

Computer-assisted pronunciation instruction as an effective means for teaching stress

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This study seeks to assess the efficacy of computer-based pronunciation instruction for enabling EFL learners in advanced English language classes at the university level to perceive and produce correct stress patterns. The study focuses on using the communicative approach in learning stress patterns which is based on providing meaningful, interactive, and authentic activities. The findings of the study reveal that computer-assisted pronunciation instruction is effective in improving the EFL learners' ability to produce and perceive correctly different stress patterns in words, phrases, and sentences, and that students also have a positive attitude toward computer-assisted pronunciation instruction and activities.

As is now widely known, computer-assisted language learning (CALL) is the use of technology enhanced methods and techniques in language learning and teaching (Kedrowicz & Watanabe, 2006; Gruba, 2006). One aspect of CALL is computer-assisted pronunciation (CAP) which is based on the use of technology for learning and teaching the segmental and suprasegmental features of the sound system, and is described by Rostron and Kinsell (1995) as the use of digitized speech for improving language pronunciation. **The computer has been used in teaching pronunciation** to achieve two purposes: (a) diagnosing the student's deviation in pronunciation and (b) assisting him/her in correcting any such deviations (Najmi and Bernstein, 1996; Kawai & Hirose, 1997; Machovikov, Stolyarov, Chernov, Sinclair, & Machovikova, 2002). Raux and Kawahara (2002) also argue that recent computer-assisted pronunciation learning focuses on two major areas: evaluation of and instruction of the different aspects of pronunciation such as stress.

In learning and teaching different aspects of pronunciation, CAP offers a variety of interactive software packages for providing EFL learners with the opportunity to perceive and practice pronunciation. Computer-assisted pronunciation instruction of-

fers many advantages which are not usually available in conventional contexts. For example, Neri, Cucchiarini and Strik (2002) point out that digitized pronunciation software allows students to access unlimited and realistic L2 input through different channels individually and provide individualized feedback automatically and instantaneously. The computer can also offer learners a chance to use many prerecorded materials. Digitized pronunciation software packages afford high-quality sound and video clips of speakers, which gives the learner the opportunity to look at articulatory movements that are used in producing sounds (LaRocca, 1994). A person may also compare his or her voice to a model made by a native speaker. Shirer (2005) confirms that it has become possible to use computers, speech technology, and linguistics together to enable learners to hear a voice of a native speaker who mastered Standard English. Students may then compare their performance to that model, sound by sound, and track their progress over time.

Many researchers have argued that research comparing effects of CALL to other forms of instruction is either impossible or irrelevant (e.g., Brown & Wack, 1999; Yildiz & Atkins, 1993) because the control group designs are not useful for evaluating technology in actual school programs (Baker, Herman, & Gearhart, 1996). It is also impossible for researchers to treat each member of the experimental group as having had the same exposure to or experience with the software (Alexander & Hedberg, 1994). However, there is still a body of research (e.g., Stenson, Downing, Smith, & Smith, 1992; Rostron & Kinsell, 1995; Dekaney, 2002; Hirata, 2004; Seferoglu, 2005) that compares the effect of CALL to other forms of traditional instruction, arguing that there are significant differences such as each learner being able to work at his or her own pace. This makes comparisons between them valid in that it allows us to find which approach is more suitable.

The introduction of technological innovations in pronunciation aims at developing techniques to help both FL learners and teachers to improve the outcomes of the educational process. Speech-interactive CALL brings to pronunciation instruction a wealth of new techniques like corrective feedback and total immersion learning (Eskenazi, 1999). There is a movement that goes beyond the limits of the classroom and gives the learner more autonomy and control in the development of their language learning ability (Pennington, 1999). However, as one researcher argues, "...the development of training techniques for L2 pronunciation is in its infancy, and there is much to be explored in assessing whether various methods of pronunciation training are effective in enabling subjects to accurately produce L2 contrasts" (Hirata, 2004, p. 358). Grant (1995) also notes that the lack of progress in pronunciation to date seems to be represented in limitations not related to the learner but in problems within the contexts for learning and teaching.

The importance of suprasegmentals

The sound system of English is studied under two main headings: segmental and suprasegmental. According to Seferoglu (2005), "Segmental aspects of the sound system includes individual vowels and consonants, and the suprasegmental aspect comprises words, phrases, and sentence stress, pitch contour or intonation, and rhythm" (p. 304). While the issue of teaching suprasegmentals in preference to segmentals is debatable, this study is based on this belief. Because segmental phonology is relatively more easily explained and taught than the suprasegmental features (Coniam, 2002), some studies focus on studying

segmental phonology in preference to suprasegmental features. However, approaches to pronunciation have shifted in focus away from segmental to suprasegmental aspects of a sound system. Jenkins (2002) emphasizes that effective communicative pronunciation competence can be achieved more through improving suprasegmental production in preference to segmentals.

Recent approaches to teaching pronunciation in computer-based contexts follow the communicative approach in teaching pronunciation. Harmer (1993) stresses the need for making sure that students can always be understood and say what they want to say. They need to master "good pronunciation", not perfect accents. That is, emphasis should be on suprasegmental features of pronunciation—not **segmental aspects—to help learners acquire communicative competence** (Seferoglu, 2005). Bott (2005) asserts, "In recent years, increasing attention has been placed on providing pronunciation instruction that meets the communicative needs of non-native speakers (NNSs) of English. Empirical research and pronunciation materials writers suggest that teaching suprasegmentals before segmentals to intermediate and advanced NNSs could be more beneficial in a shorter period of time" (p. 5).

