The Impact of Language Laboratory Instructions on the Teaching of Phonetics and Phonology

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ABSTRACT
Phonetics and phonology are crucial for mastering the sounds and rhythms of a language, which are foundational for effective communication. Despite the critical role of phonetics and phonology in language learning, traditional teaching methods employed in many educational institutions may not adequately harness students' potential abilities in pronunciation. These traditionally-oriented approaches often lack the interactive and practical components necessary for effective learning and application of phonetic and phonological concepts, hence the need for a paradigm shift to a more vibrant and dynamic method of language laboratory instructions. Therefore, the present study was designed to investigate the impact of language laboratory instructions on the teaching of phonetics and phonology. The research adopted quasi- experimental research design and guided by Communicative Language Teaching (CLT) (Richards & Rodgers, 2001) and Vygotsky's Sociocultural Theory (1978). Participants were drawn from level II students enrolled in phonetics and phonology courses at Adamu Tafawa Balewa College of Education Kangere. A total of 100 students were selected as participants using a systematic random sampling technique and divided into experimental and control groups. Data were collected through pretest, posttest and questionnaire instrument. The findings revealed that there was no significant difference between the groups at pretest, confirming initial equivalence. After the intervention, the experimental group significantly outperformed the control group on the posttest, even after controlling for pretest performance. The experimental group demonstrated significantly higher retention than the control group, with a large effect size. The findings strongly support the conclusion that the use of the language laboratory significantly enhances the teaching and learning of phonetics and phonology among student-teachers at Adamu Tafawa Balewa College of Education Kangere. The paper suggests that language laboratory should be regarded as a central, not peripheral, element in the teaching of phonetics and phonology in Nigerian Colleges of Education.

INTRODUCTION

Phonetics and phonology are essential areas of study within the field of linguistics. Phonetics involves the physical production and perception of speech sounds, while phonology focuses on the patterns and systems of sounds within a particular language or languages (Ladefoged & Johnson, 2014). Mastery of these

components is crucial for language learners, as they underpin effective communication and comprehension (Usman, 2018).

Traditional teaching strategies for phonetics and phonology frequently utilize lectures, textbooks, and rote memorization of rules and concepts. While these strategies are fundamental, they may not offer adequate practical experience or interactive learning opportunities that are crucial for students to fully internalize and apply these concepts (Celce-Murcia, Brinton, & Goodwin, 2010). Consequently, students might face challenges in pronunciation and grasping phonetic concepts, potentially affecting their overall language proficiency.

In contrast, language laboratories provide a more engaging and immersive educational experience. These facilities are outfitted with state-of-the-art audio-visual equipment, software, and tools specifically designed to facilitate the learning of language sounds and their articulations. They enable students to practice their pronunciation, receive prompt feedback, and participate in repeated listening and speaking exercises within a structured environment (Gilakjani, 2012). Research indicates that such interactive settings can greatly enhance language learning results by offering practical experience and immediate corrective feedback (Hubbard, 2009).

The incorporation of language laboratories into the instruction of phonetics and phonology is particularly pertinent within higher education institutions like Adamu Tafawa Balewa College of Education Kangere, Bauchi State. Given the institution's dedication to cultivating skilled educators and linguists, it is essential to investigate innovative teaching strategies that can improve students' learning experiences and outcomes. This study seeks to examine the effectiveness of utilizing a language laboratory for teaching phonetics and phonology in comparison to conventional or rather traditional teaching methods.

STATEMENT OF THE PROBLEM

Despite the critical role of phonetics and phonology in language learning, traditional teaching methods employed in many educational institutions, including Adamu Tafawa Balewa College of Education Kangere, may not adequately harness students' potential abilities in pronunciation. These conventional approaches often lack the interactive and practical components necessary for effective learning and application of phonetic and phonological concepts (Brown, 2007). As a result, students may find it challenging to achieve accurate pronunciation and a deep understanding of these linguistic elements. The introduction of language laboratories presents a potential solution to the challenges faced by students. However, the effectiveness of this approach in improving students' phonetic and phonological skills compared to traditional methods has not received scholarly attention within the context of Nigerian educational institutions.

