

The impact of computer-assisted pronunciation on Saudi students' production of English vowel sounds

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Abstract

This study aimed to investigate the extent to which computer-assisted pronunciation (CAP) is influential in helping Hijazi students to develop their pronunciation of English vowels within a Saudi English as a foreign language (EFL) context. It also examined whether Saudi Hijazi learners taught English vowel sounds by CAP outperform those taught via hard-copy pronunciation materials. Data were collected from 18 students who undertook an English speaking course over 11 weeks. These learners were equally divided into the experimental and control groups, who received instruction on English vowels through CAP and traditional printed materials, respectively. Quantitative and qualitative methods were employed in this study. The results of the study show that CAP significantly enhanced Hijazi EFL students' pronunciation of English vowel sounds, especially for those vowels that were nonexistent in their L1 phonemic inventory. They also suggest that CAP could be a beneficial tool to be incorporated into English speaking lessons.

Keywords: computer-assisted pronunciation (CAP); EFL context; English vowels; Hijazi students; Saudi university

Introduction

Pronunciation has been found to play a fundamental role in learning a second language (L2), significantly impacting comprehension and communication. Accurate pronunciation substantially contributes to English as a Foreign Language (EFL) learners' confidence levels, enhances clarity, and ensures they can effectively convey their message to others. Hence, pronunciation has been the focus of several EFL studies (see, for example, Sufi & Shalmani, 2018; Gilakjani & Rahimy, 2019, 2020; Saleh & Gilakjani, 2021). However, it has not received much attention in Arab EFL contexts. Accordingly, the current study is generally concerned with teaching English pronunciation in an EFL context within Saudi Arabia.

In Saudi Arabia, English is the only language used as a foreign language that is taught from the first stage of primary school. Thus, Saudi Arabian students study English for more than 10 years before enrolling in a higher education institution. However, despite this lengthy process of English language learning, a significant number of Saudi students show control over grammar but lack competence in spoken English (Alshahrani, 2016; Alresheed et al., 2017). According to Rao (2002), learners gain knowledge of vocabulary and grammar by studying English for several years. They can read well and obtain high marks in English tests. However, they are not confident enough to use English for daily communication and thus need to develop their verbal English communication skills, i.e., speaking and listening.

The prevalence of learners with a low level of proficiency in English pronunciation has raised several concerns regarding teaching English in Saudi Arabia. Many attempts have been made to promote students' communicative competency, which has led to a noticeable change in English language teaching methods. For example, there has been a shift in focus from receptive knowledge and skills (vocabulary, reading, and grammar) to productive skills (listening, writing, and speaking) (e.g., Al-Twairish, 2009; Alsubaie & Madini, 2018; Sharma, 2018; Alqasham & Al-Ahdal, 2022). Although various studies have been conducted to improve EFL learners' productive skills in education, less attention has been paid to the role of technology in enhancing students' English pronunciation (Alsofyani & Algethami, 2017).

Arabic and English have distinct vowel systems, with Arabic being characterized by fewer vowels. Arab students often face challenges in navigating the broader range of English vowels, leading to mispronunciations and difficulties distinguishing similar sounds (Ali, 2013; Alzahrani, 2014; Almurashi et al., 2023). For instance, the Arabic language, particularly the Hijazi dialect in Saudi Arabia, which is the focus of this study, has only eight vowels, namely /a/, /a:/, /e:/, /i:/, /i:/, /u:/, /u:/, and o:/. The English language, in contrast, contains many more vowels, such as /ɛ/, /ɜ:/, /ʌ/, /ɔ:/, /ʊ/, /ɑ:/, /u:/, /v/, /æ/, /ɪ/, and /i:/ (Wells, 1982; Jarrah, 1993). This absence of English vowels in the Arabic vowel system affects Arab speakers' intelligibility when communicating in English. Accordingly, Arab learners sometimes struggle to differentiate between English vowel sounds that are nonexistent in their first language, resulting in mispronunciations and difficulties in conveying the intended meanings (Almurashi et al., 2023). Hence, addressing these challenges, arising from the absence of certain vowels in the Arabic system, significantly helps enhance English vowel sound instruction for Arabic-speaking learners.

