How Effective Is SUNO.AI in Enhancing Arabic Listening Skills? An Evaluation of AI-Based Personalized Learning

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***Abstract*—This study evaluates the effectiveness of SUNO.AI, an Artificial Intelligence (AI)-based learning platform, in enhancing Arabic listening skills among second-semester students at the State Islamic University of Raden Intan Lampung. A purposive sampling technique was employed, involving 60 students who had completed an Arabic listening course. The research followed a Research and Development (R&D) method, utilizing the Hannafin and Peck model. Data collection tools included pre-tests, post-tests, and expert validation to assess the platform's feasibility and its impact on listening comprehension. SUNO.AI provided personalized exercises adapted to individual proficiency levels, offering real-time feedback and exposure to various Arabic dialects. Results from quantitative analysis showed a significant improvement in students' listening skills, with a 25% increase in post-test scores ($p < 0.05$). These findings indicate that AI-based tools like SUNO.AI can significantly enhance listening comprehension by offering adaptive learning experiences. This research contributes to the growing body of literature on AI applications in language education and provides practical insights for improving Arabic language instruction.**

***Keywords*—Arabic language learning, SUNO.AI, listening skills, artificial intelligence, educational technology**

I. Introduction

Arabic language learning holds a crucial position in Indonesia's educational framework, particularly in facilitating the comprehension of academic texts, religious scripture, and classical literature. Beyond its role as a communication medium in the Arab world, Arabic is globally recognized for its significance in fields such as diplomacy, commerce, religious studies, and cultural exchange [1–4]. In Indonesia, Arabic is part of the national curriculum, taught from primary education through higher education, aligning with the country's educational policies that emphasize foreign language proficiency [5]. Listening skills, among the core competencies of language acquisition, are especially important for mastering Arabic. Proficient listening enables learners to understand and interpret spoken conversations, lectures, and various audio materials, forming the foundation for developing speaking, reading, and writing skills [6–8]. Given this, effective methods to enhance listening skills are essential for the success of Arabic language education.

Despite the recognized importance of listening skills, significant challenges persist in teaching Arabic listening in Indonesia. A preliminary survey involving 200 students at the State Islamic University of Raden Intan Lampung revealed that 70% of students struggle with understanding spoken Arabic, while 65% reported that the available audio materials do not adequately support their listening development. Moreover, only 20% of lecturers felt confident in using technology to enhance listening instruction. These findings point to major gaps in the current teaching approaches, particularly the lack of interactive methods and insufficient use of technology [9–12]. Addressing these challenges is vital to creating more effective learning experiences and improving student outcomes.

One promising solution to these issues is the integration of AI into language learning. AI provides innovative, adaptive, and interactive learning tools that can be tailored to the unique needs of each student [13–17]. For instance, AI can deliver real-time feedback, recognize speech patterns, and offer personalized listening exercises that match the learner's proficiency level. This can significantly enhance the effectiveness of listening instruction, offering a more engaging learning experience while helping students improve their ability to comprehend spoken Arabic [18–20].

SUNO.AI, an AI-based platform, presents an advanced technological approach to overcoming the challenges in teaching Arabic listening skills. This platform uses sophisticated algorithms to process spoken input, provide speech recognition, and deliver real-time feedback. It adjusts to the learner's proficiency level, making it an interactive and adaptive tool for language learning [21, 22]. SUNO.AI also offers authentic audio materials, mimicking various accents and speech speeds, which are essential for improving listening comprehension. Its ability to provide accurate, immediate feedback ensures that learners can continuously refine their listening abilities. Hence, integrating SUNO.AI into Arabic language instruction could be a transformative approach to addressing the current challenges and enhancing the effectiveness of learning outcomes.

In light of the identified challenges and the potential of AI technology, this research seeks to answer the following questions: How can SUNO.AI-based learning media be developed to improve students' Arabic listening skills? What is the impact of using SUNO.AI on students' listening comprehension and overall proficiency? Finally, how does the integration of AI technology in Arabic instruction compare with traditional methods in terms of enhancing

student engagement and proficiency in listening?

This study aims to develop and assess Arabic learning media based on SUNO.AI, specifically designed to improve students' listening skills. By introducing AI into Arabic language instruction, the research offers a novel approach to addressing gaps in listening pedagogy. The findings are expected to contribute both to academic literature on language learning technologies and to provide practical guidelines for educators. Moreover, this research has the potential to enhance Arabic language instruction not only at the State Islamic University of Raden Intan Lampung but also across educational institutions in Indonesia and beyond.

II. Literature Review

A. Arabic Listening Skills

Listening skills in Arabic are a critical component of the language learning process. Effective listening enables learners to understand the language in everyday and academic communication contexts [11, 23–25]. The process of effective listening involves comprehending, interpreting, and responding to the messages heard. In the context of Arabic, listening skills pose unique challenges due to the phonetic, morphological, and syntactic complexities of the language. According to Hsiao-Ling Hsu, Howard Hao-Jan Chen, and Andrew G. Todd, listening skills are not just about hearing words but also understanding the context, intonation, and underlying meanings. They emphasize the importance of effective listening strategies, such as prediction, inference, and monitoring comprehension during the listening process [26].

Arabic has phonetic sounds that are uncommon in other languages, particularly emphatic consonants and uvular sounds. These sounds often pose challenges for non-native learners [27, 28]. Additionally, the complex morphological structure of Arabic, with its numerous verb and noun forms, can be a barrier to understanding real-time conversations. Arabic morphology requires learners to quickly recognize and process various word forms [29, 30]. Furthermore, Arabic features many regional dialects that differ significantly from Modern Standard Arabic (MSA). Learners accustomed to MSA may struggle to understand these dialects, which are frequently used in daily conversations [31, 32].

Several strategies have been identified as effective methods for improving Arabic listening skills. Exposure to various authentic audio materials, such as conversations, lectures, and news broadcasts, helps learners become accustomed to different accents and speaking styles. Authentic materials also provide important cultural context for understanding the language [33]. Intensive listening practice involves focusing on specific details within audio, while extensive listening involves large amounts of listening for general comprehension. Both approaches help to improve overall listening skills [34, 35]. Technology, such as speech recognition software and language learning applications, can provide interactive and adaptive listening practice. These tools can offer real-time feedback and allow learners to practice at their own pace [3, 6, 36–38].

Recent research indicates that integrating technology into the teaching of Arabic listening skills yields significant results. According to a study by Irfan Suryana, Asrianto, and Didik Murwantono, using AI-based applications in listening instruction significantly enhances listening comprehension skills compared to traditional methods. This technology offers more personalized practice, real-time feedback, and exposure to various dialects and speaking styles [39]. Furthermore, a study by Abdulaziz Alasmi shows that using audio-visual materials in Arabic language classes helps learners develop their listening skills more effectively. These materials not only capture learners' attention but also help them connect sounds with visual contexts, enhancing overall comprehension [40].

In conclusion, teaching Arabic listening skills requires a comprehensive approach integrated with modern technology. Using effective strategies and technological tools can help learners overcome existing challenges and improve their ability to comprehend spoken Arabic.

B. Arabic Learning Media

Learning media play a crucial role in the educational process, especially in facilitating and enhancing students' learning experiences. Learning media are not limited to textbooks and other printed materials but also encompass advanced digital technologies such as learning applications, e-learning platforms, and interactive software. In the context of Arabic language learning, the use of appropriate media can help students overcome challenges in learning a language with complex phonetic and morphological characteristics.

The development of information and communication technology has brought significant changes to the education sector, including language learning. Technology-based learning media have been proven effective in increasing student engagement and facilitating better comprehension [41–43]. Digital technology allows the presentation of learning materials in various formats, such as videos, audio, animations, and simulations, which can cater to different learning styles [44–47].

In Arabic language learning, digital media can provide authentic and diverse language input, which is crucial for developing listening skills. For instance, the use of videos and podcasts featuring native Arabic speakers can expose students to various accents and speaking styles, helping them develop better listening skills [9, 48]. Interactive learning media, such as language learning applications and software, enable students to practice language skills independently and receive immediate feedback. Language learning applications like Duolingo and Babbel have shown that the use of adaptive technology can increase learning motivation and retention of learning materials [49]. In the context of Arabic language learning, applications specifically designed for the language, such as Al-Kitaab and Arab Academy, offer various interactive exercises that cover listening, speaking, reading, and writing skills. These exercises are usually accompanied by automatic feedback, helping students understand and correct their mistakes in real-time.

