The Effectiveness of a Training Program Based on Features of Connected Speech in an Adaptive Learning Environment in Listening Skills among EFL Majors

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Abstract:

The current study aimed at investigating the effectiveness of a training program based on features of connected speech in an adaptive learning environment in listening skills among EFL majors. To meet such an end, the randomized pretest-posttest control group design was adopted. Participants, totaling 66 third year EFL majors at the Faculty of Education (Cairo), Al-Azhar University, were randomly selected and assigned into an experimental group (N=33) receiving the experimental treatment and a control one (N=33) receiving no instruction. Consequently, the researcher developed a listening skills checklist and a listening skills test which was administered after verifying its validity and reliability. Moreover, an adaptive learning environment was developed according to the level of proficiency, low, mid and high. More specifically, the researcher developed, firstly, the training program which comprised ten features of connected speech for the three levels, secondly, three scenarios, one for each level, to be transformed digitally by programmers. The results of the independent sample *t*-test revealed the outperformance of the experimental group students (mean=24.39) over those of the control one (mean=13.60). Furthermore, Eta squared ($\eta 2$) results showed a large effect size (.560) on the listening skills of the experimental group students. Such results indicated that the experimental treatment was effective in developing the third year EFL majors' listening skills and that 56% of the effect size could be attributed to the training program. The study recommended the need for instructing the features of connected speech in adaptive learning environments to develop the listening skills among EFL majors and suggested designing such environments according to more variables containing more features of connected speech and targeting different participants.

Keywords: features of connected speech, adaptive learning environments, EFL majors, listening skills.

فاعلية برنامج تدريبي قائم على خصائص الكلام المتصل في بيئة تعلم تكيفية في مهارات الاستماع لدى طلاب شعبة اللغة الإنجليزية كلغة أجنبية

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المستخلص:

هدفت الدراسة الحالية إلى التعرف على فاعلية برنامج تدريبي قائم على خصائص الكلام المتصل في بيئة تعلم تكيفية في مهارات الاستماع لدى طلاب شعبة اللغة الإنجليزية كلغة أجنبية. لتحقيق الغرض من الدراسة، تبنى الباحث التصميم التجريبي لمجموعتين مستقلتين أحدهما تجريبية والأخرى ضابطة. تم اختيار وتوزيع 66 طالبا بشعبة اللغة الإنجليزية، كلية التربية بنين بالقاهرة، جامعة الأزهر، بطريقة عشوائية على مجموعتين تجريبية وعددها (33) و ضابطة وعددها (33)؛ حيث تلقت الأولى المعالجة التجريبية بينما لم تتلقى الأخيرة أية معالجات. وقد قام الباحث بإعداد قائمة بمهارات الاستماع اللازمة لدى عينة الدراسة، وإختبار استماع تم تطبيقه قبليا وبعديا بعد التحقق من صدقه وثباته. كما تم إعداد مادة المعالجة التجريبية، وتتمثل في بيئة تعلم تكيفية والتي بنيت على أساس مستوى الكفاءة اللغوية، مبتدئ، ومتوسط، ومتقدم، وذلك على مرحلتين: تضمنت المرحلة الأولى تصميم البرنامج التدريبي والذي احتوى على عشرة خصائص للكلام المتصل، بينما تضمنت المرحلة الثانية تصميم ثلاثة سيناريوهات، واحدا لكل مستوى من المستويات، وذلك بغرض المعالجة الرقمية للمحتوى. وقد أسفرت نتائج اختبار (*t*) لعينتين مستقلتين عن تفوق طلاب المجموعة التجريبية بمتوسط (24.39) على طلاب المجموعة الضابطة بمتوسط (13:60). كما أظهرت نتائج (η2) Eta حجم أثر كبير (560.) في مهارات الاستماع لدى طلاب المجموعة التجريبية، الأمر الذي يشير إلى فاعلية المعالجة التجريبية للدراسة الحالية في تنمية مهارات الاستماع لدى طلاب شعبة اللغة الإنجليزية كلغة أجنبية، وأنه يمكن اعزاء 56% من حجم أثر المعالجة إلى البرناج المقدم. وخلصت الدراسة إلى بعض التوصيات والمقترحات، والتي تتمثل في استخدام بيئات التعلم التكيفية في تدريس خصائص الكلام المتصل لتنمية مهارات الاستماع لدى طلاب شعبة اللغة الإنجليزية كلغة أجنبية؛ حيث إنها تستجيب لخصائص الجيل الرقمي " Gen Z"، وتوفر بيئة تعلم فردية لكل متعلم بما يتناسب مع خصائصه ويلبي حاجاته ويعزز نموه وتقدمه، بالإضافة إلى تصميم بيئات تعلم تكيفية بناءا على مزيد من المتغيرات، بحيث تحتوي على مزيد من خصائص الكلام المتصل مستهدفة مشاركون أخرون.

