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Assessing the Impact of the Haima English Intelligent Enhancement Platform on Pronunciation Improvement: A Study of Stress Problems

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Abstract: This study investigates the effectiveness of HaiMa English, an AI-assisted words online learning platform, in improving pronunciation among learners with stress at different proficiency levels. By analyzing pre- and post-intervention audio recordings of commonly mispronounced words produced by participates, the results show significant pronunciation improvements across all proficiency levels, with greater progress observed in students with lower stress levels. Frequent interaction with native pronunciation audio and timely instructor corrections contributed to more substantial improvements. The findings highlight the platform's effectiveness in reducing pronunciation errors, particularly when stress is managed. The study underscores the need for personalized pronunciation support and the integration of stress-reducing strategies in intelligent learning tools.

Keywords: AI-assisted learning, pronunciation improvement, stress in language learning, language proficiency

Introduction

Correct pronunciation is a critical aspect of language acquisition, serving as a foundation for effective communication and linguistic fluency.[6] Among the many challenges faced by language learners, stress pronunciation—how emphasis is placed on syllables within words—is particularly significant. Mispronunciation of stress can lead to misunderstandings, reduced comprehensibility, and even hindered language proficiency, especially in English, where stress patterns often vary unpredictably from a learner's native language.[16] The importance of mastering stress pronunciation extends beyond mere phonetic accuracy; it is essential for conveying meaning, emotion, and intent in spoken communication.[10] Despite its importance, many English learners continue to struggle with stress pronunciation even at advanced proficiency levels.[7]

HaiMa English, an AI-assisted learning platform, offers a promising solution to learner's prounociation challenges. By combining native pronunciation audio recordings with real-time feedback from professional instructors, the platform allows students to repeatedly review correct word pronunciation and receive timely corrections. This approach is designed to align with human memory patterns, which rely on regularly spaced repetition and review to solidify learning.[4] The platform's emphasis on repetition and immediate feedback positions it as an innovative tool for improving pronunciation, particularly stress patterns, in language learners of varying proficiency levels. However, there is limited research on the specific effectiveness of such platforms in addressing stress pronunciation issues.

This study seeks investigate whether students using HaiMa English show measurable improvements in stress pronunciation and whether these improvements differ across language proficiency levels. Given that many students

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experience stress-related pronunciation issues, understanding the platform's effectiveness in this area could provide valuable insights into its pedagogical value. The availability of data from a year of tutoring on the platform, including commonly mispronounced stress words, offers a unique opportunity to analyze the platform's impact comprehensively. By exploring how different proficiency levels respond to the platform's training, this research will contribute to both the academic understanding of pronunciation learning and the practical development of AI-assisted language education tools.

The significance of this study lies in its potential to inform the future development of AI-assisted language learning, particularly in the area of pronunciation training. By evaluating HaiMa English's ability to address the specific and often challenging aspect of stress pronunciation, the research aims to provide insights into how AI can support learners in acquiring accurate pronunciation patterns. The findings may contribute to the refinement of educational technologies and teaching methods that integrate human instruction with AI capabilities, offering more personalized and effective learning experiences. Ultimately, this research seeks to provide practical recommendations for enhancing the accessibility and adaptability of pronunciation training, ensuring it meets the diverse needs of learners and contributes to more efficient language acquisition in varied educational contexts.

1. Literature review

1.1 Pronunciation and stress in language learning

Pronunciation is a crucial aspect of language learning, with stress patterns playing a particularly significant role in speech intelligibility and communication effectiveness.[5] Correct stress placement in words helps to distinguish between otherwise similar sounds and words in English, making it an essential skill for learners.[9] Mispronounced stress can lead to confusion in both meaning and understanding. For example, differences in word stress can alter the meaning between a noun and a verb, such as in "record" (noun) versus "record" (verb). Studies consistently show that mastering stress pronunciation is critical for language learners to be comprehended by native speakers, and failure to do so can result in communication breakdowns, even at higher proficiency levels.

In English, stress pronunciation is unpredictable compared to languages with more regular stress rules, such as Spanish or Italian. Therefore, learners often rely on memorization or feedback from native speakers to learn the correct stress patterns.[16] This makes stress, one of the more challenging aspects of pronunciation for English learners, and its importance extends beyond individual words, as it affects the rhythm and flow of entire sentences. Failure to master stress can also affect a learner's confidence in speaking, further hindering language development.