The integration of technology in Arabic language learning is not limited to the use of applications and software. E-learning platforms like Moodle and Blackboard allow instructors to manage courses online, provide learning materials, and interact with students through discussion forums and video conferencing. These platforms also enable

continuous assessment through online quizzes and assignments, helping instructors monitor student progress and provide timely feedback. Recent studies indicate that the use of technology in Arabic language learning can enhance teaching and learning effectiveness. For example, a study by Aminudin Hehsan found that the use of e-learning in Arabic language learning can significantly improve students' language skills compared to traditional teaching methods. Additionally, technology can provide a wider range of learning resources and better accessibility for students, especially in areas with limited educational resources [50].

Despite the many benefits offered by technology-based learning media, there are also challenges that need to be addressed. One of these is the readiness and competence of instructors in using technology. Some instructors may be less familiar with digital technology or reluctant to use it in their teaching [51–53]. Therefore, training and technical support for instructors are essential to ensure they can effectively utilize technology in their teaching. Moreover, there are also challenges related to technology accessibility, especially in areas with inadequate infrastructure. Nonetheless, technological advancements continue to offer new opportunities to enhance Arabic language learning. For instance, the development of AI and machine learning opens new possibilities for creating more adaptive and personalized learning media. Thus, the appropriate and innovative use of learning media can help overcome various challenges in Arabic language learning and enhance students' overall language skills.

C. Artificial Intelligence

AI is a branch of computer science focused on creating systems capable of performing tasks that typically require human intelligence. These tasks include, but are not limited to, speech recognition, natural language processing, machine learning, and decision-making. AI is designed to mimic human cognitive abilities, such as learning from experience, understanding language, and making decisions based on available data [54].

In recent years, AI has seen rapid advancements, particularly in machine learning and deep learning capabilities. Deep learning algorithms utilize artificial neural networks inspired by the human brain's workings. These algorithms can process large amounts of data and identify complex patterns that traditional methods cannot detect. This technology has been applied in various fields, including healthcare, finance, and education [6].

The application of AI in education offers significant potential to enhance the learning process. AI can provide personalized learning experiences by analyzing student performance data and adjusting instructional materials to meet individual needs. For example, AI systems can identify areas where students struggle and offer additional exercises or alternative teaching methods to help them better understand the material [55]. AI can also increase teaching efficiency by automating administrative tasks, such as grading assignments and exams, allowing teachers to focus more on direct student interaction and the development of more effective teaching strategies [56].

One of the primary applications of AI in education is adaptive learning, where AI systems dynamically adjust learning materials based on student performance and needs. This adaptive learning approach allows for a more personalized and effective learning experience, helping students learn at their own pace and address difficulties they encounter [57]. Real-time feedback provided by AI is also highly beneficial in the learning process. By continuously analyzing student performance, AI systems can offer immediate feedback on errors and how to correct them. This helps students improve their understanding directly and prevents recurring mistakes [58].

AI has shown great potential in language learning, particularly through speech recognition and natural language processing (NLP) technologies. These technologies enable students to practice listening and speaking in the target language by receiving precise and detailed feedback on their pronunciation and language use. Additionally, AI systems can simulate conversations with native speakers, providing students with experiences close to real-life interactions with native speakers [59, 60].

One example of AI application in language learning is Duolingo, a language learning app that uses AI to tailor lessons to individual students' needs. Duolingo collects data from user interactions with the app and uses machine learning algorithms to determine the appropriate difficulty level and the most effective types of exercises for each user. As a result, users can learn languages more efficiently and enjoyably [49, 61, 62].

While AI offers many benefits in education, there are also challenges that need to be addressed. One of the main challenges is privacy and data security, as AI systems require access to large amounts of personal student data. Additionally, there are concerns about potential biases in AI algorithms that could affect fairness in assessment and the provision of learning materials [63]. However, with the ongoing development of technology and improvements in data policy regulations, AI is expected to play an increasingly significant role in education in the future. Further research and development will be necessary to address these challenges and maximize AI's potential to create more effective and inclusive learning experiences [64].

D. Artificial Intelligence Tools for Language Learning

AI has revolutionized language learning by offering innovative tools that personalize the learning experience, making it more engaging and efficient. AI tools for language learning are designed to enhance learners' proficiency in various language skills reading, writing, listening, and speaking [17]. This section explores several AI tools that have gained prominence in recent years and examines their effectiveness through relevant studies.

One notable AI tool is Duolingo, which uses AI to offer personalized lessons. Duolingo applies machine learning algorithms to adapt the difficulty of exercises based on users' performance, ensuring learners receive tailored lessons. The platform employs a spaced repetition system, which helps reinforce vocabulary retention. Studies have demonstrated its effectiveness in improving learners' language acquisition. For instance, an evaluation by Bryan Smith *et al*. [65] found that Duolingo users achieved significant vocabulary and grammar improvements in Spanish and French. Another study by Sausan Nafis Amin [66] analyzed the app's success

in maintaining user engagement through gamification feature. Furthermore, Ira Irzawati [67] confirmed its potential as a supplementary tool in formal language education, highlighting its adaptability to different language learning environments.

Babbel, another AI-based language learning platform, focuses on conversational skills by using natural language processing (NLP) to simulate real-life conversations. Babbel tailors content to users' language goals and provides immediate feedback on pronunciation. According to research by Matt Kessler *et al*. [63], Babbel's approach to contextual language learning improves users' speaking fluency. A study by Milene Mendes de Oliveira *et al*. [68] further illustrated that Babbel users exhibited greater confidence in conversational settings compared to traditional learners. Moreover, Hana Vancova found that Babbel's integration of NLP tools contributes to learners' enhanced pronunciation and listening comprehension [69].

Rosetta Stone, another widely-used AI tool, emphasizes immersive learning through speech recognition and contextual interaction. It applies machine learning to improve learners' pronunciation accuracy and offers real-time corrective feedback. Rosetta Stone's TruAccent™ technology is designed to compare learners' pronunciation with native speakers, facilitating more natural speaking patterns. Research by Nursaima Harahap *et al*. [70] demonstrated that Rosetta Stone's immersive methodology enhances both listening and speaking skills in language learners. Another study by Rifqi Naufal Hermana [71] confirmed that the tool's speech recognition feature significantly improves pronunciation accuracy over time. Additionally, research by Sri Yuliani *et al*. [72] found that learners using Rosetta Stone outperformed those in traditional classrooms in terms of speaking proficiency.

A more recent AI tool gaining attention in language learning is SUNO.AI, which integrates text-to-speech and speech-to-text technologies to aid learners in developing their listening and speaking skills. SUNO.AI provides AI-generated audio responses to learners' input, allowing them to practice pronunciation, comprehension, and conversational dialogue. A study by Irfan Suryana *et al*. [39] found that SUNO.AI significantly improves learners' listening comprehension, especially for non-native speakers of English. Furthermore, Lanqin Zheng *et al*. [73] explored SUNO.AI's effectiveness in a blended learning environment, confirming that the tool facilitates interactive learning experiences that enhance speaking and listening proficiency.

In conclusion, AI tools like Duolingo, Babbel, Rosetta Stone, and SUNO.AI offer innovative solutions for personalized language learning. These tools leverage AI to provide customized lessons, immediate feedback, and real-life conversational practice, ultimately improving language proficiency in various aspects. SUNO.AI, in particular, stands out for its advanced audio-based learning features, making it a valuable tool for both general and specific language learning applications.

E. SUNO.AI for Arabic Listening Skills

The use of SUNO.AI in developing Arabic listening skills represents a novel approach to addressing the challenges faced by learners. By leveraging advanced speech recognition and adaptive feedback mechanisms, SUNO.AI can provide a highly personalized learning experience that meets the specific needs of Arabic language learners.

Recent research indicates that the use of AI-based technologies like SUNO.AI can offer various advantages in language learning. For instance, Kleopatra Megeira found that students using AI tools in language learning showed significant improvements in listening skills compared to conventional methods [74]. SUNO.AI, in particular, is capable of providing listening exercises tailored to individual proficiency levels, delivering real-time feedback, and allowing students to practice with various accents and speaking speeds. This is crucial in Arabic language learning due to the diversity of dialects and accents in the language.

Furthermore, the use of SUNO.AI in Arabic language learning not only enhances listening skills but also boosts students' learning motivation. According to a study by Becky K White, students using SUNO.AI reported higher levels of engagement and motivation in their learning process. This is attributed to the interactivity and adaptability of the technology, which allows for a more engaging and challenging learning experience [75].

