INTEGRATION OF MACHINE ROOM TECHNOLOGY IN ENGLISH LANGUAGE LEARNING TO IMPROVE ENGLISH LANGUAGE SKILLS OF PBSI STUDENTS

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Abstract*: This study investigates the integration of Machine Room technology in English language learning to improve the English language skills of second-semester students in the Indonesian Language and Literature Education Study Programme (PBSI) at Universitas Muhammadiyah Pringsewu Lampung. Employing a sequential explanatory mixed methods design, the study involved 100 students selected through cluster random sampling. Data were collected through pretest and posttest assessments across four language skills (listening, speaking, reading, and writing), a Likert-scale perception questionnaire, semi-structured interviews, and classroom observations. Quantitative results revealed that the overall mean score increased from 57.80 to 77.30, yielding a moderate normalised gain (N-Gain = 0.46). Paired sample t-tests confirmed statistically significant improvements across all four skills (p = 0.000). Qualitatively, students reported very positive perceptions of the Machine Room environment, particularly regarding engagement, perceived learning benefit, and usability (overall mean = 4.30). These findings demonstrate that Machine Room technology effectively supports integrated English language skill development within the PBSI curriculum, offering an authentic and interactive learning environment grounded in Situated Learning Theory and Constructivism.*

Keywords*: English, Machine, Room, Technology, Learning.*

INTRODUCTION

The rapid development of information and communication technology in the era of Industrial Revolution 4.0 has brought significant changes to various aspects of life, particularly in education. This paradigm shift demands innovation in teaching methods to remain relevant to the needs and characteristics of 21st-century learners. In the context of foreign language education, especially

English, the four core skills—listening, speaking, reading, and writing—play a fundamental and interconnected role in the language acquisition process. Additionally, language components such as vocabulary, grammar, and pronunciation serve as essential elements supporting comprehensive language mastery. However, English language learning in higher education continues to face challenges, particularly in creating authentic and interactive learning environments capable of holistically accommodating the development of all language skills and components (Brown, 2015). Conventional methods that rely solely on teacher-centered approaches or static instructional media are often ineffective in facilitating comprehensive understanding and authentic language use in real-world contexts.

The Indonesian Language and Literature Education Study Program (PBSI), although primarily focused on the mastery of the national language and literature, also incorporates English as part of its curriculum. Comprehensive English proficiency—encompassing all four language skills and their supporting components—is crucial for PBSI students, not only to fulfil academic requirements but also to access scientific resources, participate in academic discourse, and communicate in global contexts where English functions as a lingua franca (Lauder, 2020). The gap between the need for comprehensive English proficiency and the availability of innovative instructional methods forms the basis for the urgency of this research. According to Situated Cognition Theory, learning is most effective when it takes place in realistic and authentic contexts (Brown, Collins, & Duguid, 1989). Applying this theory in language learning requires environments that simulate real communicative situations, which conventional classrooms often cannot provide.

The use of technology in education has emerged as a promising solution to these challenges. Among the technologies with considerable potential is the Machine Room—a learning concept that simulates authentic environments for the integrated practice of language skills. This concept leverages digital technology to create virtual spaces in which students can interact with

various audio-visual scenarios, such as conversations, news broadcasts, and podcasts, while also engaging in productive activities such as speaking and writing that can be adapted to individual proficiency levels. A study by Al-Jarf (2020) found that the use of technology simulating real interactions significantly improves students' language ability and learning motivation. Furthermore, research by Hidayat & Al-Qur'an (2022) demonstrated that technology-based language learning can enhance comprehension and communicative competence among university students. Golonka et al. (2014) further noted that a technology-based language laboratory such as the Machine Room can support a wide range of learning activities, including listening comprehension through authentic audio and video materials, pronunciation practice using speech recognition technology, vocabulary development through interactive applications, adaptive grammar exercises, reading comprehension with interactive digital texts, and writing practice with collaborative tools and automated feedback.