The existing body of research underscores the advantages of interactive and hands-on learning environments in language education, particularly through the integration of technology-enhanced resources such as language laboratories (Smith, 2010; Johnson, 2015). Nevertheless, there is a dearth of literature that specifically examined the effects of language laboratory instruction on phonetics and phonology within Nigerian colleges of education. Most of the available research has been conducted in various educational settings, which may not adequately address the distinct challenges faced by Nigerian students and educators (Gilakjani, 2012). This necessitates further investigation into the integration of language laboratory instructions in teaching at Adamu Tafawa Balewa College of Education Kangere,

Purpose of the Study

The purpose of the study is to investigate the impact of language laboratory instructions on the teaching of phonetics and phonology.

LITERATURE REVIEW

Phonetics and phonology are crucial for mastering the sounds and rhythms of a language, which are foundational for effective

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communication. Phonetics deals with the physical production and perception of sounds, while phonology focuses on how these sounds function within a particular language to convey meaning (Roach, 2009). In English language teaching, these fields help students understand pronunciation, intonation, and stress patterns, which are vital for clear and accurate communication.

The acquisition of correct pronunciation is particularly challenging for non-native speakers, as it involves both the recognition of subtle sound differences and the ability to reproduce these sounds accurately. Effective phonetics and phonology instruction can bridge the gap, helping students overcome pronunciation challenges that may hinder their communicative competence (Celce-Murcia et al., 2010).

Language laboratories are specialized environments that provide students with the tools needed to engage in intensive language practice. These laboratories are equipped with audio-visual aids that allow students to listen to native pronunciations, record their voices, and receive feedback on their pronunciation and intonation (Underhill, 2005). The use of language laboratories in teaching phonetics and phonology has been shown to enhance students' learning experiences by providing opportunities for repetitive practice, self-monitoring, and immediate correction (Kenworthy, 1987). Additionally, language laboratories cater to different learning styles by combining auditory, visual, and kinesthetic elements, making them an effective tool for teaching complex phonetic concepts (Ladefoged& Johnson, 2010).

Numerous studies have highlighted the positive impact of language laboratories on students' phonetic and phonological skills. For example, research by Gilbert (2008) found that students who practiced pronunciation in a language laboratory showed significant improvement in their ability to produce accurate English sounds compared to those who received traditional classroom instruction. Similarly, a study by Lintunen (2004) revealed that the use of language laboratories improved students' confidence in speaking, as they were able to

practice in a low-pressure environment before interacting in real-life situations.

Furthermore, language laboratories have been found to reduce the cognitive load associated with learning new phonetic concepts by breaking down complex tasks into manageable steps and providing immediate feedback (Sweller, 1988). This reduction in cognitive load enables students to focus more on the learning process, leading to better retention and application of phonetic and phonological knowledge.

However, despite the benefits, the use of language laboratories is not without challenges. One of the primary issues is the high cost of installation and maintenance, which can be prohibitive for many educational institutions, particularly in developing countries like Nigeria (Afolayan, 2004). Furthermore, the effectiveness of language laboratories depends on the availability of skilled instructors who are capable of integrating laboratory activities into the broader curriculum (Underhill, 2005). Another challenge is the potential for technology-related issues, such as equipment malfunctions or software compatibility problems, which can disrupt the learning process and lead to frustration among students and teachers (Nunan, 1999). There is also the risk that the focus on technology may overshadow the pedagogical objectives, leading to an over-reliance on the laboratory at the expense of other important aspects of language teaching (Cook, 2001).