One study conducted by Seferoglu (2005) aimed to find out whether integrating accent reduction software in advanced English language classes at the university level results in improvements in students' pronunciation at the segmental and suprasegmental levels, finding that the experimental group that followed instruction which integrated the use of accent reduction software in a multimedia language laboratory outperformed the control group which followed traditional instruction. Based on the results of this study, it was found that technology has a lot to offer in pronunciation learning, and EFL learners may be provided with exposure and practice/interaction opportunities in the target language through specifically designed software programs. Similarly, Cheng (1998) reported that teachers should choose meaningful material to be used as models for practicing pronunciation aspects such as stress. Morley (1991) also recommended giving detailed attention to suprasegmental features of pronunciation and their functions in interactive discourse and stressed their application in communicative approaches to pronunciation learning and teaching.

The importance and acquisition of word stress

The present study focuses on one major aspect of the suprasegmental features of the sound system of English, namely, stress, an extra force used when a word or a syllable is produced. Roach (2004) cites four factors which make the stressed syllable more prominent than the unstressed syllable in the word: loudness, pitch, length, and quality. Handke (2000) classifies stress into three major types: lexical (words where the placement of stress leads to lexical difference), shift (words whose stress pattern is dependent on syntactic aspects), and weak (words whose segmental structure depends on their stress pattern) which has a strong form in stressed position with a full vowel and a weak form in unstressed position with a weakened vowel or a syllabic consonant.

Arabic speaking learners of English have difficulty in producing stress patterns. While stress in Arabic is predictable, stress in English is not. Aziz (1980) points out that Arab learners transfer native-language stress patterns to English which causes miscommunication and is difficult to pinpoint. Similarly, Anani (1989) analyzed the English word stress place-

ment of six native Arabic speakers, revealing that the Arab subjects placed stress on English words in conformity with Arabic stress patterns. Therefore, there is a need for research into more feasible methods and techniques for teaching and learning stress to Arabic-speaking learners of English.

To maintain a manageable scope, the study is limited to focusing on stress in the word and sentence level. It overlooks the effects of changes in sentence focus on stress. This, however, is not believed to be a serious detriment to the end results or their interpretation since there are ample examples of sentences that do not occur within any type of contexts. The study is also predicated on the belief that variations in intonation do not affect the prominence of one syllable in comparison to others within the same locale. It is based on using the CALL approach for studying stress patterns.

General findings about the effectiveness of CAP

CAP research is still quite limited. Seferoglu (2005) asserts, "There have been very few studies so far which test the effectiveness of computer-assisted pronunciation training" (p. 306). Felix (2005) also examined the effectiveness of CALL over the period 2000 – 2004 and reports that computer-based pronunciation is one of the areas that received **less attention** from the published research studies, although there has been a slight increase in interest in more recent years (Stockwell, 2007).

Some studies (Kawai & Hirose, 1997; Landahl & Ziolkowski, 1995; Leather, 1990) have used less effective methods in analyzing pronunciation. For example, Kawai and Hirose (1997), Landahl and Ziolkowski (1995) and Leather (1990) **focused on training one experimental group** and did not compare the results with control groups, which makes it difficult to show the effect of training. In addition, other studies have been interested in evaluating the effectiveness of the system, not its effect on the development of students' abilities in pronunciation. For instance, Machovikov, Stolyarov, Chernov, Sinclair and Machovikova (2002) **designed a computer-based pronunciation system for detecting word pronunciation errors**, and evaluated the system through finding the conformity between experts' and system's estimations. Several studies (see *Raux & Kawahara, 2002, for an overview*) also focused on error analysis of computer-assisted pronunciation software. There are also some studies which compare the effectiveness of technology-enhanced pronunciation programs which show the advantages of CAP instruction and programs (Chard, 1999). Other studies focus on investigating participants' attitudes toward computer-assisted pronunciation systems, such as Bott (2005), who reported that participants' reactions about CAP programs were very positive. Moreover, Sullivan and Czigler (2002) tested students' attitudes toward a computer-based pronunciation course, reporting that "The students found the course ambitious and were particularly positive toward the perception experiment task" (p. 341).

Zhang (1998) **drew the conclusion that computer technology can be usefully and successfully incorporated into a teaching curriculum** because the abilities of the experimental group in pronunciation improve. The findings of Rostron and Kinsell's (1995) study showed that the participants who used a computerized Italian program in conjunction with an Italian course **were judged to have made greater improvements than the control group in pronunciation**. Also, Hirata (2004) concluded that CAP is effective in improving the ability of

L2 learners in producing and perceiving Japanese pitch and durational contrasts. Hardison (2004) found **there were significant effects of computer-assisted training in the acquisition of L2 prosody and generalization to segmental accuracy and novel sentence**, and later suggested that meaningful contextualized input was valuable in prosody training when the measurement was at the level of extended connected speech typical of natural discourse (Hardison, 2005).

