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A Thesis presented to Universitas Tanjungpura in Partial Fulfillment of The Requirements for Thesis Writing

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LANGUAGE AND ART EDUCATION DEPARTMENT
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2026

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Neneng Avrianti

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ABSTRACT

Avrianti, Neneng. 2026. The effect of text-to-speech application on listening comprehension with an analysis of behavioral engagement: A quasi-experimental study

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This study examines the effect of a Text-to-Speech (TTS) application on senior high school students' listening comprehension skills and analyzes their behavioral engagement during instruction. Using a quasi-experimental design with a non-equivalent control group, the study compared an experimental group using TTSMaker with a control group receiving traditional listening instruction. Data were collected through pre-test and post-test listening comprehension tests and Time-on-Task (ToT) observations across four instructional sessions. ANCOVA results revealed a significant difference between groups after controlling for pre-test scores ($F(1,57) = 15.857$, $p < .001$, $d = 1.03$). Descriptive analysis of behavioral engagement indicated a moderate-to-high engagement level ($M = 78.89\%$) with considerable variability across students; however, the correlation between engagement and post-test scores was non-significant ($r = -.228$, $p = .363$). These findings suggest that TTS applications effectively enhance listening comprehension, yet observable behavioral engagement does not necessarily reflect deeper cognitive processing. The study provides practical implications for integrating TTS technology in English language teaching.

Keywords: *Text-to-Speech, listening comprehension, behavioral engagement, Time-on-Task, Experimental Study.*

CHAPTER I

INTRODUCTION

This chapter presents the background of the study. Therefore, this study aims to examine the effect of the Text-to-Speech (TTS) application on students' listening comprehension skills. In addition, it seeks to describe students' behavioral engagement during the implementation of the TTS application and to examine its relationship with listening comprehension skills.

A. Background

In English language learning, according to Peterson in Murcia, listening is the easiest way to process language input because when someone begins learning a new language, listening skills have the closest relationship with understanding the meaning of that new language (Adi, 2017). Additionally, listening skills are consistently linked to comprehension abilities. While listening is a passive type of verbal engagement in itself, it is also an active effort because hearing is predicated on the act of processing speech. When we listen to someone else speak, our interpretation of what they are saying is not predetermined. Analytical and synthesis processes occur during listening, leading to comprehension in the end (Ilona et al., 2021). Listening skills depend on how the speaker pronounces words, as the pronunciation and accent between Indonesian and English are different.. If there is incorrect pronunciation, it can lead to misunderstandings and misinterpretations of what is heard (Fitria, 2022). Therefore, in learning listening skills, it is necessary to have audio with clear pronunciation and accent, like that of a native speaker. Enhancing listening

comprehension skills is one of the most important aspects of mastering a language, especially in foreign language learning. Therefore, effective listening instruction requires access to clear, accurate, and comprehensible spoken input to support learners' understanding.

The integration of technology in education has become a promising alternative for addressing these challenges. The use of technology can enhance learning efficiency and effectiveness, facilitate student learning, and strengthen instructional content (Sarnoto et al., 2023). In English language learning, technology has transformed traditional teaching practices by enabling more flexible, interactive, and learner-centered instruction. Technologically competent teachers play a crucial role in supporting both receptive and productive language skills (Anas, 2019), while digital tools also assist teachers in managing instruction and facilitating language learning more effectively (Ahmad & Altun, 2021) and support teachers in facilitating language learning for their students (Ahmadi, 2018). The integration of multimedia resources and interactive applications has made English language instruction more engaging and personalized, meeting the diverse needs of students. This technological advancement has also enabled teachers to provide immediate feedback and track student progress more effectively, leading to improved learning outcomes. However, despite these technological advances, listening instruction in many EFL classrooms remains constrained by limited access to adaptable and level-appropriate audio materials. Traditional instruction in these contexts typically relies on teacher-fronted explanations and static CD-based audio, leaving little

room for learner-controlled input or differentiated listening practice (Richards & Rodgers, 2014; Sherina & Hasnawati, 2023).

In English as a Foreign Language (EFL) instruction, particularly at the senior high school level, the challenges are particularly evident in the teaching of listening comprehension, as audio-based input plays a central role in developing learners' ability to comprehend audio texts. In many schools, especially those with limited technological resources, teachers face difficulties in obtaining appropriate listening materials that align with lesson objectives and evolving instructional content (Yudhistiro & Silalahi, 2021). Conventional audio resources, such as CD-based materials, are often constrained by limited availability, high costs, physical deterioration, and a lack of adaptability to different instructional contexts (Sherina & Hasnawati, 2023). Moreover, teachers frequently encounter challenges in finding or creating listening materials that match students' proficiency levels and classroom needs on time (Widyana et al., 2022). In addition, reliance on textbooks or centrally provided instructional materials is often insufficient, as such resources typically offer a limited range of listening texts and do not allow teachers to modify input according to students' abilities or instructional goals.