1.2 Memory-based learning and pronunciation

One of the most effective ways to improve language learning, especially for pronunciation, is through spaced repetition, a method rooted in memory-based learning theories[4,8]. Spaced repetition involves reviewing material at increasing intervals, which helps in long-term retention of information. This technique is particularly relevant in learning stress patterns, as learners need constant exposure to correct pronunciation over time to internalize the patterns. According to Kang (2016), this method aligns with the brain's natural processes for retaining and retrieving information, making it an effective strategy for language acquisition.

In the context of pronunciation, especially stress patterns, spaced repetition allows learners to continuously practice and reinforce their skills. Studies show that frequent and repeated exposure to native pronunciation improves learners' ability to mimic and reproduce correct stress patterns.[1] This approach is used in modern language learning platforms like HaiMa English, which incorporate AI-driven audio reviews and feedback to ensure learners are frequently exposed to native-like pronunciation. By aligning the learning process with human memory mechanisms, these platforms aim to help students retain correct stress pronunciation patterns over time.

1.3 Use of AI-assisted platforms in pronunciation training

Artificial intelligence (AI) has been increasingly applied in education, especially in language learning, where it offers personalized, adaptive instruction. AI-powered language learning platforms such as HaiMa English provide a structured approach to pronunciation training by combining technology with human instruction.[14] These platforms often include

features such as native-speaker audio, voice recognition, and automated feedback, allowing learners to receive immediate corrections on their pronunciation mistakes, including stress issues.

The integration of AI into pronunciation training allows for more targeted and individualized feedback. Studies indicate that language learners benefit from AI tools that can analyze their pronunciation in real-time and offer corrections.[15] Such tools are particularly beneficial for stress pronunciation, where errors can be subtle and difficult to detect without expert feedback. By analyzing speech patterns and providing detailed feedback, AI-assisted platforms like HaiMa English can mimic the role of a human tutor, ensuring learners are continuously exposed to correct pronunciation models and guided toward improvement.

A key advantage of AI in pronunciation training is its ability to offer personalized learning experiences. AI systems can track a learner's progress over time, identifying recurring errors and adjusting learning materials accordingly. This adaptability makes AI-assisted platforms especially effective for learners with stress pronunciation issues, as the system can focus on their specific weaknesses and provide additional practice where needed.[11] Moreover, AI allows learners to practice at their own pace, making the learning process more flexible and accessible.

1.4 Pronunciation issues at different language proficiency levels

Pronunciation difficulties, particularly stress pronunciation, affect learners at all levels of proficiency, though the nature and frequency of errors can vary. Beginners often struggle with understanding basic stress rules, while more advanced learners might still have difficulties with exceptions or complex multi-syllabic words. According to Derwing and Munro (2005), even highly proficient speakers may retain a stress pronunciational errors, which can affect their intelligibility and fluency.[3]

For beginners, the primary challenge lies in recognizing which syllables to stress, as they often transfer stress patterns from their native language to English.[17] These learners may not yet have the awareness or skills to adjust their pronunciation based on feedback, leading to frequent stress-related errors. Intermediate learners tend to show improvement in recognizing stress patterns but may still struggle with consistency, especially when dealing with less familiar words. Advanced learners, while generally more proficient in other areas of language acquisition, may still exhibit persistent stress pronunciation errors due to deeply ingrained habits or fossilization, where incorrect pronunciation becomes fixed despite continued learning efforts.[3] These advanced learners may find it challenging to correct stress errors that have been part of their speech for an extended period, even though they are aware of the correct patterns.

Studies have shown that explicit pronunciation instruction is beneficial at all levels, but it is particularly critical for learners who struggle with stress pronunciation. Beginners benefit from clear, structured guidance on basic stress rules, while intermediate and advanced learners require more nuanced feedback that helps them refine their pronunciation. Importantly, research suggests that learners often need individualized attention to address specific issues like stress placement, as a one-size-fits-all approach is less effective[1].