Findings about the effectiveness of CAP for stress patterns

There have been very few studies so far which test the effectiveness of CAP for stress patterns, and results to date have been varied. Michael (2006) reported that the teaching of different aspects of pronunciation, including word stress and sentence stress, has fallen far behind that of the four basic skills in English, and there is a need to conduct more studies to develop more techniques in teaching pronunciation. Derwing, Munro and Wiebe (1998) compared the effect of the segment-based approach involving the elicitation of individual sounds and syllables and the suprasegmental approach which focuses on larger units incorporating stress. The findings of the study revealed that both groups—one using the segmental approach and the other the suprasegmental—showed significant improvement in comprehensibility and accentedness on the sentences, and only the global group showed improvement in comprehensibility and fluency in narratives. Eskenazi (1999) found that the computer is useful in learning different aspects of language pronunciation such as stressed and unstressed words. On the other hand, Stenson, Downing, Smith and Smith (1992) argued that a group which used a CAP instruction for learning different pronunciation aspects including stress patterns did not improve significantly from pre-test to post-test compared to the control group which did not use the computerized pronunciation system.

There are also some studies which have **investigated learners' attitudes toward suprasegmental features such as stress**. Coniam (2002) explored EFL learners' attitudes toward suprasegmental phonological features in English, with particular reference to features associated with the concept of 'stress timing'. He reported that the participants found the session on stress timing quite accessible, and the use of the audio-digitizing software gave them a perspective that they were not able to appreciate before. Bott (2005) also investigated students attitudes toward computer-aided self-access pronunciation materials designed to teach stress in American English. Student comments implied that their awareness of features of stress in American English improved.

A review of literature about CAP revealed that there is a shortage of studies investigating the effect of CAP instruction on different aspects of pronunciation such as stress. Most studies are conducted on a limited number of participants (3 - 8 learners) over a limited period of time (such as three 45-minute sessions, or 10-20 minutes over 8 sessions) and have serious methodological **problems (e.g., conducting research on a single experimental group, limiting evaluating CAP to the investigation of participants' opinions about the programs, using unreliable scales of evaluating students' performance, and so forth)** which threatens their reliability. The present study avoids these shortcomings through examining a larger number of participants over a longer period using reliable and valid measurements, as is explained forthwith.

THE PRESENT STUDY

This study aimed at assessing the efficacy of computer-assisted pronunciation instruction, specifically a program with activities on improving the ability of EFL learners in a major aspect of suprasegmental features of the English sound system, stress, and investigating their attitudes toward the computer-based pronunciation instruction and activities. Specifically, the study tested the following hypotheses:

1. CAP instruction will be more effective than traditional instruction in learning stress patterns in English.
2. CAP instruction will be more effective than traditional instruction in learning stress patterns in the activity type.
3. Using real words will be more effective than unreal words in learning stress patterns.
4. Students will have a positive attitude toward the computer-assisted pronunciation instruction.
5. Students will have a positive attitude toward the computer-based pronunciation activities which are used in this study.

Setting

This study was conducted in the Department of English Language and Literature, College of Arts, King Saud University in the middle of Saudi Arabia. All students were males due to cultural values which support segregation in classes between males and females. They were enrolled in a BA program which aims to promote common humanitarian values and attitudes. Students in the program take several courses during which they are exposed to authentic patterns of English language. Students usually study for four years, and they work as EFL teachers or translators when they graduate. The department has adopted a new policy in presenting English language courses based on the integration of technology-enhanced methods and syllabuses into the ELT curriculum. A CALL center was established, and several language labs were built in the department. These were equipped with the state-of-the-art hardware and software packages such as *The Mouton Interactive Introduction to Phonetics and Phonology*, which is used in the present study.

Participants and design

The participants in this study consisted of 50 Saudi EFL learners. All of them were enrolled in advanced courses in English. They took listening and speaking courses through which they chatted orally with native speakers via the Internet. They also took some pronunciation courses such as phonetics and phonology. In the semester the study took place, they took literature courses during which they watched movies based on English novels and stories. They also joined an advanced Internet-based writing course during which they chatted synchronously and asynchronously with American students about different cultural topics. They were all non-native speakers of English and fluent in Arabic. They participated in this experiment as a regular class activity in an optional course of pronunciation. Students were divided into two groups randomly. Their total mean of GPA in English was 2.87/4 which is equal to "Good" or "C+" (Group 1 = 2.84, Group 2 = 2.90 which is "Good" or "C+"). Each student completed

a pre-treatment pronunciation test in order to find the level of knowledge of pronunciation in the experiment. The results of the test revealed no significant differences between the scores of the two groups (Group 1: mean = 3.3; Group 2: mean = 3.1) on the pre-treatment pronunciation test. The average number of years that the subjects had studied English was three years and six months at university level and seven years at school. The average skill level of the participants in their use of computer was six years. The age range of all participants ranged from 21 to 26 years old with a mean age being 21.5 years. Both groups were taught by the same instructor and used the same material.

A pre-/post-test control group research design was used in the study in order to find the effect of the method of teaching (**computerized or traditional instruction**) on the development of students' pronunciation ability. The participants were randomly assigned to one of the groups: the treatment group which was taught according to the computerized instruction and the control group which studied via traditional instruction. There were no significant differences in the performance of the two groups on the pronunciation pre-test: treatment group N = 26, M = 11.93, SD = 3.01; control group N = 24, M = 12.54, SD = 2.60. The experimental group was allowed to practice on the software individually over two sessions for 12 weeks over the semester for approximately 30 minutes each session.