The primary advantages of SUNO.AI include its ability to mimic various accents and speaking speeds, provide authentic audio materials, and offer quick and accurate feedback. Additionally, this technology can be used to simulate real-life listening scenarios, which is highly beneficial in the context of Arabic language learning. Students can practice listening to everyday conversations, lectures, and other relevant situations in which Arabic is used in real contexts.

F. Artificial Intelligence in Language Learning and Listening Skill Development

The use of AI in language learning has shown a significant impact on enhancing listening skills. Various studies highlight that AI-based tools can provide a more adaptive and personalized learning experience, especially through the use of speech recognition technology and real-time feedback. For instance, research by Hongliang Qiao and Aruna Zhao [76] indicates that AI-based language learning applications like Duolingo can significantly improve listening comprehension and vocabulary acquisition through exercises tailored to user performance. Similarly, Babbel, another AI platform, has proven effective in developing conversational skills through Natural Language Processing (NLP), enabling users to engage in realistic conversational simulations [77, 78].

However, the majority of these studies focus on languages such as English, Spanish, or French, while the application of AI in Arabic language learning remains limited. Research by Rusmiyanto [79], Haifa al - Nofaie [80], and Helen Crompton [81] demonstrates that AI-based applications can improve listening skills in Arabic, particularly in understanding the diverse dialects that are typically challenging for learners to access through traditional methods. AI tools like SUNO.AI hold significant potential in Arabic language learning due to their ability to present dialectal variety and provide instant feedback, features rarely found in conventional learning tools or even in some mainstream AI platforms. Additionally, Alasmi (2023) notes that using audiovisual technology in Arabic language classes increases student engagement and

helps them connect cultural contexts with learning materials.

Although AI has been widely utilized in language education, research on its application to Arabic listening skills remains limited. This study seeks to address this gap by evaluating the effectiveness of SUNO.AI, an AI platform designed to generate songs, in facilitating Arabic language learning. The primary focus is on how SUNO.AI leverages its ability to produce authentic audio content, including variations in speed and dialects, to tackle challenges such as dialectal diversity and the phonetic complexity of the Arabic language. Most existing research has yet to explore how technologies like SUNO.AI can provide real-world listening experiences that align with the linguistic intricacies of Arabic. By assessing SUNO.AI's capacity to deliver contextually relevant audio reflecting the diversity of the Arabic language, this study offers a novel contribution. The findings highlight how AI technologies originally developed for music creation can be innovatively repurposed to address specific challenges in Arabic language acquisition.

III. Methodology

This research employs a Research and Development (R&D) approach using the Hannafin and Peck model, which consists of three main phases: needs analysis, design and development, as well as implementation and evaluation. This model is selected for its iterative and systematic approach, which is particularly effective in the development of technology-based learning media. The needs analysis phase ensures that the specific requirements of learners and the educational context are well understood before the design process begins. This is critical when developing Arabic listening media, as it ensures that the learning tool aligns with both the students' needs and the course objectives. During the design and development phase, the Hannafin and Peck model emphasizes continual revision based on user feedback, which is essential for refining the media and ensuring its effectiveness. This cyclical nature allows for improvements to be made as potential issues are identified early and rectified in real-time, resulting in a more robust and user-centered learning tool. Finally, the implementation and evaluation phase focuses on the real-world application and testing of the developed media, ensuring that it meets educational goals and enhances student engagement and learning outcomes. By employing the Hannafin and Peck model, this study ensures that the development of the Arabic listening learning media is both rigorous and adaptable, allowing for continuous improvement throughout the design process. The model's flexibility makes it highly suited to the dynamic nature of language learning, where feedback and adjustments are critical to the success of the educational media being developed. Fig. 1 illustrates the participant demographics and the sampling methodology employed in this study and Fig. 2, depicts the distribution of participant characteristics, including Arabic proficiency, exposure to technology, and experience with AI integration.

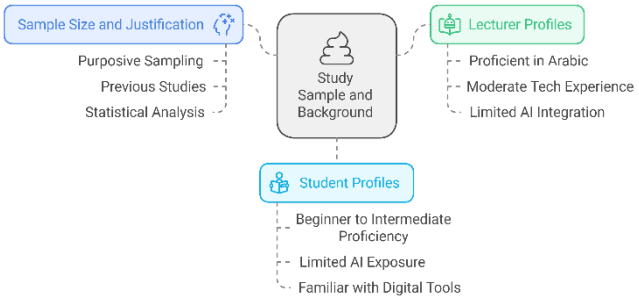

Fig. 1. Participant demographics and sampling methodology.

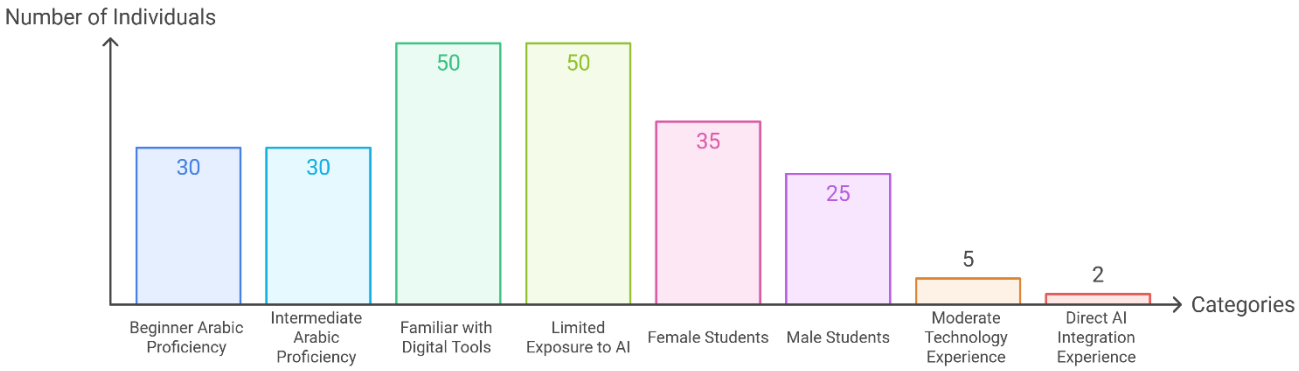

Fig. 2. Distribution of participant characteristics: arabic proficiency, exposure to technology, and AI integration experience.

The population in this study consists of all second-semester students in the Primary School Teacher Education program at the State Islamic University of Raden Intan Lampung. The sample is selected using purposive sampling techniques, consisting of 60 students who have attended Arabic listening courses and are willing to participate in the research. The selection of 60 students is justified based on both practical and methodological considerations. Firstly, previous studies on language learning media development have demonstrated that a sample size of around 50-100 students is sufficient to evaluate the effectiveness of learning interventions [82, 83]. Secondly, given the specific focus on Arabic listening skills and the available pool of students who meet the course prerequisites, the number of 60 participants ensures adequate representation while remaining feasible for in-depth analysis within the study's timeframe and resources. Furthermore, this sample size allows for meaningful statistical analysis and aligns with the recommended sample sizes for experimental studies in educational research [84].

The lecturers and students involved in the study represented a range of backgrounds and expertise in Arabic language learning. Lecturers were proficient in Arabic and had moderate experience in using technology for instructional purposes, though few had previously integrated AI tools into their teaching. Students were mostly at the beginner to intermediate level in Arabic proficiency, with limited

exposure to AI technologies but familiar with standard digital learning tools. This diverse profile allowed the study to capture varying perspectives on the use of AI in Arabic language learning, thereby enhancing the applicability and relevance of the findings. Fig. 3 outlines the research procedure applied in this study.

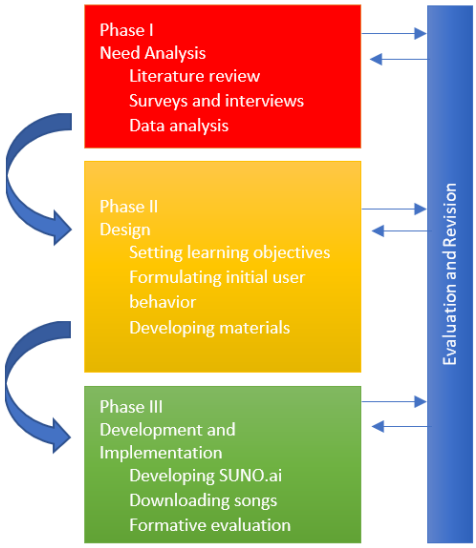

Fig. 3. Research procedure.

The first phase of this study is the Needs Analysis, where the researchers gather information to identify the issues that need to be addressed. The participants in this phase include lecturers and students involved in Arabic language teaching and learning at the target institution. The instruments used in this needs analysis were adopted from previous relevant studies that have been proven valid and reliable. The adoption of these instruments aims to expedite the research process and leverage empirically tested tools.