Traditionally, pronunciation in Saudi Arabia has been taught in classes or lectures through printed materials. Such materials make acquiring L2 English sounds difficult because of their lack of interactivity and dynamic presentation. They typically lack audio components, making it challenging for learners to accurately emulate the sounds that they attempt to learn (Nasim et al., 2022). In such traditional methods, learners often rely on static representations of pronunciation, such as written descriptions or diagrams, which may not adequately convey the nuances of sound production. This passive approach to teaching pronunciation leads to limited engagement and less effective learning outcomes. Accordingly, there has been a growing recognition of the need to incorporate more interactive and technology-driven methods into pronunciation instruction, particularly computer-assisted pronunciation (CAP). Such a tool includes both audiovisual materials and visual and interactive software, both of which provide learners with practical knowledge of sound production (Frigaard, 2002; Schofield & Davidson, 2003; Khoshshima et al., 2017; Saleh & Gilakjani, 2021).

Unsurprisingly, then, a substantial number of researchers in EFL contexts have inspected CAP's influence on learners' English pronunciation and demonstrated its key role in providing

an in-depth understanding beyond what can be gained from traditional class sessions (see, for instance, Ghounane & Rabahi, 2021; Gilakjani & Rahimy, 2019, 2020; Nasim et al., 2022; Saleh & Gilakjani, 2021; Sufi & Shalmani, 2018). They also reported that CAP offers a very important aspect regarding the production of English vowels. As an example, tongue, lip, and jaw movements are crucial components of English sounds, and CAP provides visual representations of these articulatory movements. Such articulatory animation details assist learners in understanding the subtle differences between English vowels and those of their L1. Learners are also able to observe how native speakers position their tongues, lips, and jaws to produce various sounds, helping them better understand the physical mechanics of pronunciation. As a result, learners have the potential to correct their English pronunciation mistakes and boost their practical knowledge of English pronunciation (Machovikov et al., 2002; Gilakjani, 2018; Gilakjani & Rahimy, 2020; Ghounane & Rabahi, 2021). Incorporating CAP into pronunciation instruction improves language learning efficiency, since it provides learners with various resources and tools to develop accurate pronunciation skills. This feature has attracted pronunciation instructors and lecturers who are eager to infuse dynamic, interesting, and colorful materials into their speaking sessions (Hismanoglu & Hismanoglu, 2010; Jahangiri & Sardareh, 2015; Gilakjani & Rahimy, 2019; Tejedor-García et al., 2020).

Literature Review

The current study is concerned with the influence of CAP on teaching English pronunciation within EFL contexts. Therefore, this section reviews the most recent studies in order to place the present study against the backdrop of the related prior body of scholarship.

Sufi and Shalmani (2018) conducted a study to investigate whether the integration of assisted software in teaching L2 pronunciation statistically produces a significant effect upon the growth of pronunciation skills among intermediate EFL learners in Iran. They also compared teaching pronunciation methods using software and traditional teacher-fronted instruction in terms of their effectiveness and efficiency. In their methodology, 30 intermediate Iranian EFL students were chosen on the basis of their quantitative proficiency test performance. They were also randomly allocated into experimental and control groups, each comprising 15 participants. Pre- and post-tests were administered before and after the intervention. Both groups underwent a six-session treatment of different techniques: the experimental group used TFlat software, while the control group received traditional teaching covering units on English sounds. To compare the performance of both groups on the pretest of pronunciation, the researchers conducted an independent samples *t*-test. The study's results suggested that the TFlat courseware effectively developed students' pronunciation skills. In the post-test, the experimental group demonstrated a more substantial improvement in pronunciation than the control group. The authors highlighted the potential for EFL instructors to enhance their students' pronunciation proficiency through technology in their classrooms.

Another study was carried out by Gilakjani and Rahimy (2019) to investigate the role of CAP, specifically Pronunciation Power 2 software, in enhancing the pronunciation skills of Iranian EFL learners. The researchers employed a quantitative approach to achieve this aim. They also divided their students into two groups: an experimental group and a control group, who received instruction via CAP and conventional non-CAP instruction, respectively. Post-testing was then undertaken to assess the effectiveness of each teaching method. Using statistical analysis via one-way analysis of covariance, the study observed that the experimental group significantly outperformed the control group. The authors concluded that this notable difference underscores the use of CAP in teaching pronunciation skills.