Instruments

Instructional software

The *Mouton Interactive Introduction to Phonetics and Phonology* software is used in this study. It is an interactive program to phonetics and phonology which presents activities in a multimedia environment. It is an interactive dynamic course for students attending introductory and advanced courses in phonetics and phonology. According to Handke (2000), the program consists of a number of modules. The first is the phonetics module which contains all aspects of articulatory, auditory, and acoustic phonetics, including animations and sound examples. The second is the phonology section which includes many pronunciation aspects "such as the phoneme, distinctive features, non-linear phonology, optimality theory and the sound system of British and American English." **Finally, there are several accessory modules that have additional information such as bibliographical references and help facilities, a glossary of important linguistic terms, a text-editor to aid the student's use of the CD-ROM, the presentation component that introduces information in the field, and the interactive tutor which is one of the most important modules in the program, as it presents exercises and activities.**

The main screen of the system has the table of contents which leads to the relevant chapter when a button is clicked (see the Appendix). The program (Handke, 2000):

1. has a variety of pronunciation activities which has several difficulty levels depending on the level of the student,
2. has several exercises ranging from easy to advanced and provides feedback about training,
3. trains the skill of the student and monitors his individual progress,
4. allows the user to listen to the recorded material, and
5. develops awareness of the suprasegmental features of pronunciation such as stress.

Material and task description

The course in which the study took place was an advanced course in articulatory phonetics. It briefly introduced students to the basics of phonetics with a view to familiarizing them with the organs of speech, the English sound system, IPA system, and the classification of the English sounds in terms of their point and manner of articulation. The students were also introduced to the principles of segmental and suprasegmental analysis. Concepts such as phoneme, allophone, syllable, and intonation were also introduced briefly. The focus of the course was stress and its major types - lexical, shift, and weak – including a strong form in stressed position with a full vowel and a weak form in unstressed position with a weakened vowel or a syllabic consonant. Phonemic transcription, including the stressed syllable and the weak form, was also important as students learned how to transcribe English passages, using IPA notation. Students attended lab sessions where they used audiovisual material designed to improve their English pronunciation.

The activities and tasks used in the present study in studying stress were adopted from the instructional software, *The Mouton Interactive Introduction to Phonetics and Phonology*. Activity 6 was taken from Tanka, Most and Baker's (2004) *Interactions I: Listening and Speaking*, which contains contextual, authentic pronunciation drills such as listening to a dialogue and underlining stressed words or identifying the short form. The material for the experimental group was included on a CD-ROM, and the control group used the same material, but was not exposed to the software. It followed regular pronunciation instruction that included the same content that the computerized program covered, including nonsense words and phrases where the stress patterns in words, phrases, and sentences, were prescribed. The group used exercises from the printed version of *Interactions I: Listening and Speaking*. After students listened to them, they were asked to pronounce the words correctly and perform the dialogues. The control group received feedback equivalent to the feedback provided by the software.

Below are the activities and tasks that have been used in this study:

Activity 1: Identification of Stressed Syllables in Real Words

Students are given a real English word and asked to identify the syllable that carries the main stress. They then listen to the word with correct pronunciation and receive feedback from the system which assesses the user electronically. The student listens again and pronounces the word using the correct stress.

Activity 2: Stressed Syllable in Nonsense Words

Students are provided with a nonsense English word. They listen to the word by a native speaker, and they are then asked to identify the syllable that carries the main stress. The student is evaluated electronically by the program and provided with feedback about the word. The student listens again and repeats the word using the correct stress.

Activity 3: Stressed Syllable in Synthetic Words

Students are given synthetic words - non-existing sequences of English expressions. They then listen to the sentences / phrases by a native speaker. The student is asked to identify the syllables that carry the main stress. The student is assessed electronically by the pro-

gram and provided with feedback about the sentence. The student listens to and repeats the phrase using the correct stress.

Activity 4: Phonemic Transcription

A real English word is presented. The student has to transcribe phonemically the word and the syllable that carries the main stress using the virtual keyboard. He then listens to the word by a native speaker and says it. He is evaluated electronically by the program and provided with feedback about the answer (see the Appendix).

Activity 5: Weak Form Identification

Students are shown sentences that contain words that may be weakened because they occur in unstressed positions. The student has to mark these words via simple mouse clicks. The student then listens to the sentences by a native speaker and says them. The student is evaluated electronically by the program, and receives feedback about the sentence (see the Appendix). The sentences are rehearsed and then performed.

Activity 6: Stress Identification in Real-life Dialogue

Students are asked to read a dialogue and to mark the syllable that carries the main stress in the words which have a strong form with a full vowel because they occur in stressed positions. Students then listen to the dialogue by a native speaker and check for the correct answer. The dialogue is rehearsed and then performed. Below is an example of a task about this activity type:

Listen to the following dialogue and underline the stressed words (Tanka, Most, & Baker, 2004, p. 4):

Jack: Hi! How're you doing?

Peter: You're Jack, right?

Jack: And, sorry, you're...?

Peter: Peter. Peter Riley.

Jack: Oh, yeah, we met on campus last week. Peter, this is my friend, Ming Lee, She's just moved into the building.

Peter: Hi, Ming Lee.

Ming: Nice to meet you. You can just call me Ming. Lee is my last name.