Pronunciation challenges also differ based on the learner's native language. For instance, learners from languages with fixed stress systems (e.g., French or Finnish) may find English stress patterns more confusing, as English has more irregular and varied stress rules. Learners from tonal languages, such as Mandarin, may struggle to separate stress from tone, as these elements are intertwined in their native language. As a result, proficiency in other areas of English does not necessarily equate to proficiency in stress pronunciation, underscoring the need for focused practice, regardless of language ability.

While numerous studies have examined the benefits of AI in language learning, particularly in areas such as vocabulary acquisition and grammar, fewer have focused on pronunciation training, and even fewer on stress pronunciation.

Moreover, existing research on pronunciation tends to focus on either beginning learners or advanced students, often neglecting the progression of stress pronunciation issues across proficiency levels. Studies that examine the specific challenges learners face at different stages of language acquisition are sparse, particularly in relation to how AI platforms

can address these issues. There is also limited research on the long-term effectiveness of AI-assisted pronunciation training, especially in terms of sustained improvement in stress pronunciation over time.

2. Methodology

2.1 Research question

This study revolves around the effectiveness of language learning platforms in improving pronunciation. While numerous educational technologies claim to enhance language skills, This study aims to address several key questions to better understand the platform's efficacy:

(1) Do students at different language proficiency levels demonstrate significant improvements in stress pronunciation after using HaiMa English?

(2) Are the platform's review-based methods effective in reducing stress-related pronunciation errors?

2.2 Participants

The study will involve a purposive sample of 15 junior high school graduates, using the HaiMa English platform and selected based on their language proficiency levels. (based on the score of high school entrance exam) Participants will be divided into three groups of 5 learners each, categorized by their proficiency levels: relatively beginner, relatively intermediate, and relatively advanced. Participants will be selected from the platform’s existing user base and must meet the following inclusion criteria:

•Learners must have used the platform for at least six months prior to the study.

•Learners must have access to native audio recordings and participate in regular pronunciation practice sessions with feedback from professional instructors.

The participants will be recruited through internal messaging within the platform, and informed consent will be obtained before their participation in the study.

2.3 Data collection

Data collection will be carried out in three phases: pre-intervention, intervention, and post-intervention.

(1) Pre-Intervention

Before the intervention phase, baseline data will be collected to measure each participant’s initial level of stress pronunciation accuracy. This will involve:

A recorded speech test in which participants read aloud a list of 15 commonly mispronounced stress words (previously identified by the researcher during their year of tutoring).

An initial assessment using acoustic analysis software to measure the accuracy of word stress, focusing on syllable duration, intensity, and pitch.

(2) Intervention

The intervention phase will last for one month, during which participants will continue using HaiMa English for their pronunciation practice everyday. The platform will provide learners with native audio recordings of commonly mispronounced stress words, real-time corrections, and spaced repetition tasks based on the platform’s algorithm. The participants will be required to engage in:

(3) Post-Intervention

After a months of platform usage, participants will undergo a post-intervention speech test using the same list of words from the pre-intervention phase. Their pronunciation accuracy will be re-measured using Praat software to assess improvements in stress placement. The results will be compared to the pre-intervention data to determine whether significant changes occurred in the accuracy of stress pronunciation across proficiency levels.

3. Results and discussion

The study aimed to evaluate the effectiveness of the HaiMa English platform in enhancing pronunciation skills among students of varying language proficiency levels: beginner, intermediate, and advanced. Data were collected through pretest and posttest pronunciation recordings of commonly mispronounced words. The results indicated a positive trend in

pronunciation improvement across all proficiency groups, though the magnitude of change varied significantly. This section will provide a detailed analysis of these findings, discussing how proficiency influences improvement and the implications for language learning.

3.1 Pronunciation improvements across proficiency levels

The results are summarized in Table 1, which displays the average percentage improvement in pronunciation accuracy for participants across different proficiency levels.

Table 1 The average percentage improvement in pronunciation accuracy

Proficiency level	Pretest Mean Accuracy（%）	Posttest Mean Accuary（%）	Improvement (%)
Beginner	50%	85%	35%
Intermediate	64%	85%	20%
Advanced	80%	90%	10%

For low level learners, the results revealed substantial gains in pronunciation accuracy. Pretest scores indicated that many participants struggled with basic phonetic sounds and syllable stress, reflecting common challenges faced by new language learners. After using the HaiMa English platform, the posttest results showed an average improvement of 35% in pronunciation accuracy, rising from 50% to 85%. This significant improvement can be attributed to the platform's design, which leverages repeated listening and practice, effectively aligning with established principles of language acquisition.