The instruments used in this needs analysis were adapted from previously validated studies to ensure reliability and validity, aiming to expedite the research process by leveraging empirically tested tools. For survey validation, a reliability test was conducted using Cronbach's alpha, resulting in a reliability coefficient of 0.85 for the lecturers' instrument and 0.88 for the students' instrument, both of which fall within acceptable ranges for educational research. These scores indicate strong internal consistency, supporting the reliability of the instruments. The lecturers' instrument, adapted from Oğuzhan Atabek's study [85], assesses challenges in integrating technology into language teaching, while the students' instrument, based on research by Muhammad Rehan Anwar and Herdi Aziz Ahyarudin [86], examines the needs in Arabic listening skills, specifically in the context of AI technology.

To gain deeper insights into the challenges and expectations related to AI-based technology in Arabic learning, semi-structured interviews were conducted. Participants were selected based on their availability and willingness to provide in-depth perspectives on their experiences and needs. The development of the interview questions was grounded in prior research and existing frameworks on technology integration and AI in education. For lecturers, the questions were informed by Atabek [85], which provides a comprehensive analysis of the challenges associated with integrating technology into education, including resource limitations, technical barriers, and pedagogical constraints ("Challenges in Integrating Technology Into Education," *Turkish Studies*). This study served as a foundation for questions addressing obstacles in technology integration, resource requirements, and the potential applications of AI in classroom settings. Similarly, the questions for students were derived from Anwar and Ahyarudin [86], who explored the role of AI-powered tools in Arabic language education within the Society 5.0 framework. Their study highlights learners' experiences with traditional and digital resources, perceived limitations of existing tools, and the potential of AI-enhanced solutions to address these gaps "AI-Powered Arabic Language Education in the Era of Society 5.0," *IAIC Transactions on Sustainable Digital Innovation*. These insights were instrumental in formulating questions about students' experiences, challenges, and expectations regarding AI in Arabic learning.

To ensure the validity and relevance of the questions, they were reviewed by experts in Arabic language education and educational technology. This process ensured alignment with contemporary research and educational needs. Additionally, a pilot test was conducted with a small representative sample, and feedback was used to refine the questions for clarity and applicability. The interviews were conducted individually to allow participants to freely express their views.

Ethical considerations were carefully observed to ensure the research adhered to established ethical standards. All participants were provided with a detailed explanation of the study's objectives, methodology, and their rights, including the right to withdraw at any time without consequences. Informed consent was obtained prior to conducting the interviews, ensuring participants were fully aware of their involvement and the voluntary nature of their participation. Confidentiality was strictly maintained throughout the research process, with identifying information anonymized and replaced by pseudonyms to safeguard participant privacy. The data were securely stored in password-protected files accessible only to the research team. These measures ensured that participants felt safe to share their personal experiences and opinions, which was essential for gathering authentic and meaningful data.

Data from the interviews were analyzed using thematic analysis, with key themes identified based on recurring ideas and insights. The data analysis process followed a systematic approach consisting of several key steps. The interviews were transcribed verbatim to ensure accuracy and to avoid losing critical details. The transcripts were then thoroughly reviewed to gain an initial understanding of the content. An inductive approach was employed for the coding process, where codes and themes emerged directly from the data without relying on predefined theoretical frameworks. This approach allowed the findings to authentically reflect the participants' perspectives. Initial codes were categorized and grouped into broader categories to form the main themes. To facilitate the organization, grouping, and analysis of the data, NVivo software was utilized, providing efficiency and precision in handling qualitative data. The derived themes were subsequently evaluated through discussions among researchers to ensure accuracy and validity of interpretation. To enhance transparency, the study employed strategies such

as maintaining an audit trail and triangulating data through consultations with field experts. Table 1 presents the questionnaire instruments for lecturers regarding teaching methods and the use of technology. Table 2 illustrates the student questionnaire on their experiences and difficulties with listening comprehension. Table 3 outlines the learning objectives for understanding Arabic audio material. Table 4 displays the learning materials in SUNO.AI, such as children's songs and the days of the week.

Table 1. Questionnaire for needs analysis of lecturers [85]

No	Indicator	Question	Items	Total Items
1	Teaching Methods	Identifying dominant teaching methods.	1	1
		Use of technology in teaching.	2	1
		Details of technology used.	3,4	2
2	Needs and Constraints	Identification of teaching challenges.	5,6	2
		Evaluation of technology effectiveness.	7,8	2
3	Expectations and Suggestions	Expectations for technology features.	9	1
		Suggestions for improvements.	10	1

Table 2. Questionnaire for needs analysis of students [86]

No	Indicator	Question	Items	Total Items
1	Arabic Language Learning Experience	Determining the duration of Arabic learning by respondents.	1,2	2
		Measuring the frequency of technology use in learning.	3,4	2
2	Needs and Constraints in Listening	Identifying specific difficulties in Arabic listening skills.	5,6	2
		Assessment of technology effectiveness in enhancing listening skills.	7	1
3	Expectations of AI Technology	Expectations for specific features in AI applications supporting language learning.	8,9	2
		Suggestions to improve listening learning experiences with technology assistance.	10	1

Table 3. Learning objectives for Arabic language skills

Core Competence	Key Competence
Students can understand the general content of Arabic audio material, forming a foundation for further listening skills.	Encouraging students to analyze and evaluate information heard, essential critical skills in advanced language learning.
Students can identify and understand a wide range of linguistic variations important for effective communication in different regions.	Enabling students to respond quickly and accurately based on what they hear, crucial in direct interactions.
Extensive vocabulary development allows students to understand and participate in more complex conversations.	Ensuring that each student receives materials tailored to their ability level, maximizing individual learning.
Providing practical experience through interactive simulations to reinforce learning through direct experience.	

Table 4. Listening skills learning materials based on suno.ai

No	Material Theme	Description
1	Arabic Children's Songs	Focus on basic vocabulary and simple phrases using cheerful and easily understood language.
2	Days of the Week	Help students memorize the names of days and related activities in Arabic.
3	Nature and Environment	Describing the beauty of nature, weather, and environmental elements to enrich vocabulary.
4	Family and Relationships	Songs depicting family relationships such as father, mother, and siblings.
5	Food and Drink	Introducing traditional Arabic food and vocabulary related to everyday meals.
6	Celebrations and Traditions	Explaining Arab cultural celebrations and traditions like Eid al-Fitr and Ramadan.
7	Feelings and Emotions	Expressing feelings and emotions such as happiness, sadness, and love.
8	Professions and Jobs	Introducing professions and jobs along with vocabulary for the working world.
9	Hobbies and Leisure Activities	Songs about hobbies and leisure activities like sports and arts.
10	Travel and Transportation	Explaining transportation and travel experiences both local and international.
11	Home and Residence	Vocabulary related to parts of the house and living environment.
12	Numbers and Counting	Teaching how to count numbers and basic mathematics in Arabic.
13	Animals and Plants	Introducing various types of animals and plants along with their habitats.
14	Heroes and Historical Figures	Songs about important figures in inspiring Arab history and culture.

This rigorous approach ensured that the findings not only reflected the participants' experiences but were also credible and aligned with existing literature. Such a comprehensive analysis provided valuable insights into the perspectives of both lecturers and students, illustrating how AI-based technologies can offer innovative solutions to challenges in Arabic language learning. Fig. 4 demonstrates the thematic analysis process employed in the context of AI-based Arabic language learning.

Fig. 4. Thematic analysis process in AI-based Arabic learning.

The second phase is Design, focusing on creating the initial product design based on information obtained from the previous phase. This stage begins with Formulating Learning

Objectives, establishing what is to be achieved through the developed product. Next is Formulating Initial User Behavior, assessing the initial abilities of users so that the product can be tailored to meet their skill level. Then, the Materials or content to be used in the developed product are prepared. In this phase, the researcher also designs song lyrics from each predetermined material.