الكلمات المفتاحية: خصائص الكلام المتصل، بيئات التعلم التكيفية، طلاب شعبة اللغة الإنجليزية كلغة أجنبية، مهارات الاستماع.

Introduction

Listening plays a fundamental role and is of paramount importance in foreign language learning because the key to acquire a language is to receive language input appropriately (Abdul-Aal, 2019; Abdul-Aal, & Solyman, 2019; Gilakjani, et al., 2016 & Rost, 1994). Language acquisition takes place only when students absorb enough comprehensible input. Hamouda (2013) stressed the importance of listening as a main source for acquiring understandable input. He further claimed that learning will not take place if there is no input. Without understanding inputs at the right level, any kind of learning simply cannot occur. Krashen (1982) suggests that the most important skill to be mastered in language learning is listening since writing and speaking will come naturally after listening is mastered enough in his "Natural Order of Acquisition Hypothesis".

Moreover, listening is essential for effective communication as it is the language modality that is used most frequently (Miller & Flowerdew, 2005 & Renukadevi, 2014). According to Schwartz (1998) and Gilakjani & Ahmadi (2011), adults spend almost half their communication time listening where listening takes up 40- 50%; speaking, 25-30%; reading, 11-16%; and writing, about 9%. They added that students may receive as much as 90% of their in-school information through listening to instructors and to one another.

Listening, furthermore, provides the right conditions for the development of other language skills (Hasan, 2000 & Renukadevi, 2014). Listening, therefore, is essential not only as a receptive skill but also to the development of spoken language proficiency. Rost (2002) and (2011) indicated that developing proficiency in listening is the key to achieving proficiency in speaking. He added that only a good listener can be a good speaker. Nobody has been loaded or programmed with good speaking skills at the time of birth. A baby starts speaking only by listening to the words spoken by his family members. Renukadevi, (2014) and Ziane (2011) asserted that learners cannot develop their speaking ability unless they develop their listening skills. They added that if a learner has a good listening ability in English language, it would be very easy for him\her to listen to the radio, to study, watch films, or communicate with foreigners. There is a relationship between listening to a language and learning it. Thus, learners should have a lot of practice and exposure to English in order

to develop this ability. Consequently, learners need as much exposure to English language as possible.

According to Bouach (2010), listening is useful for learners' pronunciation. That is, when learners are more exposed to spoken English, they can more know and get used to its intonation, stress, redundancy, and clusters. In addition to fostering pronunciation, listening helps learners to develop their grammar and vocabulary as well. Howatt and Dakin (1974) pointed out that among the essential skills the effective listener should be capable of is to understand the speaker's accent or pronunciation.

However, one of the most difficult skills for foreign language learners while listening is to understand the speaker's accent or pronunciation due to the unavoidable presence of features of connected speech in authentic speech (Khaghaninezhad and Jafarzadeh, 2014). Aquil, (2012), Abdul-Aal, (2019) and Wong et al., (2021) considered features of connected speech such as stress, intonation and linking as one of the main reasons for this difficulty. Many EFL learners often have considerable difficulty in comprehending the authentic language when they communicate with native speakers, watch television or listen to radio (Aquil, 2012 & Laoubi, 2019). This is because learners might not recognize words they know while listening to native speakers because of features connected speech (Christine, 2002; Chen, 2002 & Chen, et al., 2021).

Features of connected speech are central to meaning making and comprehension in speaking and listening contexts, because such features accentuate the most significant part of the message and signify where listeners should pay particular attention (O'Neal, 2010; Gilakjani, 2011; Sawaengmongkon, 2013; Ladefoged & Johnson, 2014 & Zarifi & Sayyadi, 2015). Any change in features of connected speech can cause a change in utterance meaning (Gilakjani, 2011 & Ladefoged & Johnson, 2014).

The term "connected speech" refers to "the changes in pronunciation that happen when words come together and are linked to the words around them." (Marla, 2014, p.147). Put simply, it is the way speakers really use the language in daily contexts (Crystal, 2011). Features of connected speech entail unstressed vowels, omitted sounds, and other alternation of the full form (Cele-Murica, et al.,

1996 & Chen, et al., 2021). Researchers use different terms to refer to the same phenomenon such as "sandhi forms" (Crystal, 1997), "weak forms" (Ur, 1984), "reduced forms" (Brown & Hilferty, 1986), and "connected speech" (Christine, 2002).