Therefore, this study focuses on the integration of Machine Room technology in English language learning to comprehensively enhance the English language skills of PBSI students. The study aims to bridge the gap between theory and practice in university-level English language learning by examining the effectiveness of Machine Room technology in developing the four language skills (listening, speaking, reading, and writing) along with their supporting components. Research subjects were selected from fifth-semester students of the PBSI programme, representing a population with specific needs for English language reinforcement. It is anticipated that the findings of this study will contribute meaningfully to the development of innovative and sustainable instructional methods, thereby improving the quality of language education at Universitas Muhammadiyah Pringsewu.

Based on the research background described above, several problems are identified. First, English language learning among PBSI students continues to face challenges in creating interactive and authentic

learning environments. The lack of variety in instructional approaches has contributed to low student motivation and difficulties in developing comprehensive English language skills. Second, the gap between the demand for English proficiency and the availability of innovative methods suggests that conventional teaching approaches must be reformed through more effective alternatives, such as Machine Room technology. In line with Situated Learning Theory (Lave & Wenger, 1991), which emphasises the importance of social context and environment in learning, this technology can position students within language scenarios that closely resemble real-life situations, enabling them to construct deeper linguistic understanding and communicative competence. Accordingly, this study addresses the following research questions: (1) How is Machine Room technology implemented in English language learning among fifth-semester PBSI students at Universitas Muhammadiyah Pringsewu? (2) How effective is the integration of Machine Room technology in improving students' English language skills (listening, speaking, reading, and writing)? (3) How do PBSI students perceive and respond to the use of Machine Room technology as an innovative and interactive instructional medium?

The objectives of this research are: (1) to describe the implementation of Machine Room technology in English language learning among fifth-semester PBSI students at Universitas Muhammadiyah Pringsewu; (2) to analyse the effectiveness of Machine Room technology integration in improving students' English language skills by comparing learning outcomes between the experimental group (using Machine Room) and the control group; and (3) to identify and describe PBSI students' responses and perceptions toward the use of Machine Room technology as an innovative and interactive English instructional medium. Theoretically, this research is expected to enrich the body of knowledge in the field of technology-based language education, particularly regarding the application of Machine Learning as an innovative approach to developing integrated language skills. Practically, the findings are intended to serve as a reference for lecturers and language educators in designing more

effective, technology-based learning experiences, as well as to guide institutions in developing language laboratory infrastructure that supports 21st-century learning outcomes.

A gap analysis of the existing literature reveals that, although numerous studies have examined technology-enhanced language learning in general higher education settings, very limited research has specifically addressed the integration of Machine Room technology within PBSI programmes, where students' primary academic focus is Indonesian language and literature rather than English. Most prior studies have focused on English Language Education (ELE) students who possess stronger baseline motivation for English learning, leaving a significant gap in understanding how Machine Room technology performs among learners with different disciplinary orientations and lower initial English proficiency. Furthermore, the majority of existing studies in Indonesia have examined single skills in isolation, particularly listening, rather than investigating the simultaneous development of all four language skills within a unified technology-based instructional framework. The novelty of the present study therefore lies in three dimensions: (1) its focus on PBSI students as an underrepresented population in technology-based English learning research; (2) its holistic, integrated assessment of all four language skills and their supporting components within a single intervention; and (3) its application of a sequential explanatory mixed methods design that combines quantitative measurement of skill gains with qualitative exploration of student perceptions, providing a comprehensive and contextually grounded account of Machine Room effectiveness in the Indonesian higher education context.

REVIEW OF RELATED LITERATURE

This section presents the theoretical framework and previous research relevant to the integration of Machine Room technology in English language learning, specifically in the context of the English Language Education course (Pendidikan Bahasa Inggris) for second-semester students of the Indonesian Language and Literature Education Study Programme

(PBSI) at Universitas Muhammadiyah Pringsewu.

Related Theory

English Language Learning in the PBSI Context

English language learning in higher education must target communicative competence across linguistic, sociolinguistic, and pragmatic dimensions (Richards & Rodgers, 2014). In the PBSI programme, English is a mandatory foreign language course. Second-semester students encounter the Pendidikan Bahasa Inggris course at a foundational stage, making systematic exposure to all four language skills essential for academic literacy and professional preparation as future Indonesian language teachers. Brown (2015) emphasises that effective English instruction must holistically integrate the four skills, namely listening, speaking, reading, and writing, since these skills reinforce and scaffold one another. Chapelle and Sauro (2017) further argue that digital technology can provide a more authentic and interactive learning environment than conventional methods, directly addressing the needs of PBSI students as digital natives with varying levels of prior English proficiency.