Table 5. Feasibility test instrument for Arabic material expert validators

Aspect	Indicator	Item	Total Items
Material Suitability	Song content aligns with the Arabic language curriculum.	1,2	2
	Songs introduce relevant vocabulary and phrases for the student's skill level.	3,4	2
	Linguistic structure in songs is clear and easily understood by students.	5,6	2
Educational Benefit	Songs help students effectively improve listening skills.	7,8	2
	The use of songs supports students' understanding of Arab cultural contexts.	9,10	2
	Songs motivate students to be more active in language learning.	11,12	2
Language Quality	Pronunciation and intonation in songs conform to correct Arabic language standards.	13,14	2
	Dialect variations used in songs can help students recognize different forms of Arabic.	15,16	2
Integration with SUNO.AI Technology	Integration of songs with SUNO.AI technology enhances interactivity and personalization of learning.	17,18	2
	Feedback features in SUNO.AI effectively assist students in understanding song material.	19,20	2

Table 6. Feasibility test instrument for music expert validators

Aspect	Indicator	Item	Total Items
Melody Quality	Melody is engaging and appropriate for the learning theme.	1,2	2
Music and Lyrics Harmony	Music supports and strengthens the message of the lyrics.	3,4	2
Rhythm and Tempo	Rhythm and tempo are suitable for listener comprehension.	5,6	2
Musical Variation	Sufficient musical variation to maintain interest.	7	1
Suitability with Learning Objectives	Songs support the objectives of listening skills learning.	8,9	2
Audio Production Quality	Clarity of sound and adequate production quality.	10,11	2
Motivational Potential	Potential of songs to motivate and increase interest.	12,13	2
Uniqueness and Creativity	Uniqueness and creativity in musical composition.	14,15	2

The final phase is Development and Implementation. Before the product is tested, the researchers conduct product feasibility tests involving two expert validators in Arabic materials and two music expert validators. This feasibility data is obtained using a questionnaire form. Table 5 demonstrates the feasibility test of the materials in alignment with the curriculum, and Table 6 illustrates the music feasibility test, highlighting the quality of melody and harmony.

After evaluation and revisions based on expert feedback, the next stage is product implementation. Product implementation is conducted in two stages: product usage testing by Arabic language lecturers and field testing by students. After these two stages, suggestions and feedback are obtained from lecturers and students. These suggestions and feedback are used for the evaluation and revision of learning media development. After conducting product feasibility tests, product usage tests, and field tests, the next stage is to perform quantitative data analysis based on the assessment scale of the National Education Standards Agency (BSNP) as shown in Table 7.

Table 7. Evaluation scale for feasibility test of Arabic listening skills learning media based on SUNO.ai

No	Criteria	Score
1	Very Good	5
2	Good	4
3	Sufficient	3
4	Less	2
5	Very Less	1

The quality feasibility score of the Arabic Listening Skills Learning Media based on SUNO.ai is obtained using the following formula:

$$\text{Score} = \frac{\text{value obtained}}{\text{maximum value}} \times 100\% \quad (1)$$

Once the percentage value is obtained, the feasibility of the Arabic Listening Skills Learning Media based on SUNO.ai can be determined based on the interpretation of feasibility test scores as explained in Table 8.

Table 8. Interpretation of feasibility test scores for Arabic listening skills learning media based on SUNO.ai

No	Criteria	Interpretation
1	81%–100%	Very Worthy
2	61%–80%	Worthy
3	41%–60%	Fairly Worthy
4	21%–40%	Not Worthy
5	0%–20%	Very Unworthy

To determine the effectiveness of the developed product, researchers conducted both pre-tests and post-tests to assess students' Arabic listening skills before and after using the product. The design of these tests followed a structured approach to ensure reliable and valid measurement of the targeted language skills. The pre-test was administered to students prior to the introduction of the product to establish a baseline for their listening proficiency. This test was carefully designed to cover various aspects of Arabic listening comprehension, such as understanding spoken words, recognizing different dialects, following conversations, and responding to specific listening cues. Items included in the pre-test were aligned with learning objectives based on established language proficiency frameworks, ensuring the assessment was comprehensive and reflective of real-world language use.

The post-test, administered after students had engaged with the product over a designated period, was structured similarly to the pre-test, with questions covering the same range of

listening skills. However, it also included slightly more advanced tasks to gauge any progression in the students' abilities. The consistency in the structure of both tests ensures that any improvement in scores could be attributed to the use of the developed product rather than variations in the assessment difficulty.

The criteria for evaluating students' performance were based on several key areas of Arabic listening comprehension: accuracy in identifying spoken words or phrases, fluency in understanding conversations and responding promptly, cultural context recognition, focusing on the ability to interpret the meaning of words and phrases in different dialects and social situations, and listening for specific information, where students were required to extract particular details from spoken passages. Each criterion was scored using a Likert scale ranging from 1 to 5, where 1 indicated very poor comprehension and 5 indicated excellent comprehension. The final score for each student was the cumulative result of these individual criteria, allowing for a detailed analysis of specific strengths and weaknesses in listening skills.

Once both pre-test and post-test results were collected, they were analyzed using t-tests to compare the mean scores before and after the product intervention. The t-test was selected to determine whether there was a statistically significant difference in students' Arabic listening skills after using the product. A significance level of $p < 0.05$ was set as the threshold for determining whether the improvement observed was not due to random chance.

In addition to the pre- and post-tests, this entire process involved continuous evaluation and revision. The product underwent iterative improvements based on feedback from students and teachers, as well as insights derived from the test results. User feedback was collected through surveys and focus group discussions to identify areas where the product could be enhanced, ensuring that the final version was not only educationally effective but also user-friendly and engaging. By incorporating continuous feedback loops and iterative revisions, researchers ensured that the final product was both of high quality and highly relevant to the needs of its users, ultimately enhancing its educational impact.

IV. Result and Discussion

This study aims to develop, assess the feasibility, and evaluate the effectiveness of an Arabic listening skills learning media based on SUNO.ai, focusing on several key stages: Needs Analysis, Design, Development, and Implementation. The results from each stage are described as follows:

A. Need Analysis

The needs analysis phase serves as a critical step in identifying the requirements of both lecturers and students regarding the teaching of Arabic listening skills. A comprehensive survey was conducted with lecturers and students to gather insights on the dominant teaching methods, the use of technology in teaching, and the challenges encountered in acquiring listening skills.

From the lecturers' responses, 80% reported a heavy reliance on traditional teaching methods, such as lectures and discussions, when teaching listening skills. This reliance on conventional methods highlights a gap in technology integration, as only a minority of lecturers regularly incorporate technological tools into their classrooms. While the majority (65%) of lecturers recognized the potential of technology to enhance listening skills, only 20% felt confident in using advanced tools like speech recognition software or AI-based applications to support their instruction. This hesitance suggests a lack of both familiarity with and access to the necessary technology.

Additionally, a significant barrier for lecturers was the difficulty in sourcing diverse material that could expose students to different Arabic dialects. Most teaching materials focused on Standard Arabic, with limited exposure to regional dialects. In particular, lecturers expressed challenges in finding resources that cover dialects such as Egyptian Arabic, Levantine Arabic, and Maghrebi Arabic, which are widely spoken across different regions. This scarcity in dialectal variety limits students' exposure to the full range of linguistic diversity in the Arab-speaking world. Fig. 5 provides a graphical representation of the needs analysis results, highlighting the primary challenges faced by both students and lecturers in teaching Arabic listening skills.

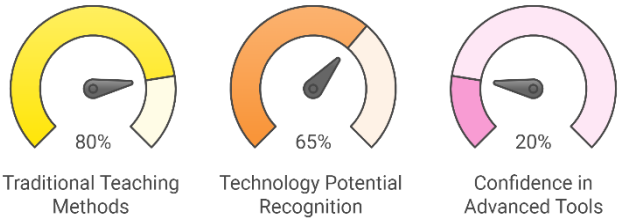

Fig. 5. A graphical representation of the needs analysis results, illustrating key challenges faced by students and lecturers in Arabic listening instruction.

From the students' standpoint, 70% of respondents struggled to understand Arabic conversations, particularly those featuring regional dialects and rapid speech. The dialects students found most challenging included Egyptian Arabic and Maghrebi Arabic. Egyptian Arabic, often considered more accessible due to its prominence in media, still posed difficulties due to the differences in pronunciation and vocabulary compared to Modern Standard Arabic. Maghrebi Arabic was reported as the most challenging, with students citing unfamiliarity with its distinct pronunciation, phonetic variations, and lexical differences.

Further analysis from the students' needs survey showed that over half of the respondents (around 55%) did not regularly use technology to enhance their listening practice. Only 30% of students frequently utilized language learning applications or AI tools in their study routines. Among the key challenges identified by students, the lack of variety and realism in available audio materials was prominent. They felt that current audio resources failed to simulate real-life Arabic speech contexts, leaving them underprepared for actual conversations. As a result, traditional teaching methods were seen as insufficient by 75% of the students, who preferred more interactive, adaptive learning media. These students expressed a strong demand for AI-based technology capable of adjusting listening materials based on their individual learning levels and providing real-time feedback on errors.