Questionnaire and interview

In order to identify general student attitudes toward computer-assisted pronunciation instruction, an eight-item questionnaire was designed by the researcher. The questionnaire was intended to investigate students' attitude toward CAP instruction and the program used in the study. The items were:

1. Computer-assisted pronunciation instruction helps me to depend on myself in learning.
2. The pronunciation program is very easy to use.
3. Computer-assisted pronunciation instruction is interesting and useful.

4. The activities and exercises are suitable and useful.
5. The methods and techniques used in teaching are effective in improving stress patterns.
6. The feedback provided by the program is useful.
7. I would like to use the program again in learning features of pronunciation.
8. In general the program is good.

Moreover, to identify students' attitudes toward computer-based pronunciation activities, a six-item questionnaire which asked students about the effectiveness of the six task type was designed. The items were:

1. Identification of stressed syllables in real words
2. Stressed syllable in nonsense words
3. Stressed syllable in synthetic words
4. Phonemic transcription
5. Weak form identification
6. Stress identification in real-life dialogue

A five-point-Likert scale was used to evaluate these points ranging from 5-1 (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, 1 = strongly disagree). The questionnaire was evaluated with regard to suitability of rubrics, its contents, and assessment scale by two raters. Both were instructors of English as a foreign language. One of them was a native speaker and the other non-native. The participants answered the questionnaire to an independent examiner to keep them from giving positive answers and avoiding negative ones just to please their instructor. The external examiner told the students before completing the questionnaire that their answer would not in any way affect their results in the course.

To find the most effective way from the participants' point of view, informal individual face-to-face interviews that lasted for **five minutes were also conducted**. During the interview, the participants were asked three open-ended questions about computer-assisted pronunciation instruction, the program, and activities. The questions were:

1. What did you like/dislike about computer-assisted pronunciation instruction and activities?
2. What did you like/dislike about the program and activities?
3. What are your suggestions for improving the program and activities?

The open-ended questions were intended to give the participants more freedom in response and elicit information that was not given in the questionnaire.

Pronunciation test

Although the participants completed a pretreatment pronunciation test in order to determine the level of knowledge in pronunciation in the experiment, pronunciation was measured with a pre-test developed by the researcher. The participants were not told in advance that they would be tested again at the end of the course. The test consisted of the following six major questions about the main activity types used in this study:

- Question 1. Identification of stressed syllables in real words
- Question 2. Stressed syllable in nonsense words
- Question 3. Stressed syllable in synthetic words
- Question 4. Phonemic transcription
- Question 5. Weak form identification
- Question 6. Stress identification in real-life dialogue

Each of these questions was given equal weight in the assessment scale (ten grades). The overall score of each student was calculated with reference to each of the seven activities (a total of 60 grades). There were ten oral production questions for each of the first four activities. For the fifth and sixth questions, students were assigned a dialogue and asked to present it.

The test was validated by the same two raters with reference to clarity of instructions, content, and scale of rating. They suggested several things such as modifying the assessment scale for the fifth and sixth questions to become a 5-point-Likert type scale with regard to producing stress patterns at different levels of communicative competence:

- 9-10 = has full communicative competence;
- 7-8 = has almost full communicative competence;
- 5-6 = has partial communicative competence;
- 3-4 = has very limited communicative competence;
- 1-2 = has no communicative competence.

The test was field-tested on a pilot study and the internal consistency of Cronbach's alpha reliability for the test instrument was determined to be .88 which is acceptable from a statistical point of view. In order to assess their presentations later by independent raters, students were videotaped while they were answering the questions of the exam. To establish inter-rater reliability, 10% of the presentations were selected randomly and scored separately by each of the two raters. They discussed differences until consensus was reached. Finally, each of the raters assessed the test, and the inter-rater reliability was found to be .91 which meets statistical standards.

Procedure

The experimental procedure consisted of the following seven phases:

1. There was a survey of personal information for all students who participated in this study about age, using a computer, period of studying English, and GPA. The instructor demonstrated to each of the participants in the treatment group how the program was used.
2. Each student completed a pretreatment pronunciation test in order to determine the level of pronunciation knowledge in the experiment.
3. Students took a pre-test in order to allow comparison with post-test performance.
4. The experiment was conducted. Computerized instruction was used with the treatment group while conventional methods were used with the control group.

5. Following the experiment, a post-test was administered.
6. Participants in the treatment group answered a questionnaire about the effectiveness of computer-assisted pronunciation instruction, the program, and the activities.
7. Finally, members of the treatment group were interviewed about the computer-based pronunciation instruction, program, and activities.

Statistical Analysis

Means and standard deviations of the overall score of each student were calculated with reference to the pronunciation activity type. A t-test was used to see if there were any significant differences between the two groups with regard to their results on the pre- and post-tests at the $p < .05$ level, with method of teaching, computerized or conventional instruction, being the independent variable and scores on the pronunciation test being the dependent variable. In order to identify the general student attitude toward the program and activities, students' responses for each of the items in the first section of the questionnaire were counted, and the mean and standard deviation for each item and for the total were calculated. For all descriptive and inferential statistics, SPSS was used.

Results

The first hypothesis I dealt with was "CAP instruction will be more effective than traditional instruction in learning word stress in English". Table 1 shows means and standard deviations for the treatment group and control group on the pronunciation post-test.