The naturally occurring speech of native speakers is mostly rapid and continuous with frequent linking, sound alteration, or reduction at word boundaries, which may cause comprehension difficulty when non-native speakers listen to it if not trained on how to process such natural speech (Brown and Kondo-Brown, 2006).

Natural English, whether formal or informal, is full of "features of connected speech", and this creates a serious obstacle for students who have little or no exposure to "features of connected speech" (AlAmeen, 2014 & Rosa, 2002). This is because non-native speakers find "features of connected speech" very different from what they would have normally heard before in language classrooms, where the speech from teachers and audio materials are typically carefully or slowly articulated (Ito, 2006). As a result, students cannot segment speech while listening to native speakers which makes listening difficult (Sun, 2002).

The use of features of connected speech is extensive as approximately 60% of words in a corpus of 88,000 American English word tokens were spoken with features of connected speech (Johnson, 2004 & Nokes, 2018). Hence, the challenge that connected speech poses for foreign language learners has been long noted in perception and production alike (Bybee, 2013). Given the difficulty of instructing listening in general contexts, it is no surprise that when instructors have been faced with the added challenge of features of connected speech instruction, they have chosen to ignore it (Nokes, 2018).

A few researchers have studied the role of teaching "features of connected speech" on perception (Ahmadian and Matour, 2014; Brown and Hilferty, 2006; Carreira, 2008 & Abdul-Aal, 2002). When Thomson and Derwing (2015) examined the researchers' choices of focus of instruction in the past and current trends in pronunciation pedagogy, it was revealed that features of connected speech were investigated in only 23% of these studies. (e.g., Gomez Lacabex and Garcia Lecumberri 2009; Harris 2002; Yanli 2008 & Muller Levis and Levis 2012).

Compared to the teaching of the other skills, teaching listening is more expensive since it requires special equipment such as tapes or CD players, computer software and hardware, language laboratories…etc. Moreover, teaching learners listening skills may be difficult for both teachers and learners who suffer from poor listening skills to learn as well. For instance, even the learners who are adequate in speaking and reading might confront problems with listening when facing a record with a quick conversation (Ghaderpanahi, 2012 & Ahmad, 2016). This necessitates abandoning traditional education and searching for more effective ways for teaching such skills.

Traditional educational systems tend to adopt a "one size fits all approach" and deal with all students in the same manner. As a result, this raises many problems since they are students with different levels of knowledge, goals and preferences, characteristics, learning styles and multiple intelligences (Gohar, & El-Ghool, 2016). Moreover, the levels of difficulty of the content can make students feel more confident, when it is too easy, or frustrated, when it is too difficult, depending on their own level of prior knowledge (Oxman, & Wong, 2014). Meanwhile, the cost of having one teacher for each student is very high, so it is not easy to provide personalized learning in such an environment (Oxman, & Wong, 2014 & Bingham, 2018).

In the modern digital era, it is important for teachers to employ technology in the classroom to engage students in instruction promoting listening skills (Hett, 2012). Today's digital world, similar to real life, allows multisensory processing of new information through presenting a combination of texts, graphics, images, audios and videos, so learners can pick up knowledge via different modes of perception (Shapran et al., 2011).

Adaptive educational environments overcome the problems that traditional educational systems cause by using a flexible generated model to dynamically adapt the learning environment for each student in a manner that best supports his/her needs (Gohar, & El-Ghool, 2016). On one hand, Adaptive learning, based on the premise that each student is an independent and unique human being, and that "one size does not fit all", provides the supportive environment that allows each student to have access to a personalized learning that caters for one's level, needs and interests (Cator, 2013). In his study, VanLehn (2011) investigated the relative effectiveness of human tutoring, intelligent

tutoring systems and other tutoring systems and concluded that some adaptive environments were nearly as effective as "one-on-one human tutoring". On the other hand, adaptive learning environments, manipulating technological advancements, can be utilized to develop education (Zhang, & Nunamaker, 2003). Put simply, the vast and fast development of information and internet technologies made adaptive environments more effective and efficient, and easier to be created (Fischman, 2011).

Adaptive learning environments personalize the teaching process through pointing and meeting the needs of individuals using the data collected during this process which results in improving the student's performance (Cator, 2013). Moreover, Students' individual differences can be met easily through the numerous variations that can be offered online or electronically through the adaptive learning environments (Gohar, & El-Ghool, 2016). As a result, it improves learner's satisfaction with the courses and motivates them to carry on and keep up (Dagger, et al., 2005).