The need for advanced technology was also underscored in

the survey, where both students and lecturers highlighted the importance of tools capable of offering real-time feedback. According to survey responses on AI feature expectations, 85% of students expressed a desire for AI-driven learning media that could help them identify pronunciation mistakes, understand conversational context, and provide exercises that closely mimic real-world Arabic use. Specifically, students wanted the AI to be able to detect and help them correct subtle errors in their pronunciation of regional dialects like Levantine and Gulf Arabic, which they found particularly challenging.

Lecturers, on the other hand, expected technology that could be integrated into the curriculum without adding extra workload. They sought user-friendly tools that would complement their teaching methods while enhancing students' engagement with Arabic dialects and improving their listening comprehension. Lecturers also expressed the importance of having technology that could adapt to different dialects and provide detailed feedback on students' progress, especially in areas like understanding regional dialects and colloquial speech. Fig. 6 offers an overview of students' expectations regarding AI-based learning tools, emphasizing their desire for personalized learning and real-time feedback.

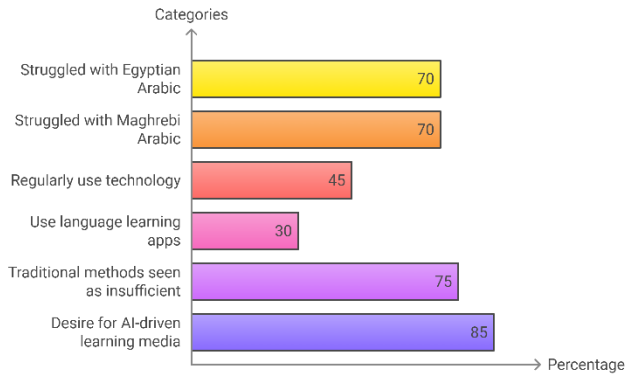

Fig. 6. Overview of students' expectations for AI-based learning tools, particularly the desire for personalized learning and real-time feedback

Overall, the need analysis reveals a significant gap between traditional teaching methods and the modern demands for technology-enhanced learning. Traditional methods, while foundational, were viewed by both students and lecturers as insufficient for achieving mastery in Arabic listening skills, particularly when it comes to regional dialects. Students and lecturers alike pointed to the potential of AI-based tools to bridge this gap by offering a more diverse, interactive, and adaptive learning experience. SUNO.ai, as an AI-based learning medium, is uniquely positioned to address these challenges. By providing exposure to a variety of Arabic dialects, real-time feedback, and interactive exercises, SUNO.ai is expected to meet the expectations of both students and lecturers, significantly improving students' listening comprehension and overall linguistic competence.

B. Design

The SUNO.ai-based learning media is designed with the goal of providing an innovative and engaging tool for students to enhance their Arabic listening skills. The design process began with the understanding that students often struggle with comprehending Arabic, particularly in mastering basic vocabulary and phrases. Therefore, this media focuses on utilizing SUNO.ai to convert learning texts into songs, helping students improve their understanding of Arabic in a more enjoyable and memorable way.

The first step in the design process is formulating the learning objectives. The primary goal of this media is to strengthen students' listening skills by introducing vocabulary and Arabic phrases in the form of songs. SUNO.ai is used to transform learning texts into songs aligned with the learning topics, allowing students to listen and memorize new vocabulary in a fun manner. For instance, songs themed around family and relationships, such as father, mother, and siblings, are used to help students become familiar with everyday vocabulary related to family life.

The next stage involves determining the learning materials. Based on Table 4. *Listening Skills Learning Materials based on SUNO.ai*, various themes are selected to cover important topics for students, such as days of the week, food and drinks, nature and environment, as well as Arab cultural celebrations. Each song is crafted to help students learn the vocabulary and phrases associated with these themes. For example, a song about the days of the week is designed to help students memorize the names of the days in Arabic along with common activities associated with those days. Similarly, songs about cultural celebrations, like Eid al-Fitr and Ramadan, are created to help students understand vocabulary related to those events. Fig. 7 illustrates the process involved in creating Arabic listening exercises using SUNO.AI's adaptive learning technology.

Fig. 7. Illustration of the process involved in creating Arabic listening exercises using SUNO.AI's adaptive learning technology.

The design process also takes into account varying student proficiency levels. Simpler materials, such as Arabic children's songs, are used for beginners, while more complex content, like songs about professions and occupations, is tailored for students with higher language skills. This ensures that the SUNO.ai songs cater to different learning levels, allowing students to study Arabic according to their capabilities.

Throughout this design process, SUNO.ai serves as a learning medium that helps students develop their listening skills through engaging and relevant songs. While feedback or interactive features are not included in SUNO.ai, classroom teaching guided by educators complements the use of this media. Educators provide direct guidance, correct errors, and ensure that students fully understand the material conveyed through the songs.

The SUNO.ai-based learning media offers a new approach to teaching Arabic listening skills. Through music, students are expected to learn more effectively and enjoyably, while

also enhancing their motivation to study Arabic.

C. Development and Implementation

The development stage of the SUNO.ai-based learning media involved validation from Arabic language content experts and music experts. The Arabic language content expert assessed the feasibility of this media based on 20 evaluation items, covering four main aspects: content relevance, educational benefits, language quality, and integration with SUNO.ai technology. Meanwhile, the music expert evaluated the feasibility of the media based on 15 evaluation items, focusing on eight key aspects: melody quality, harmony between music and lyrics, rhythm and tempo, musical variation, alignment with learning objectives, audio production quality, motivational potential, and uniqueness and creativity.

The validation results show that the SUNO.ai-based learning media was deemed highly feasible, with an overall average feasibility percentage of 92.8%. In the Content Relevance aspect, the validators noted that the songs align well with the curriculum and introduce vocabulary that is appropriate for the students' skill levels. The linguistic structure in the songs was found to be clear and easy to understand, which helps students follow the learning materials more effectively. Table 9 shows that the material evaluation is relevant to the learning objectives.

Table 9. Validation results from Arabic language material expert validators

Assessed Aspect	Average Score	Percentage (%)
Content Relevance	4.5	90%
Songs introduce vocabulary and phrases relevant to students' skill levels.	4.4	88%
The linguistic structure in the songs is clear and easily understood by students.	4.7	94%
Educational Benefits	4.8	96%
Songs support students' understanding of the Arab cultural context.	4.6	92%
Songs motivate students to be more active in language learning.	4.7	94%
Language Quality	4.6	92%
Dialect variations in the songs help students recognize different forms of Arabic.	4.4	88%
Integration with SUNO.ai Technology	4.9	98%
The songs in SUNO.ai help students understand the material through supportive musical presentation.	4.8	96%
Total Average	**4.65**	**92.8%**

In the Educational Benefits aspect, the songs were rated highly effective in helping students improve their listening skills, with a score of 96%. The songs also assist students in understanding the Arab cultural context, which is an important part of language mastery. Additionally, these songs successfully motivate students to become more engaged in the learning process.

The Language Quality aspect received high ratings, particularly in terms of correct pronunciation and intonation according to Arabic language standards. The dialect variations used in the songs were also considered very helpful in enabling students to recognize the differences between Standard Arabic and regional dialects. However, the validators suggested adding more dialect variations to further expand students' understanding. Although the Integration with SUNO.ai Technology was rated very positively, it was noted that the technology mainly functions as a tool to convert text into songs without interactive features or real-time feedback. The creativity of educators plays a key role in utilizing the SUNO.ai-generated songs to make learning more personalized and interactive in the classroom. The songs provided are capable of helping students grasp the material through music that supports the learning process. Fig. 8 presents the validation results from Arabic language content experts regarding the feasibility of the SUNO.AI-based learning media.

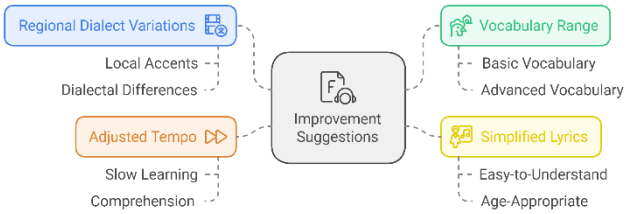

Fig. 8. Evaluation scores from Arabic language experts, focusing on the suitability and educational impact of the SUNO.AI-generated materials.

Suggestions for Improvement from the validators include adding more regional dialect variations, expanding the vocabulary range, simplifying lyrics for beginners, and adjusting the tempo of the songs to be slower for students who require more time to understand the material. Implementing these suggestions is expected to further enhance the effectiveness of the SUNO.ai-based learning media. Table 10 reviews the music evaluation, highlighting the audio quality and tempo that support the learning process.