In a similar vein, Gilakjani and Rahimy (2020) also undertook a study to examine teachers' role in employing CAP, particularly Pronunciation Power 2 software, to teach pronunciation in an Iranian context. They also inspected the effectiveness of using such a method in improving Iranian EFL students' pronunciation skills. They deployed quantitative and qualitative approaches for this purpose. The study's data were collected from a total of 100 students (66 females and 34 males), who were divided into an experimental group and a control group. Students in the experimental group received instruction from a CAP teacher, whereas those in the control group received instruction from a non-CAP teacher. Both groups underwent pretests and post-tests of English pronunciation, and the researchers employed the matched pairs *t*-test method to analyze the gathered data. The findings of the study suggested that Pronunciation Power 2 was an effective resource in teaching pronunciation, changing the teachers' roles from providers of information to facilitators of learning. They also indicated that students in the experimental group significantly developed their pronunciation skills, highlighting the efficacy of CAP in language acquisition.

Ghounane and Rabahi (2021) conducted a 6-month study to scrutinize Algerian EFL students' pronunciation with the use of CAP. This study specifically aimed to enhance learners' accurate pronunciation of English sounds using Pronunciation Coach software. Data were collected from 80 female and male Algerian EFL students, who were assigned to an experimental group and a control group. The experimental and control groups were taught differently: using a CAP teaching method for the former and a traditional teaching method for the latter. The researchers administered two tests to assess the students' performance, one before and one after instruction. The researchers found that the experimental group were more motivated to learn English pronunciation via CAP. They also observed that CAP provided a native-like environment for students, allowing them to learn how to pronounce English expeditiously sounds properly. Moreover, they noted that the experimental group exhibited (1) a development in their articulation of different English vowels (2) and an increased awareness of the primary distinctions between English and Arabic pronunciation with respect to the placement and manner of articulating the sounds.

Another study was undertaken by Saleh and Gilakjani (2021), who explored the influence of CAP on the pronunciation skills of EFL learners in Iran, utilizing Accent Master software. Seventy students were selected in this study on the basis of their performance on the Quick Placement Test (QPT) and were randomly allocated into experimental and control groups. Both groups undertook a pretest and a post-test before and after the intervention to gauge their pronunciation skills. CAP (Accent Master software) and a traditional pronunciation teaching method were employed to instruct the experimental and control groups, respectively. Statistical analyses, including independent and paired samples *t*-tests, were implemented to examine the students' performance on the tests. The study found a significant improvement in the pronunciation skills of EFL learners who received CAP instruction. It also observed a notable difference in the post-test scores, with the experimental group demonstrating more solid progress than the control group.

Another study was conducted by Nasim et al. (2022) to delve into the effect of CAP on the English pronunciation of northern EFL learners in a Saudi context and their attitudes towards this approach to teaching. The researchers gathered data from 30 participants, who were placed into the experimental and control groups, each comprising of 15 students. They also assessed the students in both groups by using similar intra-sentential pronunciation activities before and after the teaching process. The study's findings indicated that the experimental group outperformed the control group, showing a more significant improvement in their English pronunciation. They also suggested that teaching students with advanced technology

tools would help them learn pronunciation faster and more effectively than teaching with conventional methods.

Finally, a recent study was carried out by Mahmood (2024) to examine the perceptions of learners towards using high-variability phonetic training through YouGlish to develop pronunciation skills in an Australian ESL context. The researcher gathered data from 70 ESL students at an upper-intermediate level through an online survey and semi-structured interviews with 20 out of these 70 learner participants. He also employed a mixed-method approach, analyzing the collected data statistically and thematically. The study revealed that a significant number of ESL learners showed positive attitudes towards the use of high-variability phonetic training and YouGlish. They reported that these online tools improved their pronunciation skills, helping them to accurately pronounce words from various accents, including Australian, British, and American. They also emphasized the key role played by their instructor in offering explicit corrective feedback and scaffolding.

Purpose of the Study

To the best of my knowledge, no research study has been conducted to scrutinize the use of CAP to teach Hijazi students English pronunciation in a Saudi EFL context. Thus, the current study attempted to close this gap by exploring the impact of CAP on Saudi Hijazi students' pronunciation of English vowels. It also examined whether the learners taught English vowel sounds by CAP outperformed those taught by hard-copy pronunciation materials. It therefore sought to address the following questions:

1. To what extent was CAP influential in helping Saudi Hijazi EFL students to develop their pronunciation of English vowel sounds?
2. To what extent did Saudi Hijazi EFL students taught English vowel sounds via CAP outperform those taught by hard-copy pronunciation materials?