Intermediate learners demonstrated moderate improvements, with average gains of about 20% in pronunciation accuracy. Their pretest mean accuracy was 65%, which increased to 85% after using the platform. These students typically had a foundational understanding of pronunciation but faced challenges with more complex phonetic sounds and intonation patterns. The platform's structured approach facilitated the refinement of their skills through consistent exposure to native pronunciations and personalized corrections. However, some participants expressed difficulty in altering ingrained pronunciation habits, suggesting that while the platform is effective, additional strategies may be needed to address deeper-rooted pronunciation issues.

Advanced learners showed the least dramatic improvements, averaging a gain of 10% in pronunciation accuracy, from 80% in the pretest to 90% in the posttest. While these students were generally proficient in English, their gains often related to fine-tuning specific aspects of their pronunciation, such as subtle phonetic details. Instructors noted that advanced learners benefitted from targeted feedback focusing on aspects like intonation and rhythm, which are crucial for achieving a more like natural-sounding pronunciation. This finding highlights that even at higher proficiency levels, continued practice and feedback remain essential for further refinement of pronunciation skills.

3.2 Analysis of commonly mispronounced words and word stress improvement

The analysis of specific commonly mispronounced words revealed interesting patterns across proficiency levels, particularly in the area of word stress. Table 2 outlines the accuracy rate of commonly mispronounced words, Number of syllables and Stressed Syllable. Additionally, the students' pronunciation improvement of specific words after the intervention is also analyzed.

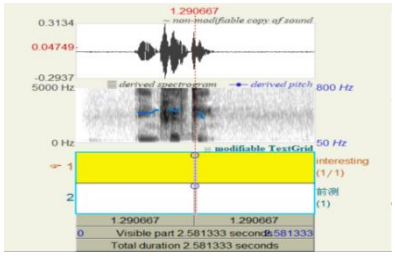
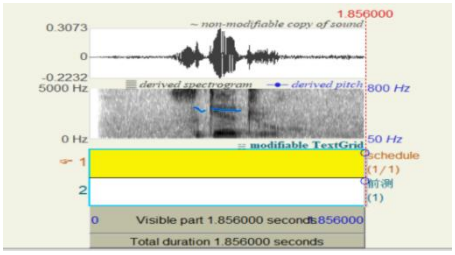
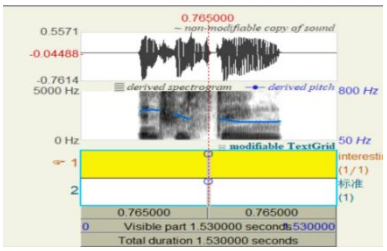
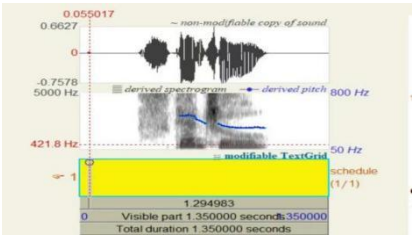
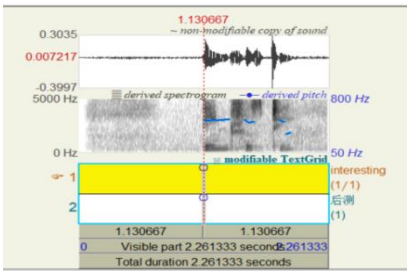
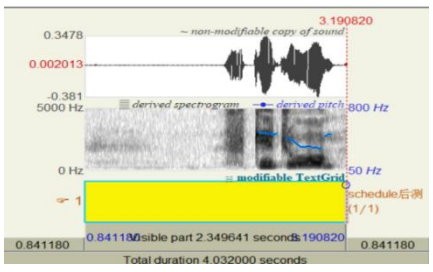
Table 2 Acquisition rate of common erroneous words