Moreover, some adaptive learning environments take into consideration the learning style of the student, if they prefer text or audio, or video, or an online book. By doing so, the drop-out rates decrease, the effectiveness in learning increases and there are higher results in learning achievements (Oxman, & Wong, 2014).

In adaptive learning environments, the preferences, background characteristics, prior knowledge of each individual can be interpreted by the system efficiently with the help of technology. The system keeps the student's personal profiles, and based on them, adjusts course to the student by providing different levels and presenting each topic, a series of skills and building blocks to master the concepts (Fischman, 2011 & Tyton,2021). Adaptive learning environments can provide adaptive content in accordance with the current situation of each learner from distributed sources in no time. It includes animation, videos, interactive diagrams and other web-based features entered when needed by students (Fischman, 2011).

Adaptive learning environments provide opportunities for teachers to apply a range of methods. Teachers can either use problem-based instruction, case reasoning, etc. Moreover, instructors are provided with opportunities to weigh the material so that students are directed to high weighted materials to study. In adaptive learning

systems, the instructor decides the proficiency level and students do not move forward until they achieve that level. Finally, instructors are informed about the students' process so that they can analyze in which content students face difficulties, by which source they overcome these problems, etc. (Kara, & Sevim, 2013 & Rosita et al. 2016).

Adaptive learning is mainly based on the constructivist theory and the theory of cognitive flexibility (Liu, et al, 2017). Adaptive learning environments emphasize constructivist paradigm and meet the assumptions of constructivism as the constructivist learning environment emphasizes learner control (Cecilia et al. 2016 & Ertmer & Newby, 1993).

Adaptive learning is the manipulation of technology to help students in individualizing their learning process (Francois, 2023& Wang 2016). Adaptive learning is a learning process where the content taught or the way such content is presented differs, or adapts, based on the responses of the individual student (Oxman & Wong, 2014). In other words, adaptive learning does not change the behavior of the students by giving reinforcement or force them to follow the start at the same place and follow the same path. Instead, it provides a personalized learning environment for all learners, both by adapting presentation and navigation through the course materials (Retalis & Papasalouros, 2005 & Hsu 2015).

Adaptive learning can be designed according to many different ability and aptitude variables such as intellectual style, cognitive styles, learning styles, prior knowledge, self-efficacy, multiple intelligences, anxiety, motivation and locus of control (Khamis, 2015).

The main goals of adaptive environments include delivering the right content, to the right person, at the proper time, presenting flexible instructional variations, providing instructional pathways that can accommodate different learning styles and learning strategies, monitoring educational processes, generating reports and providing guidance more effectively, providing formative intelligent feedback (Khamis, 2015).

As such, adaptive learning environments hold considerable potential in developing EFL students' listening skills through raising their awareness of features of connected speech. Thus, the current

study is suggesting an adaptive learning environment based on features of connected speech to develop listening skills among EFL majors.

The Study Purpose

The current study aimed at investigating the effectiveness of a training program based on features of connected speech in an adaptive learning environment in listening skills among EFL majors at the Faculty of Education for Boys (Cairo). The researcher conducted a pilot study during the academic year 2020\2021 to identify the difficulties in listening skills among the third year EFL majors at the Faculty of Education for Boys (Cairo), Al-Azhar University. The pilot study was based on four main phases, namely, the researcher's own experience, the results of the previous studies, semi-structured interviews and the content analysis of the phonetics course at the Faculty of Education for Boys (Cairo), Al-Azhar University. The results of the pilot study revealed that EFL majors at the faculty of Education for Boys (Cairo), Al-Azhar University lack the ability to comprehend natural spoken English by native speakers when watching a video or listening to a recording, even though they have been acquainted with the words before. This is because they lack the knowledge and use of features of connected speech which might hinder them from making progress in listening skills and lead to breakdowns or even failure in communication. Moreover, the researcher found out that features of connected speech exist as a part of the syllabus, but they are never or slightly covered in class according to what the students revealed during the interviews. That was supported by the literature and previous studies which strongly highlighted the need for more research on how to enhance EFL learners' listening comprehension and perception of connected speech through raising their awareness of connected speech (e.g., Abdul-Aal, 2005; Al Samarrai' & Al Nasir, 2009; Anderson-Hsieh, 1994; Ahmadian & Matour, 2014; Brown, 2006; Brown & Hilferty, 1986; Carreira, 2008; Celce-Murcia, et al., 2010; Eskenazi, 1999; Hahn, 2004; Hamad, 2014; Hamouda, 2017; Hazan et al. 2016; Levis, 2007; Laoubi, 2019; Meghlaoui, & Meriem, 2017; Neri et al., 2002&2008; Nishi & Kewley-Port, 2007 & 2008; Shamiry, 2008)

Thereupon, the researcher sought to answer the following key research question:

1- What is the effectiveness of a training program based on features of connected speech in an adaptive learning environment in listening skills among EFL majors?