Empirical studies on the use of language laboratories in Nigeria are limited, but existing research suggests that these tools can have a significant impact on language learning outcomes. A study by Alabi (2005) found that Nigerian students who used language laboratories showed marked improvement in their pronunciation and listening skills compared to those who were taught using traditional methods. The study also noted that students were more engaged and motivated when learning in a language laboratory, as the interactive nature of the environment made the learning process more enjoyable. In a similar vein, a study by Obanya (2006) highlighted the potential of language laboratories to address the challenges of large

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class sizes, which are common in Nigerian educational institutions. By allowing students to work independently or in small groups, language laboratories can provide more personalized instruction, leading to better learning outcomes.

While existing studies provide valuable insights into the benefits of language laboratories, there are several gaps that the present study intends to address. Firstly, there is a dearth of research on the specific impact of language laboratories on phonetics and phonology instruction in Nigerian tertiary institutions. Most studies have focused on general language learning outcomes, without examining the unique challenges and benefits associated with teaching these specific areas of linguistics. Secondly, there is limited evidence on the long-term effects of using language laboratories, particularly in terms of how these tools influence students' ability to retain and apply phonetic and phonological knowledge over time. Finally, there is a need for more research on the challenges associated with implementing and maintaining language laboratories in resource-constrained environments, such as those found in many Nigerian colleges and universities.

Theoretical Framework

The theoretical framework of this research is based on the Communicative Language Teaching (CLT) methodology, which highlights the significance of interaction in the process of language acquisition. CLT promotes the incorporation of authentic resources and real-world contexts in language instruction to improve learners' communicative abilities (Richards & Rodgers, 2001). The implementation of a language laboratory is consistent with CLT principles, as it offers an interactive setting for students to develop and enhance their phonetic and phonological competencies.

Another relevant theory is Vygotsky's Sociocultural Theory, which posits that social interaction plays a fundamental role in the development of cognition. Vygotsky (1978) argued that learners acquire language through guided interaction with more knowledgeable others. In the context of a language laboratory, students are provided with opportunities to interact with language materials and receive immediate feedback, facilitating the internalization of phonetic and phonological concepts.

Vygotsky (1978) emphasizes that socio-cultural theory underscores the significance of social interaction and feedback in the learning process. Language laboratories promote social interaction by incorporating pair and group activities, while also offering immediate feedback through audio-visual tools and software. This environment, rich in interaction and feedback, aligns with the principles of socio-cultural theory and fosters the understanding of phonetic and phonological concepts.

Conceptual Framework

The conceptual framework of the study explicates the nexus between variables as illustrated below.
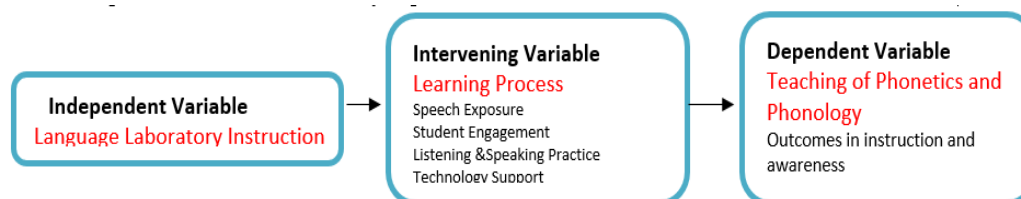

Figure 1 Conceptual Framework Indicating the Relationship between Variables (Source: Researchers)

The framework shows that language laboratory instructions enhance the teaching of phonetics and phonology learning through the learning process

METHODOLOGY

The present study employs a quasi-experimental research design, involving two group

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comparing two groups: the experimental group and the control group. The experimental group was taught phonetics and phonology using language laboratory instruction, while control group received instruction through traditional teaching method (talk/lecture method). The design allows for the evaluation of the impact of the independent variable (language laboratory instructions) on the dependent variables (phonetics and phonology learning outcome) (Creswell, 2014). Participants were drawn from level II students enrolled in phonetics and phonology courses at Adamu Tafawa Balewa College of Education Kangere. A total of 100 students were selected as participants using a systematic random sampling technique.