Methodology

Context and Participants

The study's data were assembled from 18 second-year Hijazi students majoring in English at Taibah University in Saudi Arabia. These students undertook an 11-week EFL course concerned with speaking and communication skills. They were also allocated into a control group and an experimental group. Each group included nine participants who were between 20 and 27 years old (mean age = 21.7, median = 21, standard deviation = 1.8).

Research Design

This study followed a two-group pretest–post-test design, where a pretest was given to both groups before they underwent any treatment, and a similar test was administered as a post-test after they had received treatment. This intervention was twofold. The control group was taught via the typical method of teaching English pronunciation, in which hard-copy (print) materials were applied, for 11 weeks. In contrast, the experimental group received instruction via pronunciation software for the same duration. This was to determine which teaching method positively impacted students' English pronunciation of vowel sounds.

For both the pretest and post-test, the participants were recorded in a soundproof room and were instructed to produce English vowel sounds (/ɛ/, /ɜ:/, /ʌ/, /ɔ:/, /ʊ/, /ɑ:/, /u:/, /ɒ/, /æ/, /ɪ/, and /i:/) in a /hVd/ context. Then two phonetically trained listeners rated their pronunciation of these English vowels.

Analytical Tools

The pronunciation software used for the experimental group was Pronunciation Coach Software, developed by icSpeech. It is an English language pronunciation software that includes animations showing how the sounds are produced and allows users to control the visibility of articulatory phonetics, such as the teeth, lips, tongue, and jaws (see Figure 1).

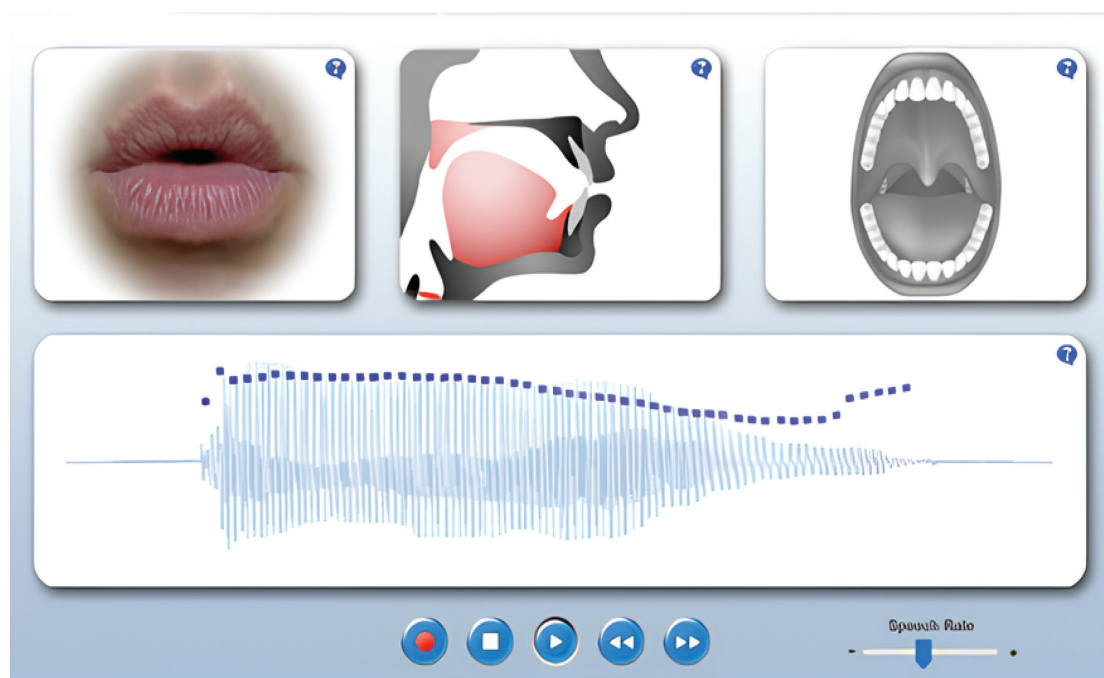


Figure 1 Screenshot of Pronunciation Coach, displaying the movements of the lips, tongue, and jaw for English phonemes

This study employed a mixed-methods approach, taking quantitative and qualitative methods into account. The analysis of variance statistical technique was used in the quantitative analysis with separate models run for each group. The first model compared the control group's results between the pretest and the post-test. The second model compared the results of the experimental group between the pretest and the post-test. Finally, the third model compared the control group's post-test results with the experimental group's post-test results.