The Study Hypotheses

To answer the question of the study, the following hypotheses were postulated:

1- There will be no statistically significant difference at (0.05) level between the mean scores attained by the experimental group learners and those of the control group in the posttest of listening skills.
2- There will be no statistically significant difference at (0.05) level between the mean scores attained by the experimental group learners in the pre/posttest of listening skills.

Methodology:

Study Design

The researcher adopted an experimental design, the pretest-posttest control group design (see figure 1 below), to investigate the effectiveness of a training program based on features of connected speech in an adaptive learning environment in listening skills among EFL majors at the Faculty of Education for Boys (Cairo), Al-Azhar University.

Figure 1

The Randomized Pretest-Posttest Control Group Design

		Pretest	Experiment	Posttest
Participants Randomly assigned to	Experimental group N = 33	O_1	X_1	O_2
	Control group N = 33	O_1	-	O_2

Note: (O_1) represents the pretest of the study instruments;

(X_1) represents the treatment condition;

(-) means that the control group received no instruction; and

(O_2) represents the posttest of the study instruments.

Participants of the study

The population of the current study was the majors of English as a Foreign Language (EFL Majors) at the Faculty of Education for Boys (Cairo), Al-Azhar University. Generally, they join Faculty when they are 18 and graduate at the age of 22. Randomly selected 66 students at the Faculty of Education for Boys (Cairo), Al-Azhar University participated in the present study for the data collection purposes. The participants were randomly assigned to an experimental group of 33 that were treated with the training program based on features of connected speech in an adaptive learning environment, and a control group of 33 that received no instruction.

Instruments of the Study

To fulfill the purpose of the study, a listening skills checklist was developed by the researcher with the aim of identifying the most adequate skills and subskills necessary for the 3rd year EFL majors at the Faculty of Education for Boys (Cairo), Al Azhar University. The listening skills checklist was developed based on the literature, the related previous studies, the Global Scale of English (GSE, 2019), CEFR and ACTFL standards. The checklist was submitted to TEFL specialized jury members to assure its content validity. After incorporating the feedback of the jury members, the final form of the listening skills checklist was confirmed valid. It consisted of two main dimensions, namely, listening comprehension with four subskills (identifying main ideas, recognizing specific information, making inferences and making predictions) and connected speech perception with ten listening subskills (weak forms of function words, linking consonant to vowel, linking consonant to the same consonant, linking /j/, linking /w/, linking /r/, intrusive /r/, elision of /t/ & /d/, assimilation of /t/, /d/, & /n/ after /p/, /b/, & /m/, assimilation of /t/, /d/, & /n/ after /k/ & /g/).

The listening Skills Test

The Listening Skills Test was developed by the researcher as a pretest-posttest to assess, on one hand, the 3rd year EFL majors'

listening comprehension of connected speech features and, on the other hand, their perception of connected speech.

The listening comprehension section[1], including twelve (12) Multiple-Choice Questions (MCQs), targeted the four listening subskills in the first dimension of the checklist. Each subskill was assessed using three questions. The participants were asked to listen to a (2:24) two minutes and twenty-four seconds story about a rat called Arthur two times and choose the correct answer. The Received Pronunciation (RP) was used with total number of (360) words and an average rate of delivery (150 wpm). It is worth mentioning that the delivery rate of the original version of the story was too fast for such participants. Thus, it was adjusted to be in line with the normal rate of delivery, on the one hand, and to suit the participants of the study, on the other hand.

The perception of connected speech section[2], including fifty (50) Fill-in-the Gap Questions, contained the ten subskills included in the second dimension of the checklist. Each subskill was assessed using five questions. The participants were asked to listen to each recording twice and then fill in the gap with the citation form of the words. Regarding the test scoring, all the items in both sections of the test received a mark for each correct answer and a zero for each incorrect answer. The test validity was verified through submitting it to a jury of TEFL specialists. They were asked to read and listen to the test items and its specifications and give their viewpoints considering certain points. The test was approved by the jury members after applying the modifications they suggested.