This situation highlights the need for instructional tools that enable teachers to generate flexible, cost-effective, and level-appropriate listening materials that can be used both in classroom instruction and independent learning contexts (Istiqomah et al., 2021). Recent developments in digital and

AI-based technologies offer promising alternatives to address these challenges. AI-powered tools, particularly Text-to-Speech (TTS) applications, enable teachers to produce customizable listening materials with consistent pronunciation, adjustable speech rates, and immediate accessibility. Furthermore, AI-based tools have been associated with increased learner engagement by providing interactive and personalized learning experiences, as well as opportunities for repeated exposure and self-paced practice (Wei, 2023; Chapelle et al., 2024).

Artificial Intelligence (AI) is a significant technological advancement that provides extensive benefits in the educational process. This technology enables users to interact, create content, and solve problems more effectively, thereby improving the quality of learning (Mills et al., 2024). According to Dewi et al. (2021) Artificial Intelligence (AI) technology can be used to develop learning and enhance students' English language skills. Additionally, AI technology can help students better master their knowledge and skills in foreign languages. It has the power to revolutionize traditional approaches to teaching foreign languages and open up new avenues for language learning (Liu, 2023).

In particular, AI technology can improve listening abilities and understanding of English. It also enhances listening skills and increases learners' motivation in listening activities after the use of AI tools (Abimanto, 2023; Woo & Choi, 2021). Dida et al. (2023) and Tan et al. (2021) suggested that one of the Artificial Intelligence (AI) technologies that can be used is Text-

to-Speech (TTS). From a technical standpoint, recent TTS systems employ machine learning–based statistical models to generate more natural-sounding speech and offer multiple voice options, which are often associated with increased learner engagement and personalization. This allows students to practice listening digitally and also enhances their listening skills through audio content. Besides that, in educational settings, Text-to-Speech (TTS) technology has proven particularly valuable for learning (Widyana et al., 2022). It serves as an effective tool for learners at various proficiency levels, from beginners to advanced, and enables educators to easily convert existing texts into an audio format for listening comprehension lessons.

Tan et al. (2021) state that the technology provides crucial support for users who may have difficulty accessing written content in their non-native languages. In conclusion, TTS technology represents a versatile tool that enhances language accessibility, user engagement, and educational support. By providing these features, Dida et al. (2023) and Tan et al. (2021) explained that TTS creates a more inclusive experience for diverse users while maintaining high-quality audio output and customization options. Empirical studies have reported positive effects of TTS on specific language skills, particularly listening comprehension (Istiqomah et al., 2021; Karakaş, 2017; Manu & Masan, 2020; Matsuda, 2017; Nurhamidah, 2024; Widyana et al., 2022) and learner engagement (Al-Jarf, 2022; Amin, 2022; Chiang, 2019; Huang & Liao, 2024; Meihami & Husseini, 2021; Sherina & Hasnawati, 2023).

A comprehensive understanding of Text-to-Speech (TTS) applications in English language learning has become increasingly important in recent years. Recent studies have highlighted the growing potential of Text-to-Speech (TTS) technology in supporting English language learning, particularly through providing consistent pronunciation models, adjustable speech rates, and flexible access to listening input (Chiang, 2019; Al-Jarf, 2022; Dida et al., 2023). Empirical evidence suggested that TTS can support various language skills, including listening comprehension, by allowing learners to control the pace of auditory input and engage in repeated listening (Matsuda, 2017; Nurhamidah, 2024). Despite these reported benefits, research on the pedagogical implementation of TTS in authentic EFL classroom contexts remains limited. Many existing studies focus primarily on technical development, learner perceptions, or isolated skill improvement rather than examining how TTS is systematically integrated into classroom instruction (Raffoul & Jaber, 2023). As a result, teachers often lack clear instructional models that demonstrate how TTS can be effectively embedded within regular listening lessons, especially at the senior high school level, where empirical classroom-based implementation is still limited.