Words	Part of speech	Number of Errors	Accuracy(%)	Number of syllables	Stressed Syllable
interesting	adjective	8	53.33	2	#1
interview	verb	5	33.33	3	#1
unhealthy	adjective	3	20.00	3	#2
programme	noun	9	60.00	2	#1
relative	adjective	3	20.00	3	#1

badminton	noun	3	20.00	3	#1
exercise	verb	4	26.66	3	#1
seafood	noun	2	13.33	2	#1
schedule	noun	6	40.00	2	#2
yesterday	noun	4	26.66	3	#1
invitation	noun	4	26.66	4	#3
environment	noun	3	20.00	4	#2
cycle	verb;noun	1	6.66	2	#1
pollution	noun	5	33.33	3	#2
hotel	noun	2	13.33	2	#2

In the process of acoustic analysis, the author will use Prrat software to analyze and compare the recording of native speakers and the recording of subjects in pre-test and post-test. The first word analyzed is “interesting”, which contains three syllables. The following table 3 is a comparative analysis of the pronunciation situation of native speakers and the pre-test and post-test pronunciation situation of the subjects. The pictures in the table are spectrograms generated by Praat software

Table 3 The Acoustic Analysis of the representative words

	“interesting”	“schedule”
The native speaker recordings		
The pre-test recordings of the participant3		
The post-test recordings of the participant3		

According to traditional auditory perception, native speakers place the main stress of the word on the first syllable in, while almost all subjects place the main stress of the word on the second syllable, i.e., “ters”, in the pre-test. Taking the audio analysis of subject No. 3 as an example, it can be seen more clearly from the spectrogram of the native speakers in the picture that the recording of the word by subject No. 3 in the pre-test is very different from that of the native speakers. Compared with the spectrogram of the native speaker, the waveform of the sound signal and the amplitude of the acoustic energy of the subject are very different from each other. When reading the second syllable “ters”part of the word, subject No.3 intentionally raises the pitch value, and at the same time, the intensity value is also enhanced, in other words, the

subject wrongly assigns the word stress position to the second syllable. And from the data derived from Praat speech analysis software, the first syllable “in” of the word was the highest point of the pitch, and the results of the analysis of the traditional auditory description were the same, the two ways of analyzing the pronunciation of the stress corroborated with each other to get the same conclusions, but the results through the Praat speech analysis software were more scientifically and accurately. In contrast to the spectrograms of the native speakers, it is obvious that the native speakers assigned the stress of the word on the first syllable in, in contrast, we found that the Chinese subjects shifted the stress position from the first syllable to the second syllable in the assignment of the stress position of the multisyllabic word interesting, which indicates that the Chinese subjects' stresses have occurred in the error of post-stress placement.

And after one month's training on the HaiMa platform and repeated constantly review and timely correction by professional tutors, the subjects' pronunciation was relatively improved. From the figure, we can see that the subjects moved the stress position to the correct position of the first syllable in the post-test pronunciation. And the pitch of the second syllable relatively decreased a lot. However, there is still a lot of room for improvement compared to the pronunciation of the native speaker. For example, in the recording of the posttest, the third syllable”ting” has a very long pitch, which indicates that Chinese subjects make the mistake of dragging out the end of the word when reading aloud, which is due to the influence of the negative transfer of the native language.

As shown in the table 3, in the two-syllable word “schedule”, the native speaker's sound length and strength data are mainly concentrated on the first syllable, followed by the secondary stress on the second syllable. In contrast, in the pre-test data, the subjects' assigned the stress mainly to the first syllable, but greatly weakened the pronunciation of the second syllable. The second syllable had a long tone, but it was easily ignored by the subjects resulting in a significant lack of strength and length of articulation. After one month of intervention and exercise, this phenomenon was significantly improved, but in terms of the details of pronunciation, the post-test subjects were still deficient in the performance of long sounds, and the native speakers' pronunciation followed the ranking of the loudness of words from low to high to low. The post-test subjects over-emphasized the pronunciation of the second syllable. And from the statistical results of the correctness rate, 40% of the messengers misclassified the stress position of the word. It shows that the theoretical knowledge of Chinese medicine mastered by the messengers is still quite scarce.

All in all, the targeted approach of the HaiMa English platform, emphasizing these specific words and their stress patterns, resulted in a noticeable reduction in mispronunciations by the posttest phase. This focused practice not only improved pronunciation accuracy but also enhanced the learners' understanding of word stress, which is crucial for achieving natural-sounding speech.