English Language Skills and Machine Room Support

The four English language skills form the core competencies targeted in the PBSI Pendidikan Bahasa Inggris course, each supported distinctly by Machine Room technology. Listening, as a fundamental receptive skill, involves receiving, constructing meaning, and responding to verbal messages through bottom-up processing, top-down processing, and metacognitive awareness (Rost, 2016; Vandergrift & Goh, 2012). In this course, the curriculum covers foundational communicative topics including Greetings, Daily Activity, Numbers, Occupations, Apologising, and Conversational Dialogues. Machine Room technology supports the listening dimension through interactive audio-visual materials aligned to each theme: recorded greeting exchanges and social dialogues for the Greetings and Apologising units, narrated daily routine videos and number-based listening tasks for the Daily Activity and Numbers units, occupation-themed interviews and role-play recordings for

the Occupational unit, and multi-turn conversational dialogues integrating all topics. This thematically structured input approximates the real-world English communication PBSI students will encounter in academic and professional settings.

Speaking is a productive skill involving real-time oral production requiring linguistic accuracy and pragmatic competence in fluency, cohesion, and contextual appropriateness (Thornbury, 2020). For PBSI students as prospective teachers, developing speaking competence is critical for professional readiness. Machine Room technology supports this through recorded speech practice with speech recognition feedback, enabling self-monitoring of pronunciation and fluency without classroom anxiety. Reading is a complex cognitive process involving word recognition, syntactic parsing, and inference-making across literal, inferential, and critical comprehension levels (Grabe & Stoller, 2019; Anderson, 2014). Machine Room facilitates this through interactive digital texts equipped with embedded dictionaries, annotation tools, and comprehension exercises. Writing, as a social productive process requiring idea organisation and audience awareness (Hyland, 2019), is supported by collaborative word-processing tools and automated feedback systems that scaffold the full writing process and help students transfer academic writing strategies from Indonesian to English.

Language Components

Vocabulary, grammar, and pronunciation serve as the building blocks of English communicative competence in the Pendidikan Bahasa Inggris course. Vocabulary knowledge encompasses form, meaning, and use, requiring repeated contextualised exposure and active practice (Nation, 2013; Schmitt, 2019). In the Machine Room environment, students encounter vocabulary through authentic audio-visual input, interactive applications, and gamified activities aligned to course themes. Grammar knowledge covers three dimensions: form, meaning, and use in communicative context (Larsen-Freeman, 2015). Machine Room supports this through adaptive, contextualised grammar exercises reinforcing both formal accuracy and communicative appropriateness. Pronunciation, encompassing segmental and

suprasegmental features, is supported by speech recognition software that provides immediate feedback on specific phonological features that differ markedly between English and Indonesian (Celce-Murcia et al., 2010; Derwing & Munro, 2015).

Language Learning Theories

The integration of Machine Room technology in this course is grounded in two complementary theories. Situated Learning Theory (Lave & Wenger, 1991; Brown, Collins, & Duguid, 1989) holds that knowledge cannot be separated from the context in which it is used. Machine Room operationalises this by positioning PBSI students within authentic English communicative scenarios such as occupational role-plays, daily routine interactions, and apology exchanges that are directly relevant to their future roles as teachers. Constructivism (Vygotsky, 1978) proposes that learners actively build knowledge through interaction, guided by the Zone of Proximal Development (ZPD). Machine Room supports this through adaptive learning pathways calibrated to each student's proficiency level, and through collaborative activities that facilitate social interaction, meaning negotiation, and peer scaffolding (Lantolf & Thorne, 2006).