The findings in Table 1 indicate that the treatment group which used the computerized pronunciation instruction outperformed the other group which used the regular instruction on the stress post-test (mean score = 36.19 and 31.17 respectively). The t-test was run, and it was found that these results were significant at the $p < .05$ level.

The second topic I dealt with was about the effect of the method of teaching (computerized or traditional instruction) on the development of students' abilities on the different types of activities used for teaching pronunciation in this study. Table 1 presents the number of students, means, and standard deviations for the treatment and control groups on the type of activity on the post-test. The descriptive statistics shown in the table reveal that the computerized instruction method achieved higher results with reference to task type than the traditional method did. However, the t-test revealed that there were no significant differences between computerized instruction and conventional instruction attributed to the first four task types while the findings were significant for the last two activity types at the $p < .05$ level, which shows that activities based on meaningful words-in-sentences context were found to be more effective than synthetic words-in-sentences contexts or (un)real words-in-isolation contexts.

When the results of the treatment groups are compared descriptively with regard to activity type, a certain pattern emerges for most of the activities. Activities including words-in-sentence context had the highest means (total mean = 5.97). For example, Activity 6 "Stress Identification in Real-life Dialogue" had the highest mean (7.54). The second highest mean (6.77) was for Activity 5 "Weak Form Identification". On the other hand, the activi-

Table 1. Activity Type, Number of Students, Means, and Standard Deviations for the Treatment and Control Group on the Pronunciation Post-test

No.	Activity	Group	N	Mean	Std. Deviation
1	Identification of Stressed Syllables in Real Words	computerized	26	5.65	1.65
		traditional	24	5.25	2.09
2	Stressed Syllable in Nonsense Words	computerized	26	4.96	3.16
		traditional	24	4.83	3.05
3	Stressed Syllable in Synthetic Words	computerized	26	5.54	2.80
		traditional	24	4.71	2.39
4	Phonemic Transcription	computerized	26	5.73	2.71
		traditional	24	5.29	2.14
5	Weak Form Identification	computerized	26	6.77	1.77
		traditional	24	5.42	2.30
6	Stress Identification in Real-life Dialogue	computerized	26	7.54	2.08
		traditional	24	5.67	2.53
Total		computerized	26	36.19	4.13
		traditional	24	31.17	5.83

ties based on words-in-isolation context had the lowest mean (total mean = 5.29); see, for instance, Activity 1 "Identification of Stressed Syllables in Real Words" and Activity 2 "Stressed Syllable in Nonsense Words" (mean = 5.65 and 4.96 respectively). The t-test revealed there were statistically differences between differences between activities including words-in-sentences context and the activities based on words-in-isolation context at the $p < .05$ level.

I also compared students' scores on the pronunciation post-test with regard to task type. Activities were grouped into two major categories: activities including real words, phrases or sentences ("Identification of Stressed Syllables in Real Words", "Phonemic Transcription", "Weak Form Identification", and "Stress Identification in Real-life Dialogue") and activities based on unreal words or sentences ("Stressed Syllable in Nonsense Words", and "Stressed Syllable in Synthetic Words". Table 2 presents the results of all students who participated in this study with regard to task type (real or unreal words, phrases, and sentences).

Based on Table 2, activities that contained real words, phrases, or sentences got a higher mean (5.94) than activities based on unreal or synthetic words (mean = 5.02). Table 1 also supports this finding and shows that activities based on real words, phrases, or sentences

like Activity 6 “Stress Identification in Real-life Dialogue”, Activity 5 “Weak Form Identification”, and Activity 4 “Phonemic Transcription” got the highest means (G1= 7.54 and G2 = 5.67, G1 = 6.77, and G2 = 5.42, and G1 = 5.73 and G2 = 5.29 respectively). On the other hand, the lowest means were for Activity 3 “Stressed Syllable in Synthetic Words”, and Activity 2 “Stressed Syllable in Nonsense Words” (means: G1 = 5.54 and G2 = 4.71, and G1 = 4.96 and G2 = 4.83 respectively). A t-test was run, and it was found that these findings were significant at the $p < .05$ level.

Table 2. Means and Standard Deviations of all Students in Activities Including Real and Unreal Words

Activity	Mean	Std. Deviation
Real words	5.94	1.07
Unreal words	5.02	1.82

The fourth hypothesis the study dealt with was “Students will have a positive attitude toward the computer-assisted pronunciation instruction”. For this purpose, an eight-item questionnaire about the effectiveness of the program based on a five-point-Likert scale was designed. Table 3 presents the results of the questionnaire (means and standard deviations of the eight items) about students evaluation of the instructional software used in this study.

Table 3. Students’ Attitude toward the Instructional Software Used in this Study

No.	Item	Mean	Std. Deviation
1	Computer-assisted pronunciation instruction helps me to depend on myself in learning	3.92	.93
2	The pronunciation program is very easy to use	4.12	.77
3	Computer-assisted pronunciation instruction was interesting and useful	3.30	1.07
4	The activities and exercises were suitable and useful	2.69	.93
5	The methods and techniques used in teaching are effective in improving stress patterns	4.08	.74
6	The feedback provided by the program is useful	4.15	.78
7	I would like to use the program again in learning features of pronunciation	4.27	.72
8	In general the program is good	4.35	.94

Table 3 shows that students had a positive attitude toward the program and believed it was generally good. Item 8 "In general the program is good" got the highest mean (4.35), which shows that students had a general positive attitude toward the program. Conversely, other items like Item 4 "It has suitable and useful activities and exercises" noticeably had a low mean (2.69), which signifies that some students found the activities and exercises unconvincing. However, these means still show a positive attitude toward computer-assisted pronunciation instruction and the program used in the study.