In the qualitative method, by contrast, interviews were carried out with participants in the experimental group to investigate their attitudes toward the CAP teaching model employed in the course (the interview questions are provided in Appendix A.)

Findings

As previously discussed, the main purpose of this study was to explore the influence of CAP on the production of English vowel sounds by Hijazi EFL students. To achieve this aim, this study, as outlined above, applied quantitative and qualitative analyses. In this section, I first report the statistical findings associated with the quantitative assessment, followed by those reached by the qualitative assessment through interviews.

Quantitative Analysis

As already presented, the current study compared pronunciation tests before and after the intervention to determine any difference in vowel classification accuracy between the two tests. The two groups produced similar mispronunciations for various English vowel sounds during the pretest. The pretest also revealed significant patterns and challenges in language acquisition (see Tables 1 and 2). In detail, for /ɑ:/, both the control and experimental groups achieved a very similar rate of correct pronunciation: 61% and 60%, respectively. For /æ/, the control group displayed a 51% rate of correct pronunciation, whereas the experimental group achieved a slightly lower rate of 48%. In producing /i:/, both groups had a high percentage: 80% for the control group and 82% for the experimental group. In producing the English vowels /ε/ and /ɜ:/, both groups struggled and found them difficult to pronounce, with their production accuracy ranging from 40% to 49%. For /ɪ/, both groups produced this sound with a high degree of accuracy: 82% for the control group and 85% for the experimental group. For /ɒ/, both groups demonstrated some difficulties and achieved moderate accuracy: 55% for the control group and 52% for the experimental group. For /ɔ:/, both groups had a similar production accuracy: 51% for the control group and 49% for the experimental group. For /ʌ/, both groups had very similar accuracy results: 59% for the control group and 60% for the experimental group. Finally, for /u:/ and /ʊ/, both groups pronounced these vowels with a high degree of accuracy, ranging from 81% to 82%. Overall, the average production accuracy for both groups was almost the same: 62.36% for the control group and 62.82% for the experimental group. This indicates that both groups had almost the same level of English vowel sound pronunciation.

Table 1 A confusion matrix showing the percentage of correct responses in the category discrimination task for the control group in the pretest (the matrix displays the expected and actual responses)

Expected/ Actual response	/ɑ:/	/æ/	/i:/	/ε/	/ɜ:/	/ɪ/	/ɔ:/	/ɒ/	/ʌ/	/u:/	/ʊ/
/ɑ:/	61	21							2		
/æ/	33	51							35		
/i:/			80		53	8					
/ε/				40		9			3		
/ɜ:/					46						
/ɪ/			19	59		82					
/ɔ:/							51	13			
/ɒ/							27	55			
/ʌ/	5	27						15	59		
/u:/							21			81	19
/ʊ/								16		18	80

Table 2 A confusion matrix showing the percentage of correct responses in the category discrimination task for the experimental group in the pretest (the matrix displays the expected and actual responses)

Expected/ Actual response	/ɑ:/	/æ/	/i:/	/ɛ/	/ɜ:/	/ɪ/	/ɔ:/	/ʊ/	/ʌ/	/u:/	/ʊ/
/ɑ:/	60	21							3		
/æ/	29	48							34		
/i:/			82		50	8					
/ɛ/				43		6			2		
/ɜ:/				2	49						
/ɪ/			17	54		85					
/ɔ:/							49	21			
/ʊ/	4						26	52			
/ʌ/	6	30						13	60		
/u:/							24			81	17
/ʊ/								13		18	82

For the post-test, the comparison between the two groups' improvement in pronunciation reveals distinctive trends across various vowel sounds (see Tables 3 and 4). For /ɑ:/, the control group showed an improvement of 72% in their production accuracy, whereas the experimental group displayed a higher degree of 82%. For /æ/, the control group enhanced their production accuracy achieving 63%, whereas the experimental group demonstrated more development, reaching 72%. For /i:/, the control group produced this vowel with an accuracy of 88%, whereas the experimental group produced it with a higher degree of accuracy: 96%. For /ɛ/, the control group accomplished moderate production accuracy: 53%. In contrast, the experimental group demonstrated a higher degree of production accuracy: 74%. For /ɜ:/, both the control group and the experimental group increased their production accuracy to 55% and 78%, respectively. For /ɪ/, the control group had a high rate of production accuracy (90%), whereas the experimental group showed even a higher rate: 97%. For /ɔ:/, both the control and experimental groups demonstrated a rise in their production accuracy to 55% and 83%, respectively. For /ʊ/, the control group enhanced their production accuracy, achieving 66%, whereas the experimental group showed more enhancement, reaching 76%. For /ʌ/, the control group displayed a production accuracy rate of 70%, whereas the experimental group showed a higher rate of 84%. For /u:/, both the control and experimental groups showed a significant increase in their production accuracy, achieving 91% and 97%, respectively. Finally, for /ʊ/, the control group produced it with a high percentage of accuracy (92%), whereas the experimental group produced it with a higher percentage of accuracy: 96%. Overall, the average production accuracy for the control group was lower than that of the experimental group, namely 72.27% versus 85%, suggesting that the experimental group demonstrated more development than the control group.