The test was, consequently, piloted to (50) 3rd year EFL majors at the Faculty of Education for Boys (Cairo), Al Azhar University during the first term of the academic year 2022\2023. The purpose of piloting the test was to determine its suitability to the learners through their reactions and answers, compute its reliability and the time needed

[1] This section was extracted from *Practical English Phonetics and Phonology: a resource book for students (4th Ed.) by Beverley Collins, Inger M. Mees and Paul Carley.*

[2] This section was extracted from *Pronunciation Practice Activities: a resource book for teaching English pronunciation by Martin Hewings and Clear Speech (3rd Ed.) by Judy B. Gilbert.*

to finish it. The reliability of the test was computed using the split-half method. The statistical analysis showed that the test was highly reliable and ready for the main administration with coefficient (0.896).

Moreover, the internal consistency of the LST was computed in order to assure its reliability. In computing the internal consistency of the LST, the following correlation coefficients were calculated:

- The correlation coefficients of the total score of each item in the LST and the total score of the LST. The statistical analysis indicated that item No. 45 was the least correlated (.301*) while item No.48 was the most (.765**).
- The correlation coefficients of the total score of each item in the dimension (perception of connected speech features) and the total score of that exact dimension. The statistical analysis showed that item No. 45 was the least correlated (.326*). The correlation coefficients of the total score of each item in the dimension (listening comprehension) and the total score of that exact dimension. The statistical analysis showed that the fourth item was the least correlated (.326*)
- The correlation coefficients of the total score of the first dimension (perception of connected speech features) and the total score of the LST was (994**).
- The correlation coefficients of the total score of the second dimension (listening comprehension) and the total score of the LST was (907**).

The above results showed high internal consistency of the LST and therefore it is highly reliable and ready for the main study.

The Treatment Material

The program of the current study targeted ten features of connected speech, namely, weak forms of function words, linking consonant to vowel, linking consonant to the same consonant, linking /j/, linking /w/, linking /r/, intrusive /r/, elision of /t/ & /d/, assimilation of /t/, /d/, & /n/ after /p/, /b/, & /m/, assimilation of /t/, /d/, & /n/ after /k/ & /g/. The forementioned features are all presented in an adaptive learning environment (henceforth ALE) which basically addresses EFL majors' listening difficulties, adheres to the principle that "one size does not fit all" and aims to provide learners with personalized learning; learning that attends to the needs and interests of EFL

majors. Adaptive learning can be based on many different ability and aptitude variables such as intellectual style, cognitive styles, learning styles, prior knowledge, self-efficacy, knowledge level or level of proficiency, anxiety, motivation, etc. The present study used the level of proficiency variable as a basis for designing dynamic adaptation of the learning environment for each student in a personalized way that best supports learning. Thus, the program was designed to suit three levels of proficiency (low – mid – high).

The purpose of the ALE was twofold; first, designing the training program based on features of connected speech, second, designing the ALE itself in which such a program was presented. Consequently, the main objectives, intended learning outcomes, delivery modes and teaching methods of each session in the three levels were determined. Regarding the materials and the presentation in each level, the Low level received a textual-based presentation while the Mid level received a video-based presentation with slow delivery rate. Finally, the High level received a video-based presentation with a normal delivery rate. The practice in all levels was divided into controlled, guided and free with a difficulty level suitable for each level.

Moreover, each level comprised eight sessions in addition to an introductory session for all levels. Each session started with a warm-up activity “Do you remember?” to activate students’ schemata and to link the current to the previous knowledge. Each session ended with a reflection activity “Time for Reflection” that helped students reflect on their own learning. The program also provided students with additional or extra resources for more information and practice at the end of each session.

For the sake of defining the level of each student, each session was preceded by a pretest “Be on the Right Track” for determining the level of proficiency of each student, Low, Mid, High, according to his score on the pretest. After studying the content of each session, students were asked to do a posttest “Have you Really Got it?” to make sure that they have attained the ILOs of the sessions. If the students’ score is 75% or above, they are congratulated and advised to study the following session. However, if their score is below 75%, they are asked to study the session again and retake the posttest.

The researcher, with the help of experts in TEFL, stated an approximate duration for each activity in each session. Then, the durations of all activities in each session were collected. Consequently, the duration of each session was (2:45) two hours and forty-five minutes in the (Low) level, (2:15) two hours and fifteen minutes in the (Mid) level and (1:50) one hour and fifty minutes in the (High) level.