CALL, TELL, and Machine Room Technology

Computer-Assisted Language Learning (CALL) and Technology-Enhanced Language Learning (TELL) provide the broader pedagogical framework for Machine Room integration. CALL has evolved from behaviourist drill-and-practice to integrative, multimedia-based paradigms that provide authentic input, immediate feedback, self-paced learning, and low-anxiety practice (Levy, 2015; Chapelle, 2010). TELL further emphasises that technology should enhance rather than replace instruction, leveraging personal and connected digital tools that bridge students' informal digital literacy with formal language learning (Reinders & White, 2016; Godwin-Jones, 2018). Machine Room as a technology-based digital language laboratory integrates computers, multimedia, the internet, interactive software, and collaborative tools to create a dynamic environment for simultaneous development of all four skills and their supporting components (Son, 2014; Golonka et al.,

2014). Its effectiveness depends not on technology availability alone but on the quality of instructional design, task guidance, and systematic monitoring (Ahmadi, 2018; Stockwell & Hubbard, 2013).

Motivation in Language Learning

Motivation is among the most influential affective variables in language learning success. In the PBSI context, many students choose the programme for their interest in Indonesian language rather than English, making instrumental motivation the more prevalent orientation. Self-Determination Theory (Deci & Ryan, 2000) identifies three psychological needs that sustain intrinsic motivation: autonomy, competence, and relatedness. Machine Room technology supports all three simultaneously by giving students control over learning pace and task selection, delivering immediate individualised feedback, and facilitating collaborative communication activities. Al-Hoorie and MacIntyre (2020) further note that technology enhances motivation through engaging content, personalisation, gamification, and connection with authentic English-language communities, transforming a potentially low-motivation required course into a meaningful and learner-driven experience.

Previous Research

Empirical research consistently demonstrates that technology-based language laboratories produce significant improvements in English language skills. Hwang and Chen (2019) found that mobile technology improved listening comprehension scores by 23% among Taiwanese university students, alongside higher motivation levels. Al-Jarf (2020) similarly reported an 18% increase in listening skills and greater engagement, with students crediting the ability to replay materials independently. Son (2014) and Ahmadi (2018) both documented substantial listening comprehension gains in controlled experiments using digital language laboratories, reporting a 27% improvement and a large effect size (Cohen's d = 1.24) respectively, with benefits extending to detail identification, main idea comprehension, and inferencing.

The meta-analysis by Golonka et al. (2014), synthesising 350 studies, found positive effect sizes for all four skills:

listening (d = 0.52), speaking (d = 0.47), reading (d = 0.45), and writing (d = 0.41), confirming that technology-based language laboratories can achieve integrated skill development. Pedagogical integration quality was identified as the decisive factor in determining effectiveness. In the Indonesian higher education context, Hidayat and Al-Qur'an (2022) reported significant gains across all four skills among 150 university students using a digital learning platform, with positive perceptions of flexibility, accessibility, and interactivity, closely mirroring the profile of second-semester PBSI students.

In Indonesia specifically, Jati (2019) found that 85% of 200 university students held positive perceptions of language laboratory use, particularly for listening and speaking, though technical issues and limited practice time were noted as constraints that directly inform the Machine Room design in this study. Romadhoni and Kuswandono (2021) confirmed that Indonesian students value digital flexibility while highlighting the importance of blended synchronous and asynchronous modes. In Lampung, Suryanto (2020) demonstrated a statistically significant listening skill improvement ($p < 0.05$) with an average gain of 15 points using a multimedia language laboratory, providing the most geographically proximate evidence for the feasibility of Machine Room integration at Universitas Muhammadiyah Pringsewu. Taken together, these studies confirm the pedagogical effectiveness of Machine Room-type environments across diverse higher education contexts and provide a strong empirical foundation for the present research.

METHODOLOGY OF STUDY

Research Design

This study employed a mixed methods approach using a sequential explanatory design (Creswell & Plano Clark, 2018), in which quantitative data were collected and analysed first, followed by qualitative data to explain and contextualise the quantitative findings. The quantitative component used a pre-experimental one-group pretest-posttest design to measure changes in students' English language skills before and after the Machine Room intervention. The qualitative component used a descriptive

exploratory approach to investigate students' perceptions and experiences of Machine Room-based learning. This combined approach was selected to provide a comprehensive picture of both the effectiveness of the intervention and the reasons behind the observed outcomes.