3.3 Relationship between language proficiency and pronunciation improvement

The relationship between language proficiency and pronunciation improvement is a nuanced and dynamic one. As learners progress in their language acquisition journey, the way they approach pronunciation, and the extent to which they can improve, varies significantly based on their proficiency level. In the context of a platform like HaiMa English, which provides structured, repeated exposure to native pronunciation alongside personalized feedback, the degree of pronunciation improvement is closely tied to the learner’s current command of the language. Each proficiency level—beginner, intermediate, and advanced—presents unique challenges and opportunities for growth in terms of pronunciation accuracy and accent development.

For relatively low level students, often have low frequency exposure to the sounds, stress patterns, and intonations of the target language. They may rely heavily on the phonological rules of their native language, leading to significant pronunciation errors when speaking a new language like English.[18] These errors can manifest in the mispronunciation of vowel and consonant sounds, incorrect word stress, and difficulties with rhythm and intonation. For instance, learners whose first language lacks certain sounds found in English (e.g., the "th" sound in "think") may struggle to produce these sounds accurately.

Despite these challenges, beginners generally demonstrate the most noticeable and rapid improvement in

pronunciation. The lack of prior experience with the language means there is considerable room for growth. Platforms like HaiMa English, which offer repeated exposure to native speech and immediate feedback from professional instructors, provide beginners with a structured environment to build a solid foundation in pronunciation These low level students benefit greatly from the platform's review system, which is based on human memory patterns, as frequent practice and review help solidify correct pronunciation habits. For example, a beginner who consistently mispronounces the word "measure" might, through repeated listening to native pronunciation and teacher corrections, gradually adjust their articulation and stress patterns until the word is pronounced correctly.

However, while beginners show rapid improvement, they may also be at risk of forming incorrect pronunciation habits if not guided effectively. At this stage, students are still in the process of internalizing the rules of the target language. Mispronunciations can become ingrained if not corrected early, which is why the role of frequent corrective feedback is crucial. The platform's ability to offer native pronunciation audio alongside professional guidance ensures that students receive accurate models to imitate, helping them form proper speech patterns early on. Beginners need to engage consistently with the platform, as irregular usage may result in slower progress or a higher likelihood of retaining their native accent.

For Moderate phonological competence students, They are at a stage where they have gained a reasonable understanding of the phonology of the target language. They are typically able to produce the majority of the language's sounds and may be somewhat familiar with its stress patterns and intonation. However, while they have moved beyond the basic struggles of beginners, intermediate learners often retain specific pronunciation errors that are harder to correct. These could include misplacing stress in multi-syllable words, using inappropriate intonation patterns in complex sentences, or difficulties with certain vowel or consonant sounds that differ significantly from their native language.

For intermediate learners, pronunciation improvement tends to be more targeted. They are not starting from scratch but are instead focused on refining the areas where they still struggle. The feedback they receive from HaiMa English's instructors is likely to focus on correcting persistent errors rather than introducing entirely new pronunciation concepts. For example, an intermediate learner might consistently misplace stress in words like "photograph" (saying "photo-GRAPH" instead of "PHO-to-graph"). Through the platform's feedback and native pronunciation exposure, the learner can become more aware of these subtleties and adjust accordingly.

For intermediate learners, They often have a higher level of cognitive control over their pronunciation[2]. They are better able to consciously monitor and adjust their speech based on feedback, which allows for more precise improvements. The platform's use of native audio and corrective reviews helps intermediate learners fine-tune their pronunciation. However, improvement may be less rapid than at the beginner stage, as the remaining errors are more specific and may require focused effort to correct.

One key area where intermediate learners tend to show significant improvement is in the natural flow of their speech. At this stage, learners are increasingly focused on achieving fluency and sounding more natural, moving beyond isolated words and working on sentence-level intonation, rhythm, and overall coherence. HaiMa English's emphasis on native pronunciation is particularly beneficial for these learners, as it helps them incorporate essential features like sentence stress, linking sounds, and natural intonation, all of which contribute to a more native-like speaking style. As they continue to progress, intermediate learners can expect to make steady improvements in these areas, particularly when utilizing the platform's memory-based review process. This feature encourages repetition and reinforcement of corrections, ensuring that learners internalize the correct pronunciation patterns and make lasting gains in fluency and confidence

For High phonological competence students with subtle errors, They have a strong command of the language's sound system. They are able to produce most sounds correctly and have a good understanding of stress, rhythm, and intonation patterns. However, despite their proficiency, many advanced learners still retain a noticeable accent, often due to subtle mispronunciations or intonation issues that persist. For example, they may struggle with sounds that are similar but not identical to those in their native language or may have difficulty with the natural flow of fast-paced, conversational speech.