Data were collected using pre-tests and post-tests to measure students' understanding and pronunciation accuracy. Questionnaire was administered to gather feedback on the challenges and benefits experienced by students and teachers (Bryman, 2012). The field work was conducted over a semester. The experimental group received instruction using the language laboratory, while the control group was taught using traditional methods. At the level of Pre-test,

Both groups took a test in phonetics and phonology to determine the baseline performance. Pre-test was administered at the beginning of the semester, and post-test was conducted at the end of the semester. The questionnaire was distributed at the end of the semester to both students and teachers. Data from the pre-tests and post-tests were analyzed using descriptive and inferential statistics, such as mean scores, standard deviations, and t-tests, to determine the significance of differences between the groups. The analyses were presented in tables.

FINDINGS AND DISCUSSION

The data collected were analysed using Statistical Package for the Social Sciences (SPSS, version 25). The analysis was designed to investigate the impact of using language laboratories on the teaching and learning of phonetics and phonology among students at Adamu Tafawa Balewa College of Education Kangere. The analyses were carried out in three stages: preliminary descriptive statistics, inferential statistics using Analysis of Covariance (ANCOVA) and independent-samples t-tests, and effect size estimation.

Table 4.1: Descriptive Statistics of Students' Performance by Group

Group	N	Pretest	Pretest	Posttest	Posttest	Retention	Retention
		M	SD	M	SD	M	SD
Experimental	50	32.40	4.85	68.20	6.32	65.40	6.05
Control	50	32.10	4.72	55.10	5.98	52.30	5.67

Table 4.1 indicates that both groups performed at approximately the same level during the pretest (Experimental: M = 32.40, SD = 4.85; Control: M = 32.10, SD = 4.72), confirming group equivalence at baseline. After the intervention, the experimental group outperformed the control group in both the posttest (Experimental: M = 68.20, SD = 6.32; Control: M = 55.10, SD = 5.98) and the retention test (Experimental: M = 65.40, SD = 6.05; Control: M = 52.30, SD = 5.67). These

results provide preliminary evidence that the use of instructional materials, particularly the language laboratory, enhanced students' performance and retention.

An Analysis of Covariance (ANCOVA) was conducted to determine whether there was a significant difference between the experimental and control groups on the posttest scores after controlling for pretest performance. The results are shown in Table 4.2.

Table 4.2 ANCOVA Summary for Posttest Scores (Controlling for Pretest)

Source	SS	Df	MS	F	P	Partial η²
Pretest (Covariate)	820.45	1	820.45	14.21	< .001	.128
Group	2400.85	1	2400.85	41.55	< .001	.300

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Source	SS	Df	MS	F	P	Partial η²
Error	5600.30	97	57.73			
Total	8821.60	99				

In the table 4.2 above, the covariate (pretest scores) had a significant effect on the posttest, $F(1, 97) = 14.21$, $p < .001$, partial η² = .128. More importantly, after controlling for pretest scores, there was a statistically significant main effect of group on posttest scores, $F(1, 97) = 41.55$, $p < .001$, partial η² = .300. This suggests that 30% of the variance in posttest scores was explained by the instructional method (use of language laboratory versus traditional methods), indicating a large effect size according to Cohen's (1988) benchmarks.

To examine retention differences between groups, an independent-samples t-test was conducted. The results are summarized in Table 4.3.

Table 4.3 Independent Samples t-Test Results for Retention Scores

Group	M	SD	t(98)	P	Cohen's d
Experimental	65.40	6.05			
Control	52.30	5.67	-11.21	< .001	1.72

As shown in Table 4.3, the experimental group scored significantly higher on the retention test ($M = 65.40$, SD = 6.05) than the control group ($M = 52.30$, SD = 5.67), $t(98) = -11.21$, $p < .001$. The effect size, Cohen's $d = 1.72$, indicates a very large practical effect, suggesting that the instructional materials had a substantial impact not only on immediate learning outcomes but also on long-term retention.