It is worth mentioning that the researcher had to examine and delve deeper into about 30 coursebooks and 10 websites in phonetics, phonology, listening, speaking and pronunciation to collect the content and the activities of all the three paths in the program.

For assuring the validity of the program, it was submitted to a jury members specialized in TEFL. The researcher continued reviewing, organizing and rewriting the content of the training program until a 100% agreement was reached on each session and activity with the experts. This target was met after the fourth version of the program.

Consequently, three scenarios, one for each path, were designed and given to programmers to design the adaptive learning environment. Those specialists transformed the pretests, posttests, objectives, intended learning outcomes, content of each session and any other element into a digital adaptative learning environment. After many careful revisions and trials for the whole content and aspects of the adaptive learning environment by the experts, it was finally published and session 2 was conducted on 10 students, who were excluded from the final experiment, as a pre-administration to verify the clarity of the content and the appropriateness to the learners.

The Procedures of the Study

Pre-Administration

Given that the validity and reliability of the LST were established, it was administered as a pretest to both the experimental group students (N=33) and control group students (N= 33) at the beginning of the second term, exactly on 2-13-2023, in the academic year 2022\2023. The purpose of the pre-administration of the LST was to assure the equivalence between both groups and to identify the difference between the mean scores attained by both groups on the listening skills pretest and posttest.

Table 1

Independent sample t-test of the study groups' listening skills pretest mean scores (df = 64)

LST	Groups	N	Mean	Std. Deviation	Std. Error Mean	*t*	Sig. (2tailed)
Perception of Connected Speech Features	EX.	33	10.9394	3.92061	.68249	.963	.339
	Control	33	10.0606	3.48155	.60606		
Listening Comprehension	EX.	33	3.3333	1.05079	.18292	.903	.370
	Control	33	3.0909	1.12815	.19639		
Total	EX.	33	14.2727	4.46005	.77640	1.072	.288
	Control	33	13.1515	4.02431	.70054		

The independent sample *t*-test indicated that there was no statistically significant difference at 0.05 level between the mean scores attained by the experimental group students and control group ones on the listening skills pretest. This means that the experimental group students and those of the control one started from the same level before the treatment and any difference found in the listening skills posttest might be attributed to the treatment they received.

Administration of the Experimental Treatment

The training program based on features of connected speech in an adaptive learning environment which represented the independent variable was administered to the experimental group students. The administration of the experimental treatment continued from 2\25\2023 to 3\25\2023 with a total number of eight sessions, two sessions per week, preceded by the introductory session. Meanwhile, the control group students received no treatment.

It is worth mentioning that a training session was conducted to the experimental group students to make sure that they have the computer skills needed for learning through the adaptive learning environment. Moreover, they were trained on how to login the environment, how to access the content and activities of the sessions, how to take the pretests before and posttest after each session and how

to make a good use of the additional or extra resources on the environment.

Post-Administration

The post administration of the LST was conducted after the experimental treatment to reveal the changes in students' listening skills of both the experimental and control group students.

The Study Results

The study sought to answer the following question:

1- What is the effectiveness of a training program based on features of connected speech in an adaptive learning environment in listening skills among the 3rd year EFL majors at the Faculty of Education for Boys (Cairo), Al-Azhar University?

To answer the question of the study, the following two hypotheses were tested:

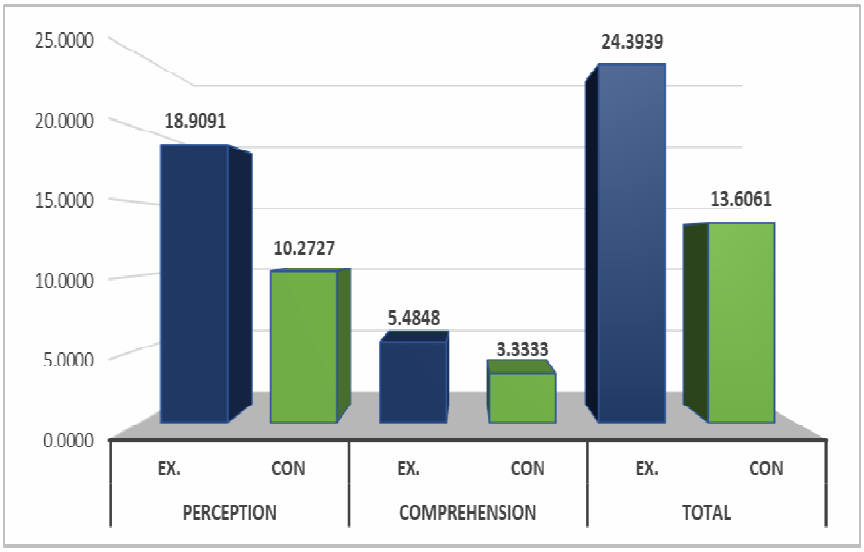
1- There will be no statistically significant difference at (0.05) level between the mean scores attained by the experimental group students and those of the control group in the posttest of listening skills.
2- There will be no statistically significant difference at (0.05) level between the mean scores attained by the experimental group students in the pre/posttest of listening skills.