Table 3 A confusion matrix showing the percentage of correct responses in the category discrimination task for the control group in the post-test (the matrix displays the expected and actual responses)

Expected/ Actual response	/ɑ:/	/æ/	/i:/	/ɛ/	/ɜ:/	/ɪ/	/ɔ:/	/ɒ/	/ʌ/	/u:/	/ʊ/
/ɑ:/	72	16									
/æ/	23	63							27		
/i:/			88		44	4					
/ɛ/				53		5			2		
/ɜ:/					55						
/ɪ/			11	46		90					
/ɔ:/							55	11			
/ɒ/							25	66			
/ʌ/	4	20						11	70		
/u:/							19			91	7
/ʊ/								11		8	92

Table 4 A confusion matrix showing the percentage of correct responses in the category discrimination task for the experimental group in the post-test (the matrix displays the expected and actual responses)

Expected/ Actual response	/ɑ:/	/æ/	/i:/	/ɛ/	/ɜ:/	/ɪ/	/ɔ:/	/ɒ/	/ʌ/	/u:/	/ʊ/
/ɑ:/	82	15									
/æ/	17	72							15		
/i:/			96		18	1					
/ɛ/				74	3	1					
/ɜ:/					78						
/ɪ/			3	25		97					
/ɔ:/							83	5			
/ɒ/							2	76			
/ʌ/		12						9	84		
/u:/							14			97	3
/ʊ/								9		2	96

The next step was to run an analysis of variance. The results of both groups yielded the following findings. For the control group, the difference between the results of the pre- and post-tests was not significant ($p = 0.151$), but it was significant for the experimental group ($p = 0.0009$). A comparison between the post-test results for both groups revealed a significant difference ($p = 0.0323$).

Qualitative Analysis

After they had completed the course, the researcher interviewed the students in the experimental group and analyzed their responses and comments to reach more insightful conclusions about CAP's influence on their pronunciation of English vowel sounds. Figure 2 below summarizes all the comments received from the students in the experimental group.

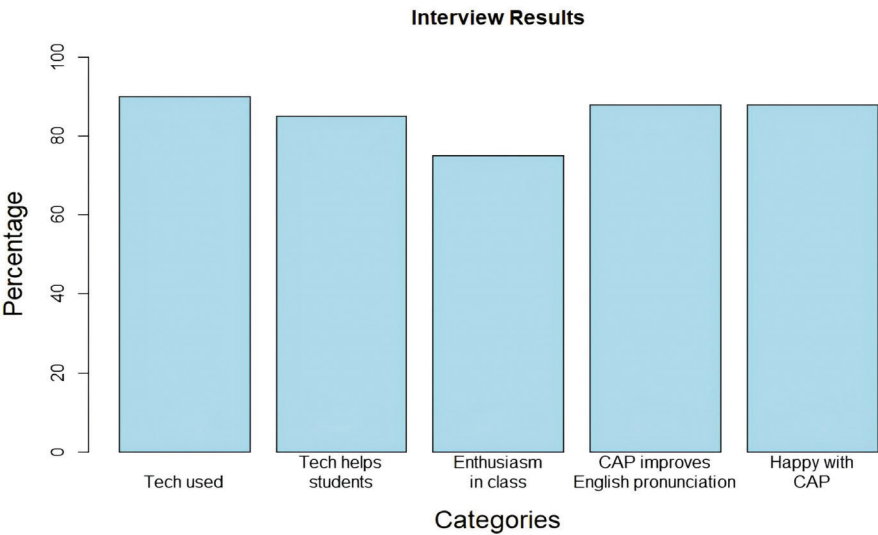


Figure 2 The experimental group's comments from the interview

To gain a general overview of Hijazi EFL students' attitudes towards using CAP to teach English pronunciation in the classroom, the researcher started the interview by asking, "Have you ever used any applications/software to aid your studies?" This question was intended to gauge the learners' familiarity with study-related applications and software. Notably, a significant proportion of respondents (90%) commented that they had used various applications and software tools in their studies, including dictionaries, Microsoft Office software, and some translation applications.