Figure 1. Methodology of Study: Mixed Methods Approach

Participants

The study was conducted in the Indonesian Language and Literature Education Study Programme (PBSI), Faculty of Teacher Training and Education (FKIP), Universitas Muhammadiyah Pringsewu Lampung. The population consisted of all second-semester PBSI students enrolled in the Pendidikan Bahasa Inggris course in the 2025/2026 academic year, totalling 120 students divided into four parallel classes (A, B, C, and D). Using Slovin's formula with a 5% margin of error, the minimum required sample was 92 students. To account for potential dropout and ensure adequate representation, the final sample was set at 100 students, selected through cluster random sampling. Three classes were randomly drawn from the four available parallel classes, and students from those classes were invited to participate proportionally. This sampling technique was appropriate because the classes were already formed as natural groups with relatively homogeneous characteristics in terms of curriculum, timetable, and instructor (Creswell, 2014).

Instruments

Four types of instruments were used to collect data. First, language skills tests (pretest and posttest) assessed students' listening, speaking, reading, and writing abilities using parallel forms to minimise test effect. Listening and reading were assessed through multiple-choice and short-answer tasks; speaking was assessed through structured oral performance tasks scored using an analytic rubric; and writing was assessed through

guided paragraph-writing tasks scored for content, organisation, vocabulary, grammar, and mechanics. All test instruments were validated through expert judgement and piloted for reliability prior to use. Second, a perception questionnaire using a five-point Likert scale measured students' attitudes toward and experiences of Machine Room-based learning across dimensions of engagement, usability, and perceived benefit. Third, a semi-structured interview guide was used with ten purposively selected students to explore in-depth perceptions and learning experiences. Fourth, an observation checklist was used by the researcher during six learning sessions to document implementation processes, student engagement, and emerging challenges.

Procedures

The study was conducted over six months. During the preparation phase (Months 1 to 2), the research team reviewed literature, developed and validated all instruments, obtained institutional approval, and prepared the Machine Room facility and instructional materials covering the course topics of Greetings, Daily Activity, Numbers, Occupations, Apologising, and Conversational Dialogues. During the implementation phase (Months 2 to 3), a pretest was administered to establish students' baseline proficiency across all four skills. This was followed by 14 Machine Room-based learning sessions integrated into the regular Pendidikan Bahasa Inggris course schedule, with researcher observation conducted during six of these sessions. Upon completion of the intervention, a posttest using the same instrument format was administered, followed by questionnaire completion and semi-structured interviews with selected students.

Data Analysis

Quantitative data from the pretest and posttest were analysed using descriptive statistics (mean, standard deviation, and percentage) and inferential statistics. A Paired Sample t-test was conducted to determine the statistical significance of the difference between pretest and posttest scores ($p < 0.05$). The magnitude of learning gains was calculated using the normalised gain score (N-Gain) formula proposed by Hake (1998), in which a score above 0.7 indicates high gain, 0.3 to 0.7

indicates moderate gain, and below 0.3 indicates low gain.

Qualitative data from interview transcripts and open-ended questionnaire responses were analysed thematically through a process of coding, categorising, and identifying recurring patterns in students' perceptions. Findings from both strands were integrated through triangulation to produce a comprehensive and mutually reinforcing interpretation of the effectiveness of Machine Room technology in improving the English language skills of PBSI students.

RESULT AND DISCUSSION

Students' English Language Skills Before and After Machine Room Integration

The pretest and posttest scores of 100 second-semester PBSI students across four English language skills are presented in Table 1. All four skills showed improvement following 14 sessions of Machine Room-based instruction covering the topics of Greetings, Daily Activity, Numbers, Occupations, Apologising, and Conversational Dialogues.

Table 1. Pretest and Posttest Mean Scores of English Language Skills (N = 100)

Skill	Pretest Mean	Posttest Mean	Gain	N-Gain	Category
Listening	58.40	78.20	9.80	.48	Moderate
Speaking	54.70	74.50	9.80	.44	Moderate
Reading	61.30	80.60	9.30	.50	Moderate
Writing	56.80	75.90	9.10	.44	Moderate
Overall	57.80	77.30	9.50	.46	Moderate

Table 1 shows that the overall mean score increased from 57.80 (pretest) to 77.30 (posttest), yielding an average N-Gain of 0.46, which falls in the moderate category according to Hake's (1998) classification (0.3 to 0.7 = moderate). Reading recorded the highest N-Gain (0.50), followed by Listening (0.48), while Speaking and Writing both reached 0.44. These results indicate that Machine Room technology produced consistent and meaningful improvement across all four skills, with receptive skills showing a marginally greater gain than productive skills, consistent with the pattern reported by Golonka et al. (2014) in their meta-analysis of technology-based language learning.

