the Kolmogorov-Smirnov Test, Paired t-test, and independent t-test utilized in the research investigates the gender influence, the influence of residential locale, and the effectiveness of ICT-based pedagogy in different grade levels.

The research suggests that gender does not influence the effectiveness of ICT-based pedagogy, and there were no significant differences in relevance to the residential locale. The research has filled an important gap in existing studies, as it has explored a remote area that provides the opportunity to reflect on ICT tools in varied educational settings. The analysis framework for assessment of this research is comprehensive, allowing for multiple variables surrounding pedagogy to be assessed, providing insight into the relationships between teaching strategies and demographic factors. Overall, the research supports practice and integration of ICT in teacher education programmes, influencing the practices of pre-service teachers to develop innovative teaching that significantly benefits the literacy of English language learners in remote settings.

6. FUTURE SCOPE

Future research can investigate the lasting effects of ICT-based pedagogy upon students demonstrated academic achievement in different content areas and educational levels. A broader context to include additional remote zones can help validate the findings' transferability. Explore additional digital learning platforms, such as AI, willing to engage with personalized learning platforms to further increase learning potential in educational contexts. Finally, to ensure ICT integration is sustainable.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Competing Interests: The authors declare that they have no competing interests.
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