In particular, classroom-based studies examining TTS across structured listening phases (pre, while, post) are still missing (Raffoul & Jaber, 2023). Although listening pedagogy emphasizes structured stages and strategic support to facilitate comprehension (Richards, 2008; Vandergrift & Goh, 2012), few studies have examined how TTS functions across these stages to support both

bottom-up and top-down listening processes (Field, 2009). Furthermore, while learner engagement is widely recognized as a key factor in successful listening instruction, TTS research relies heavily on self-report; observable engagement metrics are under-represented (Wei, 2023). Raffoul and Jaber (2023) emphasize that the research on the simultaneous investigation of comprehension and engagement in senior-high TTS settings remains limited. Consequently, there is limited empirical evidence on how TTS influences students' on-task behavior during listening activities in real classroom settings.

However, few studies have simultaneously examined the effect of TTS on listening comprehension within a quasi-experimental classroom design while also capturing students' behavioral engagement through direct observational measures such as Time-on-Task. Most existing studies rely on self-reported engagement or perception-based data, leaving a gap in understanding how students actually behave during TTS-supported listening activities in real classroom settings.

Therefore, there is a need for classroom-based research that examines the practical implementation of TTS technology within structured listening instruction. This study seeks to address this gap by investigating the effect of a Text-to-Speech application on students' listening comprehension skills and describing students' behavioral engagement during the implementation of the TTS-supported instruction, as well as examining its relationship with listening comprehension skills in a senior high school EFL context, using a quasi-

experimental design and integrating TTS into the pre-, while-, and post-listening stages of instruction.

B. Research Purpose

This study aims to investigate the effect of using a Text-to-Speech (TTS) application on students' listening comprehension skills among senior high school students in Pontianak. The study employs a quasi-experimental method with a non-equivalent control group design. It compares students who receive listening instruction supported by a TTS application with those who are taught using traditional listening instruction. Additionally, this study aims to examine students' behavioral engagement during the implementation of TTS-supported instruction, specifically its patterns across instructional sessions as measured through Time-on-Task observation, and to analyze its relationship with listening comprehension skills, with engagement observed only during the treatment sessions and not during the pre-test or post-test. The findings of this study are expected to contribute empirical evidence on the pedagogical use of TTS technology as an alternative instructional tool for listening comprehension skills in EFL classrooms and to provide a reference for future research and instructional practice.

C. Research Questions

This study aims to answer the following research questions:

1. Is there a significant effect of the Text-to-Speech (TTS) application on students' listening comprehension skills after controlling for their pre-test scores?
2. What is the extent and nature of students' behavioral engagement during the implementation of TTS-supported listening instruction in the experimental group?
    a. To what extent are students in the experimental group behaviorally engaged during TTS-supported listening instruction, and how does this engagement vary across individual students and four instructional sessions?
    b. What types of on-task and off-task behaviors emerge among students in the experimental group during TTS-supported listening instruction?
3. Is there a significant relationship between students' behavioral engagement during the treatment sessions and their post-test listening comprehension scores?

Through these research questions, this study aims to examine the effect of using a Text-to-Speech (TTS) application on students' listening comprehension skills by comparing the performance of students who receive TTS-supported instruction with that of students who receive traditional listening instruction. Additionally, students' behavioral engagement, as measured through Time-on-Task (ToT) observations during the implementation of the

TTS application, is explored to describe students' level of engagement in the learning process and to examine its relationship with students' post-test listening comprehension scores, representing learning outcomes after the treatment. Behavioral engagement is conceptualized as a process variable occurring during learning, while listening comprehension scores represent the outcome of that process. The findings of this study are expected to provide valuable insights into the potential of TTS technology as an innovative approach to teaching listening comprehension skills in EFL contexts.

D. Research Hypotheses

The hypothesis presents predictions about the findings expected by the researcher in their study (Creswell, 2012). Here are the predictions for this study:

1. For the research question about comparing the experimental group with the TTS application and the control group with traditional methods:
   - H_0: There is no significant difference in students' post-test listening comprehension skills between those taught using the Text-to-Speech (TTS) application and those taught using traditional methods after controlling for pre-test scores.
   - H_1: There is a significant difference in students' post-test listening comprehension skills between those taught using the Text-to-Speech (TTS) application and those taught using traditional methods after controlling for pre-test scores.

2. For the research question about the relation between students' engagement and their listening comprehension achievement:
   - H_0: There is no significant relationship between students' behavioral engagement and their listening comprehension skills.
   - H_1: There is a significant relationship between students' behavioral engagement and their listening comprehension skills.

These hypotheses guide the statistical analysis to determine the effect of the Text-to-Speech (TTS) application on students' listening comprehension skills. In addition, students' behavioral engagement, as measured through Time-on-Task (ToT) observations during the treatment sessions, is used to describe students' level of engagement and to examine its relationship with their listening comprehension skills. Together, these findings aim to provide valuable insights into the potential use of TTS technology in EFL listening instruction.