The next question in the interview was, "Do you think integrating technology into the classroom would help students deepen their understanding of English lessons, particularly pronunciation?" The purpose of this question was to determine the students' perceptions of using technological resources to teach English lessons in the classroom. Eighty-five percent of the participants agreed. For example, one student said: "Certainly, I believe it could be intriguing and beneficial to incorporate technology into our learning." Another respondent stated, "I find it advantageous to integrate technological tools into our classroom."

The third question was, "How did you feel when your instructor employed a CAP approach to teach English vowel sounds in the classroom? Why?" Approximately three-quarters (75%)

of the students responded that they experienced enthusiasm during class because of the use of CAP. For example, one commented, "I felt enthusiastic about using CAP in the classroom because it was something new to me for teaching English pronunciation."

The fourth question was, "Do you feel that your pronunciation of English vowel sounds has been improved after using CAP?" This question was to inspect to what extent CAP was a powerful tool to help Hijazi students develop their pronunciation of English vowels. Almost 90% of the participants observed that their English pronunciation had noticeably improved, describing CAP as a useful tool for teaching pronunciation. By way of exemplification, one participant said, "Yes, the audiovisual effects featured in CAP helped me produce English sounds correctly, thus improving my speaking skills." Another participant also stated, "CAP could make English pronunciation simple and interesting." Finally, the fifth question was "What is your opinion of employing CAP to teach English pronunciation?" This question was intended to gauge students' overall satisfaction with CAP in their speaking and communication sessions. About 90% of the respondents conveyed their happiness, stating that they occasionally found themselves unaware of the passage of time when studying English pronunciation through CAP. To illustrate, one student said: "Yes, I love this method of teaching English pronunciation because it is informative." Another student commented similarly: "Yes indeed, I like the idea of using CAP, since it has audio and visual effects."

Discussion

This study aimed to examine to what extent CAP assisted Saudi Hijazi learners in enhancing their pronunciation of English vowel sounds. It also explored whether the students who received CAP instruction outperformed those who received instruction using traditional printed materials. The quantitative and qualitative analyses conducted in this study demonstrated that CAP played a major role in enhancing students' production of English vowels. In other words, CAP was influential in helping Saudi Hijazi EFL students to develop their pronunciation of English vowel sounds (the first research question). The analyses also revealed that the learner participants taught by CAP showed more solid progress than those taught by hard-copy materials (the second research question). To elaborate, the quantitative assessment exhibited notable similarities and differences between the control and experimental groups in pronunciation tasks. Starting with the pretest production task, both groups displayed similar difficulties in producing English vowels at this stage. These challenges were expected, as outlined in the literature review, because English contains more vowels than Arabic, which is the L1 of the learner participants in this study. Therefore, the students struggled to differentiate between English vowel sounds existing in their L1 language and those that are nonexistent, such as /ʌ/, /v/, /ɔ:/, /ɛ/, and /ɜ:/ (Almurashi et al., 2023). These unfamiliar vowels had the lowest rates of correct pronunciation in the confusion matrix and underscored the participants' lack of knowledge in producing such English sounds.

In the post-test production task, the control and experimental groups showed improvements in their ability to produce English vowels, including those that are absent in their L1 phonemic inventory. These vowels were notably difficult for both groups; however, their production improved notably in the post-test. Although both groups demonstrated progress in their English vowel production, the experimental group consistently achieved greater improvements across a range of vowel sounds compared with the control group. The difference in performance between the two groups in the post-test was statistically significant. Such a result highlights the superior performance of the experimental group and reflects the positive impact of the CAP teaching method applied to them. Furthermore, the experimental group's consistent strides in improving their pronunciation improvement suggest that CAP is an effective tool for enhancing

English pronunciation skills across various linguistic challenges. This observation is in line with the findings of previous studies, such as Ghounane and Rabahi (2021), Gilakjani and Rahimy (2019), Hismanoglu and Hismanoglu (2010), Khoshshima et al. (2017), and Tejedor-García et al. (2020).