Table 10. Validation results from music expert validators

Assessed Aspect	Average Score	Percentage (%)
Melody Quality	4.4	88%
Music and Lyrics Harmony	4.6	92%
Rhythm and Tempo	4.7	94%
Musical Variation	4.3	86%
Alignment with Learning Objectives	4.6	92%
Audio Production Quality	4.8	96%
Motivational Potential	4.5	90%
Uniqueness and Creativity	4.6	92%
Total Average	**4.6**	**92%**

The validation results from the music expert show that the SUNO.ai-based learning media is deemed highly feasible for use in teaching Arabic listening skills. Based on Table 10 Feasibility Test Instrument for Music Expert Validators, musical aspects such as melody quality, harmony between music and lyrics, rhythm and tempo, musical variation, and audio production quality received high scores, with an overall average of 92%. The music expert assessed that the melodies used in the media are sufficiently engaging and aligned with the learning theme, which helps maintain students' interest. Additionally, the harmony between the music and lyrics is considered effective in reinforcing the messages conveyed in the learning materials, helping students better understand the content of the songs.

The rhythm and tempo were also evaluated as suitable for students' comprehension levels, especially in the context of the learning songs used. However, the validator noted that for beginner students, some songs may need tempo adjustments to help them follow along better. The musical variation was considered adequate, though the inclusion of traditional

Arabic musical instruments was recommended to enrich students' learning experience and help them grasp the cultural dimensions embedded in language learning. The audio production quality received excellent ratings. The clarity of sound and the adequate level of production were judged to support the learning process, ensuring that students can easily hear and understand the song lyrics. Moreover, the songs were considered to have strong motivational potential, encouraging students to be more active in the learning process. The uniqueness and creativity of the musical compositions were also rated highly, although there were suggestions to further enhance the distinctiveness of some compositions to provide students with a more diverse and engaging listening experience. Fig. 9 showcases the validation results from music experts regarding the quality and appropriateness of the music used in the SUNO.AI-based learning media.

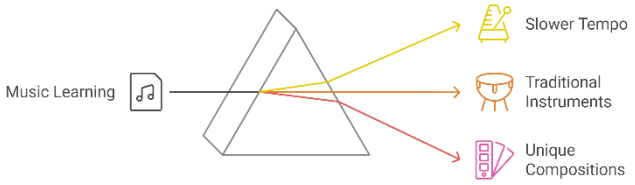

Fig. 9. Music experts' validation of the quality and appropriateness of the songs created through SUNO.AI for language learning purposes.

Suggestions for Improvement: The music experts provided several suggestions for improving the effectiveness of this learning media. First, it is recommended that some songs have a slower tempo, especially for beginner students, to allow them to follow and comprehend the lyrics more effectively. Adjusting the tempo is crucial to accommodate the varying listening abilities among students. Second, the validator suggested adding more traditional Arabic musical instruments to some songs. By incorporating traditional instruments, students will not only learn the language but also become more exposed to Arabic musical culture, enhancing their overall cultural understanding. Lastly, although the musical compositions were generally rated as good, the validator suggested enriching the uniqueness of some compositions to make the listening experience more diverse and engaging for students.

By implementing these improvements, the SUNO.ai-based learning media is expected to become even more effective in enhancing students' listening skills and enriching their overall learning experience.

D. Application and Testing Phase

After the development and validation process by experts, the SUNO.ai-based learning media was implemented to assess its feasibility and effectiveness on 60 students in the Elementary School Teacher Education Program. This testing involved a pre-test and post-test process to evaluate the improvement in students' listening skills after using the AI-based media.

The trial began with a pre-test to measure the students' initial listening skills in Arabic. Afterward, the students used the SUNO.ai-based media for several weeks, followed by a post-test to assess the improvements achieved.

Pre-test: Students took a preliminary test (pre-test) consisting of 20 questions. This test was designed to evaluate their listening skills, especially in recognizing different Arabic accents and vocabulary.

Media Usage: Following the pre-test, students used the SUNO.ai media, which provided various listening exercises with real-time feedback, covering a range of accents and speaking speeds in Arabic.

Post-test: After several weeks of using the media, students took the same listening skills test (post-test) to measure improvements in their abilities.

Before conducting statistical tests, all the questions used in the pre-test and post-test were tested for validity and reliability to ensure that the measurement instruments met the required standards. The results of this test are shown in Table 11:

Table 11. Validity and reliability test results for pre-test and post-test instruments

Question Items	Validity Coefficient (r)	Validity	Cronbach's Alpha	Reliability
1	0.78	Valid	0.89	Reliable
2	0.82	Valid	0.90	Reliable
3	0.80	Valid	0.89	Reliable
4	0.75	Valid	0.88	Reliable
5	0.81	Valid	0.91	Reliable
6	0.79	Valid	0.90	Reliable
7	0.83	Valid	0.92	Reliable
8	0.77	Valid	0.88	Reliable
9	0.76	Valid	0.89	Reliable
10	0.84	Valid	0.91	Reliable
11	0.81	Valid	0.90	Reliable
12	0.79	Valid	0.89	Reliable
13	0.85	Valid	0.92	Reliable
14	0.80	Valid	0.90	Reliable
15	0.76	Valid	0.87	Reliable
16	0.82	Valid	0.89	Reliable
17	0.78	Valid	0.88	Reliable
18	0.81	Valid	0.91	Reliable
19	0.84	Valid	0.92	Reliable
20	0.80	Valid	0.90	Reliable

The results of the validity test show that all question items have a validity coefficient above 0.70, indicating that the instrument is valid for measuring listening skills. Additionally, the Cronbach's Alpha values for all items were above 0.85, demonstrating that the instrument is reliable and consistent.

After completing the validity and reliability tests, pre-tests and post-tests were conducted on the students. Fig. 10 displays the t-test results, indicating the improvement in Arabic listening skills after utilizing the SUNO.AI platform.

Table 12. T-Test results for Pre-Test and Post-Test listening skills improvement

Group	Pre-test Average	Post-test Average	Improvement (%)
Experimental Group	60	85	25%

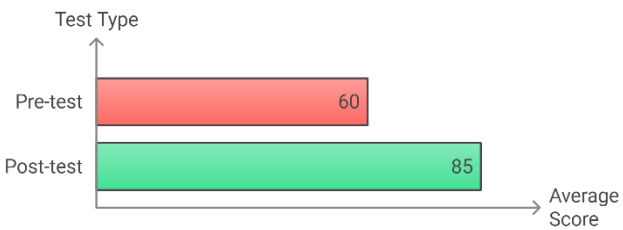

Fig. 10. T-test results showing the improvement in students' Arabic listening skills after using the SUNO.AI platform for a set period.

The Table 12 shows that the average pre-test score of the students was 60, indicating difficulties in understanding Arabic conversations, especially with accent variations. After using the SUNO.ai-based media, the average score increased to 85, reflecting a 25% improvement. A t-test was used to test the significance of the difference between the pre-test and post-test results. The statistical test results indicated that the improvement was significant ($p < 0.05$), demonstrating that the use of SUNO.ai media had a significant impact on improving students' listening skills.

E. Discussion

This study aimed to develop Arabic listening proficiency media using SUNO.ai, a platform integrating AI into language learning. The research findings demonstrate the significant impact of SUNO.ai in enhancing students' Arabic listening skills, as evidenced by the improvement in post-test scores compared to pre-test scores. These results are consistent with previous research on AI's effectiveness in language learning, particularly in improving listening comprehension. For instance, studies by Suryana *et al*. [39] and Alasmi [40] support the conclusion that AI-based applications provide personalized, real-time feedback, leading to greater gains in listening proficiency compared to traditional methods.

A comparison of SUNO.ai with AI-driven tools used in learning other languages, such as Duolingo and Babbel, reveals unique strengths specific to Arabic learning. For instance, Duolingo's AI-based exercises primarily focus on gamification and simplified language tasks, which have been highly effective for learners of Spanish, French, and English [63, 66, 67, 87]. However, these platforms often fall short in providing the level of dialectal variation and real-world listening scenarios that SUNO.ai offers for Arabic learners. Babbel, another AI-powered language platform, focuses on structured lessons with increasing difficulty and has shown significant effectiveness in improving grammar and vocabulary skills for languages such as German and Italian [88, 89]. While Babbel does provide listening exercises, the lack of real-time feedback and absence of region-specific dialectal features in their Arabic curriculum limits its efficacy in fostering comprehensive listening skills, which SUNO.ai directly addresses.