Statistical Significance of Improvement

A Paired Sample t-test was conducted to determine whether the

observed improvements were statistically significant. The results are summarised in Table 2.

Table 2. Paired Sample t-test Results for Each Language Skill

Skill	Mean Diff.	S-Dev.	t-value	f	ig. (2-tailed)
Listening	19.80	5.42	36.52	9	.000
Speaking	19.80	6.18	32.01	9	.000
Reading	19.30	5.03	38.37	9	.000
Writing	19.10	5.87	32.55	9	.000

As shown in Table 2, all four skills yielded statistically significant results ($p = 0.000 < 0.05$), indicating that the improvement observed after Machine Room integration was not attributable to chance. The t-values ranged from 32.01 (Speaking) to 38.37 (Reading), confirming strong and consistent evidence of the intervention's effectiveness. These findings align with Ahmadi (2018), who reported a large effect size (Cohen's $d = 1.24$) for listening comprehension gains in a comparable digital language laboratory study, and with Hidayat and Al-Qur'an (2022), who documented significant improvements across all four skills among Indonesian university students using a digital learning platform.

Students' Perceptions of Machine Room-Based Learning

Qualitative data gathered through a Likert-scale questionnaire and semi-structured interviews with ten selected students revealed three dominant themes: engagement and motivation, perceived learning benefit, and usability. Table 3 presents the questionnaire results across these dimensions.

Table 3. Students' Perception Questionnaire Results (N = 100)

Dimension	Mean Score (1-5)	Category
Engagement and Motivation	4.31	Very Positive
Perceived Learning Benefit	4.42	Very Positive
Usability and Ease of Use	4.18	Positive
Overall	4.30	Very Positive

The overall mean perception score of 4.30 indicates a very positive reception of Machine Room-based learning among PBSI students. The highest-rated dimension was Perceived Learning Benefit (4.42), reflecting students' recognition of the technology's contribution to their English skill development. Interview data further revealed that students valued the ability to replay audio-visual

materials independently, receive immediate feedback on pronunciation through speech recognition, and engage with thematic content such as occupational dialogues and daily activity narrations that felt directly relevant to their real-world communication needs. These findings are consistent with Jati (2019), who reported that 85% of Indonesian university students held positive perceptions of language laboratory use, and with Al-Hoorie and MacIntyre (2020), who noted that technology enhances motivation by fulfilling the psychological needs of autonomy, competence, and relatedness as described in Self-Determination Theory (Deci & Ryan, 2000).

One challenge identified through observations and interviews was initial difficulty with the speech recognition interface, particularly for students with limited prior exposure to English pronunciation practice. This finding underscores Ahmadi's (2018) caution that technology availability alone does not guarantee effectiveness, and that structured technical guidance and scaffolded task design are essential components of successful Machine Room implementation. Despite this, the majority of students reported increased confidence and independence in English learning by the final sessions, suggesting that the challenges were transitional rather than persistent barriers. The integration of Machine Room technology in the PBSI Pendidikan Bahasa Inggris course thus demonstrates both quantitative effectiveness and qualitative value, supporting the application of Situated Learning Theory (Lave & Wenger, 1991). By embedding English practice within authentic, contextually meaningful, and professionally relevant scenarios for second- semester PBSI students.

DISCUSSION

The findings of this study demonstrate that the integration of Machine Room technology produced statistically significant and practically meaningful improvements across all four English language skills among second-semester PBSI students. The overall N-Gain of 0.46 indicates moderate improvement consistent with Hake’s (1998) classification, and the pattern of results aligns closely with prior meta-analytic evidence. Golonka et al. (2014) reported positive effect sizes for all four skills in technology-

based language laboratories (listening d = 0.52, speaking d = 0.47, reading d = 0.45, writing d = 0.41), and the present study mirrors this ordering, with receptive skills (reading and listening) demonstrating slightly higher gains than productive skills (speaking and writing). This pattern may be attributed to the nature of Machine Room input, which provides rich audio-visual materials that naturally scaffold comprehension before production.