The next question I dealt with was related to students' attitude toward the activities used in teaching the stress aspect of pronunciation. Table 4 presents means and standard deviations with reference to task type.

Table 4. Students' Attitudes toward the Activities Used in Teaching the Features of Pronunciation

No.	Activity	Mean	SD
1	Identification of Stressed Syllables in Real Words	4.04	1.22
2	Stressed Syllable in Nonsense Words	1.85	.73
3	Stressed Syllable in Synthetic Words	2.61	.57
4	Phonemic Transcription	4.23	.91
5	Weak Form Identification	4.46	.71
6	Stress Identification in Real-life Dialogue	4.58	.64
Total		3.63	0.80

The results in Table 4 reveal that most participants in the experimental group had a relatively positive attitude toward task type (mean = 3.66). It is also noticed that some items received markedly higher means than the total mean. For example, the highest mean (4.58) was for Activity 6 "Stress Identification in Real-life Dialogue". This was followed by Activity 5 "Weak Form Identification" (mean = 4.46). On the other hand, Activity 2 "Stressed Syllable in Nonsense Words" got the lowest mean (mean = 1.85). The next lowest mean (2.61) was for Activity 3 "Stressed Syllable in Synthetic Words". These results confirm that students preferred language to be taken from authentic situations.

The second part of the investigation of students' attitude toward computer-assisted pronunciation instruction, the program, and activities used in the study was the interview which contained three open-ended questions about advantages, disadvantages of the computer-assisted pronunciation instruction, the program, and activities. Most students reported that they found computer-assisted pronunciation instruction to be effective and they were able to use the program "efficiently by themselves after one week" from the beginning of the study. They also stressed the importance of the activities and the exercises which have different levels of difficulty. One of the students provided an exaggerated

answer when he said that, "In the future I think the computer will replace the teacher in teaching". Another student said, "I can say I no longer need a teachers in pronunciation because the program is very very very easy to use it" [sic].

However, most students (22 comments) complained about the frequent appearance of an error message which told them that the program did not respond. Moreover, most students also commented about the exercises based on "unreal words". One of the students said, "I wanted the program giving examples based on real English" [sic]. Students also have a major complaint about words-in-isolation contexts exercises. Eighteen students raised questions about the advantages of these activity types for the process of learning English. Some students also criticized the way the program was presented when it occupied the whole screen and did not allow other files to work simultaneously or even to be seen though this is related to the user, not the structure of the program. Another student suggested, "...adding a recorder to the program to record my voice and listen to it to know my errors [sic]."

DISCUSSION AND CONCLUSION

Based on the findings of this study, it can be suggested that computerized instruction is more functional in teaching stress patterns than more traditional methods. This finding is supported by research done to investigate the effectiveness of computer-based pronunciation instruction. For example, Hirata (2005) found that CAP training was effective in improving the ability of L2 learners to produce and perceive different aspects of pronunciation. Similarly, the findings reported by Raux and Kawahara (2002) showed that computerized pronunciation instruction and programs were effective because they provide meaningful feedback to the learners on their strengths and weaknesses. Stibbard (1996) also concluded that technological advances such as computerized facilities aided the development of learners' self-monitoring skills in learning different language areas like pronunciation. Moreover, the findings of Rostron and Kinsell's (1995) study showed that all participants who trained using computerized pronunciation program in their study made improvements and outperformed the control group on the pronunciation test.

The results of the present study also show that as students used activities including authentic-examples contexts (real words, phrases, or sentences), they achieved slightly higher scores on the pronunciation post-test than activities based on unreal single words or non-existing sequences of English words. This finding supports using the approach of meaningful communication in learning pronunciation aspects of English sound system. In the same way, Morley (1991) recommended giving detailed attention to suprasegmental features of pronunciation and their functions in interactive discourse and stressed their application in communicative approaches to pronunciation learning and teaching. Cheng (1998) also argued that teachers should choose meaningful material to be used as models for practicing pronunciation aspects like stress, and students achieved higher results on activities based on words-in-sentences contexts than words-in-isolation contexts. Providing students with a variety of connected speech context directs their attention to the overall utterance, not to how the word or segment in isolation is uttered. This conclusion is also supported by Hirata (2005) who found that trained groups who used computerized instruction made robust improvement in words-in-sentences contexts.

The findings of the current study reveal that students had a positive attitude toward computer-based pronunciation instruction, the program, and the activities used in this study. This finding is also supported by other research done to identify student attitudes toward the integration of computer-based training instruction and programs into the pronunciation curriculum. For example, Bott (2005) observed that participants' reactions to each unit of a computer-aided pronunciation program were very positive as they said that the program was easy to use, enjoyable, clear, and provided up-to-date information. Similarly, Sullivan and Czigler (2002) reported that students found a computer-based pronunciation course to be an ambitious undertaking, and they had a positive attitude toward the experiment tasks and activities. Coniam (2002) also drew the conclusion that the participants found the session on stress timing quite accessible, and the use of the audio-digitizing software gave them a perspective that they were not been able to appreciate before. Moreover, Rostron and Kinsell's (1995) study indicated that the participants in their study felt that the computer-based pronunciation instruction improved their pronunciation of Italian and helped them in developing vocabulary. Finally, Lasagabaster and Sierra (2003) concluded, "students clearly see [the] software program as a complementary tool in the foreign language classroom" (p. 293).