CAP also seems to be an invaluable approach for addressing the issues associated with certain phonetic elements. In addition, the notable improvement in pronunciation skills observed for the experimental group indicates that CAP has enormous potential for accelerated learning. Accordingly, these useful insights into language acquisition provide valuable directions for educators and researchers alike. Educators are encouraged to consider incorporating this successful learning method into broader language instruction strategies, thereby contributing to more effective language learning environments (Gilakjani & Rahimy, 2020). Researchers are also encouraged to refine these findings through continued experimentation. By collaborating closely with educators, researchers would be able to provide deeper insights into practical CAP software, ensuring its relevance and impact in real-world educational settings.

For the qualitative assessment through interviews, the Hijazi EFL students indicated their familiarity with applications and software, expressing a readiness to incorporate technology into their learning environments and prepare themselves for the future workforce, in which digital literacy is important. They also highlighted technology's significant role in enhancing comprehension and the students' desire for its integration into the classroom to facilitate a more informative learning experience and to have access to a wealth of information beyond traditional resources. Furthermore, they demonstrated enthusiasm and a preference for using technology to teach English pronunciation because it provides visual aids that encourage student interaction in the classroom, create more engaging lessons, and offer real-time feedback. They also reacted positively to CAP because it improved their English pronunciation noticeably and simplified their acquisition of English vowel sounds. Finally, they were pleased about using CAP in the classroom because it has beneficial features, such as audiovisual effects, which simplify pronunciation lessons. In brief, the students' positive feedback regarding the CAP approach to teaching English speaking lessons highlights its role in offering interactive, informative, and enjoyable pronunciation experiences, resulting in enhanced second-language acquisition (e.g., Gilakjani, 2018; Jahangiri & Sardareh, 2015; Nasim et al., 2022; Tsai, 2019). This allows us to conclude that CAP is an incredibly useful tool because it offers visual representations of vowel sounds, helps students observe the characteristics of each sound, and compares their pronunciation with a native speaker's pronunciation or a target model.

Conclusion

This study was specifically directed at examining the effect of CAP in helping Saudi EFL students enhance their pronunciation of English vowels. It was original in exploring the CAP's role in a Hijazi context within Saudi Arabia. It was also significant in seeking to contribute to the field of teaching English pronunciation. Taking the quantitative measures and qualitative observations into account, this study recommends using CAP over the traditional textbook-based method because it allows learners to understand the intricate interactions of the vocal organs in sound production, thereby helping to enhance their acquisition of English vowel sounds.

This study has also significant implications for both theory and practice. Theoretically, it contributes to the field of second language acquisition since it demonstrates how the implementation of CAP approach improves pronunciation, particularly for sounds that are nonexistent in the learners' first language. Practically, it highlights how teachers use CAP tools to make learning more interactive and engaging, helping students overcome specific pronunciation difficulties. For example, CAP helps learners understand the specific tongue

and lip positions for vowel sounds and develop their awareness of subtle differences between similar vowel sounds. It also allows students who struggle with vowel sounds to obtain targeted practice and immediate feedback. However, teacher training should be taken into account in the sense that some language educators may need training in how to incorporate CAP effectively into their lessons.

This study has also some limitations. The first limitation involves the small sample size collected, i.e. only 18 students. The second limitation relates to the short period of intervention when the study was conducted, i.e. 11 weeks. The final limitation is associated with the focus on one aspect of pronunciation, i.e. English vowel sounds. Therefore, it is not possible to generalize the findings beyond this relatively limited setting. For further research within a similar context, it is recommended to involve a larger dataset, a longer period of intervention, and more aspects of pronunciation such as consonants, stress, or intonation. These recommendations will make the findings less tentative and enable stronger claims to generalizability to be made. For further research, it is suggested to investigate the impact of different CAP tools across various contexts and examine how the phonemic inventory of L1 influences the acquisition of English vowel sounds.

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Appendices

Appendix A: Interview questions

(Interview 1uestions)

Name: _____ Level: _____ Age: _____

1. Have you ever used any applications/software to aid your studies?

2. Do you think integrating technology into the classroom would help students deepen their understanding of English lessons, particularly pronunciation?

3. How did you feel when your instructor employed a CAP approach to teach English vowel sounds in the classroom? Why?

4. Do you feel that your pronunciation of English vowel sounds has been improved after using CAP?

5. What is your opinion of employing CAP to teach English pronunciation?