The novelty of this research lies in its specific focus on Arabic listening skills, a subject that has received less attention in AI-driven language learning studies. SUNO.ai's capacity to mimic various Arabic dialects and speaking speeds offers a more comprehensive exposure to real-life listening scenarios, addressing one of the major challenges in Arabic language acquisition. This is a critical advantage over mainstream language learning tools like Duolingo and Babbel, where the primary focus is on standardized language instruction. SUNO.ai's real-time adaptation to user performance allows it to personalize lessons more effectively for Arabic learners, catering to both Modern Standard Arabic and dialectal varieties, an area where most AI-based tools fall short. This adaptive approach has been noted as a key driver in language acquisition success, particularly in studies of adaptive technologies for language learning [74].

Although this study demonstrates promising results, it is important to acknowledge the limitations of the analysis methods employed. First, the study's reliance on pre-test and post-test scores to measure improvement in listening proficiency, while effective for capturing changes over time, may not fully account for all variables that contribute to language learning success. Factors such as students' prior exposure to Arabic outside of the classroom, the influence of individual learning styles, and external factors (e.g., access to additional resources or personal motivation) were not controlled or accounted for in this analysis. As a result, the post-test improvements attributed to SUNO.ai may be influenced by these unmeasured variables.

Second, the use of quantitative methods such as standardized test scores provides a narrow view of language acquisition, focusing primarily on measurable outcomes such as listening comprehension. While these metrics are useful for evaluating immediate gains, they may overlook other dimensions of language proficiency, such as communicative competence, cultural understanding, or long-term retention of listening skills. Future research could incorporate qualitative methods, such as interviews or observational studies, to capture more nuanced data on students' experiences with AI-based language learning tools. Such approaches could provide deeper insights into how students engage with and apply the listening skills they acquire through SUNO.ai.

Third, the sample size in this study may also limit the generalizability of the findings. While the results suggest that SUNO.ai is effective in improving Arabic listening proficiency, the study was conducted within a specific educational context with a relatively small number of participants. The findings may not be fully applicable to other learning environments, particularly those with different technological infrastructures, educational policies, or student demographics. Expanding the study to include more diverse settings and larger sample sizes would strengthen the external validity of the results.

Finally, the study's analysis did not take into account the long-term retention of listening skills gained through the use of SUNO.ai. The pre-test and post-test design captured immediate improvements, but it remains unclear whether these gains are sustained over time. Future research should incorporate longitudinal studies to assess whether the listening proficiency improvements achieved through AI-driven tools are maintained in the long run, and if not, what factors contribute to the decline in retention.

In terms of practical implications, the integration of SUNO.ai into the Arabic language curriculum presents several opportunities for educators. First, SUNO.ai can alleviate one of the key challenges faced by Arabic language teachers exposure to diverse dialects. By allowing learners to practice listening to different dialects in controlled settings, the tool provides a resource that many educators may not have readily available in traditional classrooms. This could be especially beneficial in settings where access to native speakers or dialect-specific materials is limited.

Second, SUNO.ai's ability to provide immediate, personalized feedback on listening exercises enhances the self-paced learning environment, enabling students to work on their weaknesses independently. This can free up educators to focus on more advanced instructional strategies or provide individual support where necessary. Furthermore, the AI-driven adaptability of the tool means that it can be used

across a range of proficiency levels, making it suitable for both beginners and more advanced learners. Educators could use SUNO.ai as a supplemental tool for homework assignments, as part of a flipped classroom model, or for in-class exercises, thereby diversifying their teaching methods and engaging students in interactive learning.

However, despite these benefits, there are potential challenges to implementing this tool in different educational contexts. One major challenge is the digital divide, particularly in regions where access to reliable internet or devices is limited. Schools or institutions in under-resourced areas may struggle to adopt AI-based tools like SUNO.ai due to infrastructure constraints. Moreover, some educators may lack the necessary training or confidence to integrate AI technologies into their teaching practices. Previous research has shown that teacher resistance to technology adoption can stem from insufficient professional development or a lack of familiarity with digital tools [90–92]. As a result, providing adequate training and ongoing support to educators is crucial for the successful integration of SUNO.ai into Arabic language curricula.

Another potential challenge is the alignment of AI-generated learning content with standardized language curricula. While SUNO.ai offers flexibility in lesson adaptation, its content may not always perfectly align with the learning objectives outlined by educational authorities. Educators may need to spend additional time curating or supplementing AI-generated exercises to ensure they meet specific curriculum standards or language proficiency benchmarks. This could increase the workload for teachers and require them to carefully monitor how the AI adapts to students' performance.

Additionally, the study sheds light on the potential of integrating AI technologies like SUNO.ai into the curriculum to address the limitations identified in traditional methods, such as the lack of technological resources and lecturers' confidence in utilizing digital tools. The findings from the survey conducted in this study resonate with previous reports by White [75], indicating that AI-driven learning platforms increase motivation and student engagement in language learning. This is particularly notable when compared to other AI tools used in Western language instruction, which, while effective, do not address the unique intricacies of the Arabic language, such as its rich dialectical diversity and complex phonological structure [93].

The contribution of this research is not only in proving the effectiveness of AI-based learning tools but also in providing practical insights for educators seeking to implement similar technologies in their classrooms. The focus on real-time feedback and dialectal diversity offers a fresh perspective in the realm of Arabic language learning, which has previously been underrepresented in the literature. This innovative approach addresses gaps in current methodologies and demonstrates the importance of technological integration in modern education. Compared to other AI-driven platforms that emphasize Western languages, SUNO.ai stands out as a tailored solution for Arabic, a language known for its distinct challenges in listening comprehension due to its variation in spoken dialects and complex phonetics.

The findings of this study have important implications for the future of Arabic language learning, particularly in enhancing listening skills through personalized AI-driven exercises. Further research could explore the application of this technology in other areas of language learning, such as speaking and reading, and assess the long-term impacts on overall language proficiency.

V. Conclusion

This study highlights the significant potential of integrating AI through the SUNO.ai platform to enhance Arabic listening skills. By offering adaptive exercises and real-time feedback tailored to individual learners, AI creates a more interactive and efficient learning environment. The research contributes to the growing body of literature on AI in language education, specifically addressing the unique challenges of teaching Arabic listening skills, such as dialect diversity and the limitations of traditional methods. The findings underscore the importance of leveraging AI technologies in language learning, particularly for languages like Arabic, where dialectical variation can pose challenges. AI-based platforms like SUNO.ai can be instrumental in overcoming these barriers by offering personalized and context-specific learning experiences.

Educators across various levels can utilize SUNO.ai to meet the needs of their students. At the elementary level, teachers can introduce basic Arabic vocabulary and phrases using interactive listening exercises tailored for young learners. For secondary-level students, SUNO.ai can be used to address more complex language structures and dialects, offering personalized exercises that cater to individual learning gaps. University-level and adult learners can benefit from advanced listening exercises that feature both dialectal variations and formal Arabic, with real-time feedback providing a clear sense of progress and areas for improvement. The broader implications of these findings suggest that AI can also be integrated into other areas of language learning, such as speaking, reading, and writing, thereby making it a versatile tool for language educators.

However, several limitations should be noted. This study focused on a single platform (SUNO.ai) and one specific language skill (listening), which may limit the generalizability of the findings. Additionally, the study did not take into account external factors such as the learners' previous exposure to AI or differences in language proficiency levels, which could have influenced the results. To address these limitations, future research should consider investigating the effectiveness of various AI tools across multiple language skills and more diverse learning environments.

Future research could also explore the long-term impact of AI-based learning on language proficiency, particularly whether the benefits observed in listening comprehension extend to other skills like speaking or reading. Additionally, examining how AI tools like SUNO.ai perform in formal versus informal educational settings would help assess their broader applicability. There is also a pressing need to investigate ethical concerns and potential biases in AI-driven language learning platforms, especially regarding inclusivity and accessibility for learners with diverse needs. These findings pave the way for future studies that seek to expand our understanding of AI's role in education.

CONFLICT OF INTEREST

The authors declare no conflict of interest

AUTHOR CONTRIBUTIONS

Umi Hijriyah (U.H.) contributed to the conceptualization, supervision, and project administration of the study. Relit Nur Edi (R.N.E.) was responsible for funding acquisition and formal analysis. Muhammad Aridan (M.A.) played a key role in the conceptualization, data curation, software development, and writing the original draft of the manuscript. Haida Umiera Hashim (H.U.H.) was involved in writing - review & editing. Erlina (E.) contributed to the methodology and resource provision. Guntur Cahaya Kesuma (G.C.K.) oversaw the project administration and resource provision for the study. All authors had approved the final version.

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