The analyses revealed three major findings: There was no significant difference between the groups at pretest, confirming initial equivalence. After the intervention, the experimental group significantly outperformed the control group on the posttest, even after controlling for pretest performance. The experimental group demonstrated significantly higher retention than the control group, with a large effect size. The findings strongly support the conclusion that the use of the language laboratory significantly enhances the teaching and learning of phonetics and phonology among student-teachers at Adamu Tafawa Balewa College of Education Kangere.

The baseline equivalence validates the internal consistency of the study, as any post-intervention differences can reasonably be attributed to the instructional approach rather than extraneous variables. The findings align with methodological principles emphasized in experimental research design, where equivalence of groups prior to treatment enhances the validity of results (Creswell & Creswell, 2018).

The results of the ANCOVA showed a statistically significant difference in posttest performance between the experimental and control groups, even after controlling for pretest performance, with a large effect size (partial η² = .300). This demonstrates that instructional materials substantially improved learning outcomes. The finding is consistent with the Communicative Language Teaching (CLT) framework, which emphasizes the role of interactive, authentic resources in facilitating meaningful communication and language acquisition (Littlewood, 2014).

In addition, the results corroborate sociocultural theory, particularly Vygotsky's (1978) proposition that learners acquire knowledge more effectively through mediated tools and collaborative interactions within the Zone of Proximal Development (ZPD). Instructional materials, in this study, acted as mediational tools that scaffolded learning, enabling pupils to engage with the English language in a more active and participatory manner.

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The finding also resonates with empirical studies in African contexts. For instance, Olagbaju and Popoola (2020), who emphasized that the use of instructional materials fosters deeper cognitive process that leads to durable memory of learned concepts. It also supports international findings, such as those of Mayer (2021).

CONCLUSION AND RECOMMENDATIONS

In conclusion, this study set out to examine the impact of the language laboratory on the teaching of phonetics and phonology at Adamu Tafawa Balewa College of Education Kangere. The findings revealed that its use significantly improved students' posttest performance and retention compared to traditional methods. Grounded in Communicative Language Teaching and Sociocultural Theory, the study confirmed that learning is enhanced when student-teachers interact with authentic, multimodal resources. Therefore, the language laboratory should be regarded as a central, not peripheral, element in the teaching of phonetics and phonology in Nigerian Colleges of Education. Based on the findings, several recommendations are proposed. It is recommended that lecturers consistently integrate the language laboratory into the phonetics and phonology curriculum to improve student-teachers' outcomes.

Furthermore, the College administration should invest in the maintenance, upgrading, and potential expansion of the current language laboratory facilities to ensure their reliability and capacity. Teacher training programs for lecturers should also include professional development workshops focused on the effective pedagogical use of the language laboratory. Finally, a broader recommendation is for the National Commission for Colleges of Education (NCCE) to consider revising the NCE curriculum guidelines to mandate practical, lab-based sessions for phonetics and phonology, thereby institutionalizing this effective approach across all teacher training colleges.

The present study focused on students at Adamu Tafawa Balewa College of Education Kangere; therefore, future research could build upon this work in several ways. Subsequent studies could replicate this investigation in other Colleges of Education across different geo-political zones in Nigeria to enhance the generalizability of the findings.

Researchers could also explore the impact of language laboratory instruction on other language skills beyond phonetics and phonology, such as pedagogy for teaching methods or general oral communication proficiency. Conducting longitudinal studies to track how the phonetic skills acquired in the language laboratory impact student-teachers' actual teaching performance during their teaching practice and in their future careers would provide valuable insight into the long-term benefits of this intervention. Lastly, incorporating qualitative approaches, such as interviews and focus group discussions, would grant deeper insights into the perceptions and lived experiences of both students and lecturers regarding the use of the language laboratory.

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