The statistically significant t-test results (p = 0.000) across all four skills confirm that the observed gains cannot be attributed to chance, lending strong quantitative credibility to the intervention. These findings are consistent with Ahmadi (2018), who reported a large effect size (Cohen's d = 1.24) for listening gains in a comparable digital language laboratory, and with Hidayat and Al-Qur'an (2022), who documented significant improvements across all four skills among Indonesian university students. The contextual similarity of these reference studies — particularly their Indonesian higher education settings — strengthens the transferability of the present findings to the PBSI context at Universitas Muhammadiyah Pringsewu.

The qualitative findings further enrich this picture by revealing why the quantitative gains occurred. Students' very positive overall perception (mean = 4.30) reflects the fulfilment of the three psychological needs identified by Self-Determination Theory (Deci & Ryan, 2000): autonomy through self-paced task selection, competence through immediate individualised feedback, and relatedness through collaborative activities. The highest-rated dimension, Perceived Learning Benefit (4.42), suggests that students were not merely engaged with the technology superficially but recognised its contribution to their actual language development. This alignment between subjective perception and objective test gains is consistent with Al-Hoorie and MacIntyre (2020), who noted that motivational engagement and performance gains are mutually reinforcing in technology-enhanced learning environments. The single most prominent challenge — initial difficulty with speech recognition, particularly for students with limited prior pronunciation exposure — was transitional rather than persistent,

indicating that structured scaffolding in early sessions can effectively bridge this gap. Future implementations should therefore incorporate dedicated orientation sessions for the speech recognition interface before progressing to communicative tasks. Taken together, the quantitative and qualitative strands converge on a coherent interpretation: Machine Room technology is an effective, motivating, and contextually appropriate instructional medium for holistic English language skill development in the PBSI programme.

CONCLUSION AND SUGGESTION

Conclusions

This study demonstrates that the integration of Machine Room technology in the Pendidikan Bahasa Inggris course significantly improved the English language skills of second-semester PBSI students at Universitas Muhammadiyah Pringsewu. All four skills, namely listening, speaking, reading, and writing, showed statistically significant gains ($p = 0.000$) with an overall N-Gain of 0.46, classified as moderate improvement. Reading recorded the highest gain, followed by listening, speaking, and writing. Beyond measurable skill gains, students responded very positively to the technology (mean perception score 4.30), particularly valuing immediate feedback, thematic audio-visual content aligned to course topics, and the ability to practise independently. These findings confirm that Machine Room technology, when integrated with well-designed instructional activities grounded in Situated Learning Theory and Constructivism, constitutes an effective and motivating medium for English language learning in the PBSI context.

Suggestions

Based on the findings, several suggestions are offered. For lecturers, it is recommended to continue and expand the use of Machine Room technology in the Pendidikan Bahasa Inggris course, with particular attention to scaffolding students' initial use of speech recognition tools to reduce technical barriers in the early sessions. For programme administrators, investment in maintaining and updating Machine Room infrastructure, including stable internet connectivity and varied interactive software, is essential to sustain the quality of technology-based language instruction.

For future researchers, it is recommended to employ a true experimental design with a control group to strengthen causal claims, to extend the study to higher semesters, and to explore the long-term retention of language gains beyond the immediate posttest. Investigating the spesifics constribution of individual course topics such as Greetings, Occupations, and Conversational Dialogues to each language skill would also provide more targeted instructional insights. In terms of contribution to future research, this study provides an empirically validated instructional model that future researchers can adopt, adapt, or expand: the sequential explanatory mixed methods framework employed here offers a replicable template for examining both the quantitative effectiveness and qualitative dimensions of technology-based language interventions in non-English major programmes across Indonesian higher education. The moderate N-Gain benchmark established in this study further serves as a reference point against which future studies using a true experimental design with a control group can calibrate their expectations and interpret the magnitude of observed effects. Ultimately, the present research contributes to building a contextually grounded evidence base for technology-enhanced English language learning in Indonesia, supporting researchers, educators, and institutional policymakers in making informed decisions about future language laboratory investments and curriculum design

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