E. Research Significance

This study offers several significant contributions to the field of education and English language learning.

1. Theoretical Significance

This study contributes to the existing body of knowledge regarding the integration of AI technology, specifically Text-to-Speech applications, in English language education. It provides empirical evidence on the effect of TTS technology on listening comprehension skills among senior high school students. Additionally, the study offers insights into students'

engagement during the implementation of the technology and its relationship with listening comprehension in language learning contexts.

2. Practical Significance

a. For Teachers

For teachers, the implementation of Text-to-Speech (TTS) technology offers valuable insights as an alternative solution for creating customized audio materials. This study provides practical implications for integrating TTS into listening instruction within the English language curriculum. Furthermore, it offers guidance on how TTS can be systematically implemented in listening activities to support students' listening comprehension development. This technology helps teachers overcome the common challenge of obtaining suitable audio materials for teaching listening skills, making it easier to develop and deliver effective listening exercises.

b. For Educational Institutions

For educational institutions, the study offers valuable insights to support decision-making processes regarding the implementation of technology-enhanced learning methods. It provides empirical evidence that can guide institutions in adopting TTS-supported instruction to better align with modern educational needs. Additionally, the study helps address the common challenge of resource limitations by offering a cost-effective solution for providing flexible and level-appropriate

audio materials for language learning. It also contributes to institutional efforts in promoting the integration of digital technologies to enhance the quality of English language instruction.

c. For Students

For students, the use of Text-to-Speech (TTS) technology provides several key benefits. It introduces an accessible tool that enables independent language learning at the student's own pace. Through this technology, students gain valuable opportunities to hear and practice clear and consistent pronunciation models. Additionally, the flexibility of this system allows students to continue their language learning outside of classroom hours, creating more opportunities for practice and improvement.

F. Research Scope

1. Research Variables

In this study, the independent variable being examined is the use of a Text-to-Speech (TTS) application called TTSMaker. The primary dependent variable measured in this study is students' listening comprehension ability, while student engagement is examined as an additional variable to describe students' behavioral engagement during the learning process. Meanwhile, the control group receives traditional listening instruction without the use of TTS technology. The assessment primarily focuses on evaluating students' listening comprehension skills, while

student behavioral engagement is analyzed descriptively and examined in relation to listening comprehension.

a. Independent Variables

Text-to-Speech Application

The independent variable in this study is the type of listening instruction, which is defined as the use of a Text-to-Speech (TTS) application, specifically the TTSMaker application, in listening activities. The TTS application functions as a digital learning tool designed to support listening comprehension by providing synthesized English pronunciation and intonation. In this study, the use of Text-to-Speech serves as the main instructional treatment in the experimental group, whereas the control group receives traditional listening instruction without the use of TTS technology. The implementation of the TTS-based instruction is intended to enhance students' exposure to spoken English during listening activities. A detailed description of the instructional procedures, including the frequency, duration, and instructional stages of the treatment, is presented in Chapter III. During the assessment phase, the TTSMaker application was used as audio material while students completed a paper-based listening comprehension test to measure their listening performance after the treatment.

b. Dependent Variables

1) Listening Comprehension

The primary dependent variable is students' listening comprehension, which refers to students' ability to understand spoken English after the instructional treatment. This ability was measured using listening comprehension tests that assessed key aspects of listening skills, including identifying main ideas, recognizing specific details, making inferences, and evaluating audio texts. Differences in students' listening comprehension test scores between pre-test and post-test, as well as between groups, were used as indicators of the effect of the TTSMaker application on students' listening comprehension skills.

2) Students' Engagement

Student engagement is examined as an additional variable in this study. Specifically, this study focuses on behavioral engagement observed during the implementation of the instructional treatment. Engagement was measured using the Time-on-Task (ToT) observation method, which is a well-established behavioral indicator of students' active participation in learning activities (Fisher et al., 2015; Spanjers et al., 2008).

In this study, behavioral engagement reflects the extent to which students maintain attention and actively participate in listening

activities during the learning process, as indicated by their on-task and off-task behaviors. The engagement data are collected during the implementation of the Text-to-Speech application to provide a description of students' engagement levels. In addition, the data are analyzed to examine the relationship between students' behavioral engagement and their listening comprehension skills, rather than to measure a direct causal effect. The detailed procedures for measuring student behavioral engagement are presented in Chapter III.