However, it is noticed that Item 4 "The activities and exercises were suitable and useful" got a low mean. Likewise, students had a negative attitude toward Activity 2 "Stressed Syllable in Nonsense Words" and Activity 3 "Stressed Syllable in Synthetic Words" in their evaluation of the activities and exercises of the program. These findings are in harmony with the results reported in the open-ended questions. For example, most students complained about using unreal words, synthetic words, and ill-formed words in learning pronunciation. They suggested replacing these activities with examples from authentic English. Hirata (2005) suggested, "L2 learners must also integrate the acquired phonetic and phonological knowledge into the use of language for meaningful communication" (p. 372).

The findings of this study should be interpreted with caution for the following reasons. Firstly, the results are limited to using specific software. Secondly, the questionnaire included a limited number of items, and a more detailed attitude questionnaire is required to investigate students' attitudes toward different aspects of computer-based pronunciation instruction, programs, and activities; it may include investigating instructors' opinions and more items about different aspects of each activity of the program. Thirdly, although the number and period of time were larger than that of many other studies, the current research was conducted on a relatively limited number of students, and there is a need for other studies to be conducted on a greater number of students over even longer periods. Fourthly, both the experimental and control group were taught by the same person, the researcher, which is not an ideal situation considering the possibility of bias.

The findings of the study may lead to further studies using the same method to address different features of pronunciation such as intonation. Moreover, it is interesting to examine whether other computer-based training methods, techniques, and computerized programs can yield the same results as those found in this study with regard to teaching different features of pronunciation like stress.

In conclusion, this study yielded four major findings. First, the students who participated in the computerized pronunciation training achieved better results in their overall test

scores than the control subjects did on the stress tasks. There were also significant differences for tasks including activities based on meaningful words-in-sentences context over other task types. Third, activities based on real words, phrases or sentences received higher scores than those including unreal or non-existing sequences of English words or sentences. The final finding concerned students' attitudes, revealing that students in the experimental group generally had a positive attitude toward the computer-based pronunciation method, the program, and the activities used in the study.

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Appendix: Figures and Tables

Figure 1. A Screenshot of the Table of Contents

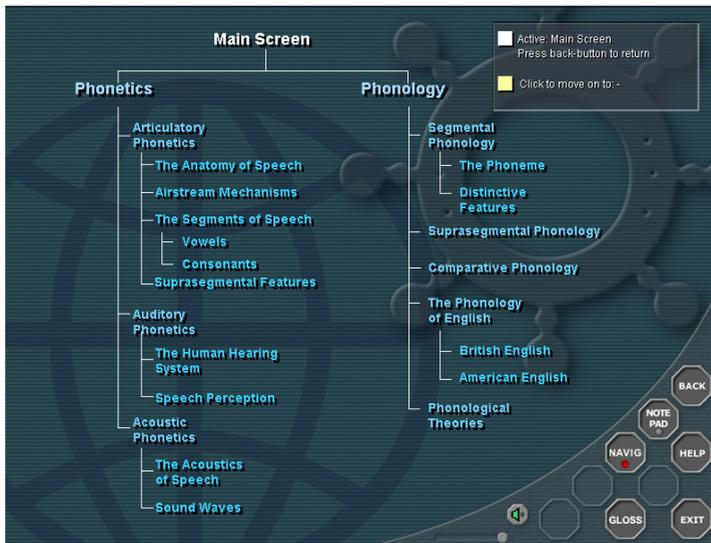


Figure 2. A Screenshot of Activity 4 - Phonemic Transcription

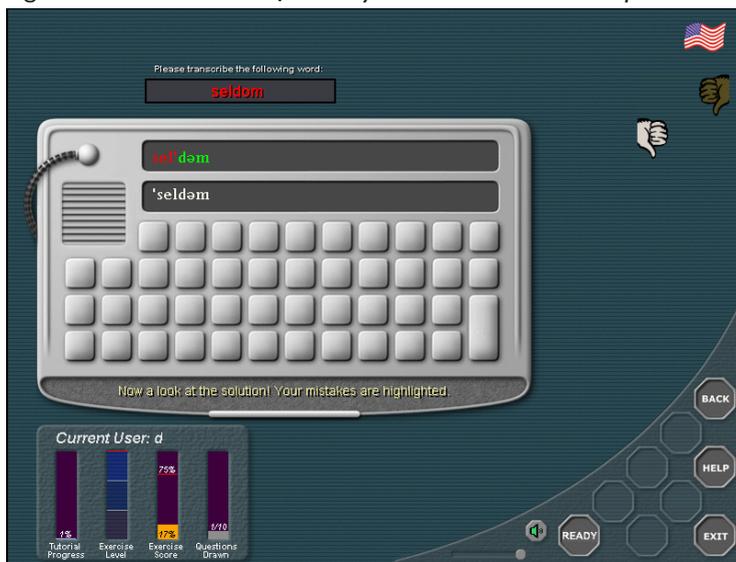


Figure 3. A Screenshot of Activity 5 - Weak Form Identification