At the advanced level, pronunciation improvement tends to be more incremental and refined. Advanced learners are

often focused on polishing the finer aspects of their accent, seeking to reduce their foreign accent and sound more like native speakers. However, because they are already quite proficient, the improvements they make are often less dramatic than those seen at the beginner or intermediate levels. The feedback provided by HaiMa English is likely to be focused on small, nuanced corrections, such as adjusting vowel length in certain words or mastering the pitch and stress patterns in more complex sentences.

One challenge that advanced learners often face is the so-called "plateau effect," where noticeable improvement in pronunciation becomes more difficult to achieve as learners approach near-native fluency.[13] While the platform's repeated exposure to native pronunciation can help learners refine their accent, making substantial changes to their pronunciation may require focused effort and long-term practice. Nonetheless, the platform's ability to offer high-quality feedback on minor pronunciation issues can still lead to meaningful improvements, even if progress is slower.

It is also important to note that for advanced learners, the goal may shift from merely improving pronunciation to reducing their accent. Achieving a completely native-like accent is a difficult and sometimes unrealistic goal, especially for adult learners.[12] However, HaiMa English can help advanced learners reduce the salience of their foreign accent by refining the small aspects of pronunciation that contribute to the perception of accented speech, such as prosody, intonation, and rhythm. This incremental refinement can help them sound more fluent and natural in conversation.

The relationship between language proficiency and pronunciation improvement on the HaiMa English platform is characterized by varying rates of progress at different stages of language acquisition. Ultimately, the platform's structured feedback and repeated exposure to native pronunciation support learners at all levels, enabling them to continuously improve their pronunciation and fluency.

4. Conclusion

The present study aimed to evaluate the effectiveness of the HaiMa English platform in improving stress pronunciation skills among students of varying language proficiency levels. Through a structured analysis of pretest and posttest results, this research provided valuable insights into how different proficiency levels impact pronunciation improvement, particularly concerning word stress. The findings highlighted several key themes that contribute to understanding the relationship between language proficiency and pronunciation enhancement.

The results indicated that all proficiency levels demonstrated improvement in pronunciation accuracy, with significant differences observed across groups. Beginners showed the most pronounced gains, with an average improvement of 35%, while intermediate and advanced learners improved by 20% and 10%, respectively. This trend underscores the platform's effectiveness in catering to the needs of novice learners who may require more foundational support in pronunciation skills.

Furthermore, the study reinforces the importance of using technology and AI-assisted platforms like HaiMa English to facilitate language learning. The combination of native audio recordings and personalized feedback from professional instructors creates an immersive learning environment that aligns with effective memory and learning patterns. As learners engage with authentic language materials, they are more likely to internalize correct pronunciation, leading to long-term improvements in their speech.

Despite the positive findings, this study has limitations that warrant consideration. The sample size, while sufficient for preliminary analysis, may not be representative of the broader population of language learners. Future research should aim to include a larger and more diverse sample to enhance the generalizability of the results. Additionally, longitudinal studies that track pronunciation improvement over an extended period could provide deeper insights into the long-term effectiveness of AI-assisted language learning platforms.

Moreover, future studies could explore the specific components of pronunciation improvement that are most influenced by different instructional methods. By examining the nuanced aspects of pronunciation—such as word stress, intonation, phonetic detail, and rhythm—researchers could gain deeper insights into how these features interact with various teaching techniques. Understanding how specific methods affect different pronunciation components would allow

for the refinement of instructional strategies, enabling more targeted and effective approaches to language learning. Additionally, investigating the impact of learner motivation, engagement, and psychological factors on pronunciation improvement would provide a more comprehensive understanding of the language acquisition process. Such research could shed light on how emotional and cognitive factors, such as self-efficacy and anxiety, influence learners' ability to acquire and maintain accurate pronunciation, ultimately leading to more holistic and effective pedagogical approaches.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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