2. Terminology

a. Text-to-Speech (TTS)

Text-to-Speech (TTS) is a technology that converts written or electronic text into spoken audio. With this system, users can adjust various settings such as speaking speed, tone, and audio format, and the generated voice can be saved as an audio file (Fleizach & Hudson, 2016; Legat, 2016; Yudhistiro, 2016). In this study, the Text-to-Speech application used is TTSMaker, which supports multiple languages, offers customizable voices, and produces natural-sounding speech output for listening activities.

b. Listening Comprehension

Listening comprehension refers to a complex process that goes beyond simply hearing spoken words; it requires the listener to actively

interpret, analyze, and construct meaning from what is heard. This skill is vital when processing extended forms of speech such as conversations, narratives, or academic lectures, where understanding depends not only on recognizing words and phrases but also on grasping the speaker's intent, tone, and contextual cues. As Kim and Pilcher (2016) note, effective listening comprehension integrates both the reception of auditory input and the cognitive process of making sense of it, highlighting its essential role in successful communication and learning. In this study, listening comprehension is operationally defined as students' ability to understand spoken English as measured through a listening comprehension test administered before and after the instructional treatment.

c. Student Engagement

Engagement refers to the extent to which students are actively involved in learning activities. It is commonly discussed in terms of behavioral engagement, which reflects students' observable participation and sustained attention during learning. In this sense, engagement represents students' active effort and focus throughout the learning process. Rather than merely indicating physical presence, engagement emphasizes active participation, manifested through purposeful behavior in learning activities (Anderman et al., 2024; Cirocki et al., 2024; Duchesne et al., 2022).

In this study, student engagement is specifically defined as the extent of behavioral engagement observed during the implementation of the instructional treatment and measured using the Time-on-Task (ToT) observation method. Engagement is operationalized as the percentage of time students spend on-task during listening activities, calculated by dividing the total number of on-task observations by the total number of observation intervals. This percentage is treated as a continuous variable (scale data) ranging from 0% to 100% for descriptive and correlational analysis. For interpretive purposes only, these percentages may be categorized into high (80–100%), moderate (60–79%), and low (<60%) engagement levels to facilitate practical understanding.

3. Research Limitations

a. Population Scope

The study is limited to senior high school students in Pontianak, focusing specifically on English language learning. The population consists of tenth-grade students, with a sample of approximately 30 students in each group (experimental and control groups) selected from intact classes. As the sample is not randomly assigned, the findings may be subject to group differences and may not fully represent the broader student population. Therefore, the findings of this study may not be generalizable to students at different educational levels, in other regions, or with different learning characteristics.

b. Technological Scope

The use of technology in this study is specifically confined to the TTSMaker application as the selected Text-to-Speech (TTS) tool, with attention directed exclusively toward the basic features available in its free version. As a result, the findings may be influenced by the limitations of this particular application and may not fully represent the effect of other TTS tools with more advanced features. In addition, differences in voice quality, naturalness, and customization across TTS applications may lead to different learning outcomes. These limitations may affect the generalizability of the findings to other contexts or the long-term impacts of TTS technology use.

c. Measurement Scope

This study focuses only on behavioral engagement as measured through Time-on-Task observation. Other dimensions of engagement, such as emotional and cognitive engagement, are not examined. Therefore, the findings related to student engagement are limited to observable classroom behaviors and may not fully capture students' internal learning experiences.

d. Duration of Treatment

The duration of the treatment in this study is relatively short, consisting of a limited number of instructional sessions. Therefore, the findings may not fully reflect the long-term effects of using the TTS

application on students' listening comprehension and engagement. Short-term exposure may only capture immediate learning gains and observable engagement, rather than sustained improvement over time.

e. Control of External Variable

This study does not fully control for external variables that may influence students' listening comprehension and engagement, such as differences in teacher instruction, classroom environment, students' prior exposure to English outside the classroom, and individual motivation. Although efforts were made to maintain similar instructional conditions between groups, these factors may still affect the results and should be considered when interpreting the findings.

f. Audio Delivery Mode

The control group received listening input through teacher-led reading, while the experimental group received TTS-generated audio. This difference in delivery mode introduces a potential confound, as natural human speech (teacher reading) and synthesized speech (TTS) differ in prosody, intonation, and perceived naturalness. Consequently, any observed differences in listening comprehension between groups may be attributable to the audio delivery mode in addition to, or instead of, the TTS technology itself.

g. Statistical Power for Correlational Analysis

The correlational analysis for RQ3 used a subset of 18 students present in all four sessions. This reduced sample size limited statistical power to detect meaningful correlations, particularly given the ceiling effects in both variables. The non-significant result should be interpreted cautiously, as it may reflect insufficient power rather than the absence of a true relationship.