Testing Hypothesis One

For testing hypothesis one, the mean scores of the experimental group students and those of the control group on the listening skills posttest were computed using descriptive and inferential statistics. Figure (2) below graphically shows the differences between the mean scores of the experimental group students and those of the control group on the listening skills posttest.

Figure 2

Raw means of the experimental and control group students on the LS posttest



The figure above shows that there were observable differences between the mean scores attained by the experimental group students and those of the control group on the LS posttest and its main dimensions in favor of the experimental group students' mean scores. To substantiate this descriptive analysis, inferential statistical analysis was used utilizing the Independent Samples t-test to find out if such differences are statistically significant.

Table 1

Independent sample t-test of the study groups' listening skills posttest mean scores (df = 64)

LST	Groups	N	Mean	Std. Deviation	Std. Error Mean	*t*	Sig. (2tailed)
Perception of Connected Speech Features	EX.	33	18.9091	4.17106	.72609	9.664	0.00
	Control	33	10.2727	2.99241	.52091		
Listening Comprehension	EX.	33	5.4848	.83371	.14513	10.591	0.00
	Control	33	3.3333	.81650	.14213		
Total	EX.	33	24.3939	4.64314	.80827	10.914	0.00
	Control	33	13.6061	3.26859	.56899		

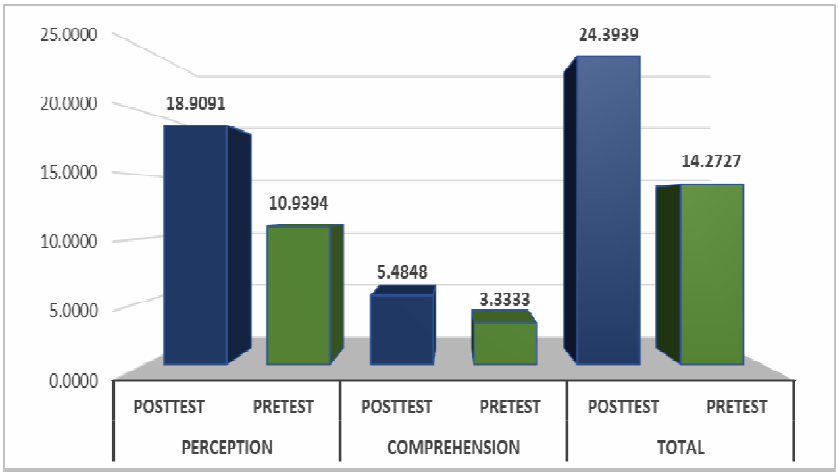
The results of the independent sample t-test indicated that there were statistically significant differences at 0.05 level between the mean scores attained by the experimental group students and those of the control one on the LS posttest and its main dimensions in favor of the experimental group students. This means that the first null hypothesis was rejected and the alternative one was accepted stating that "*there was a statistically significant difference at 0.05 level between the mean scores attained by the experimental group students and those of the control one on the LS posttest and its main dimensions in favor of the experimental group students*".

Testing Hypothesis Two

For testing hypothesis two, the mean scores attained by the experimental group students on the listening skills pre/posttest were computed using descriptive and inferential statistics. Figure (3) below graphically shows the differences between the mean scores attained by the experimental group students on the listening skills pre/posttest.

Figure 3

Raw means of the experimental group scores on the LS pre/posttest



The figure above shows that there were observable differences between the mean scores attained by the experimental group students on the LS pre/posttest and its main dimensions in favor of the posttest mean scores. To substantiate this descriptive analysis, inferential

statistical analysis was used utilizing the Paired- Samples t-test to find out if such differences are statistically significant (Table 3) below.

Table 3

Paired sample t-test of the experimental group mean scores on the listening skills pre/posttest (df = 32)

LST	Groups	N	Mean	Std. Deviation	Std. Error Mean	*t*	Sig. (2tailed)
Perception of Connected Speech Features	Posttest	33	18.9091	4.17106	.72609	42.594	0.00
	Pretest	33	10.9394	3.92061	.68249		
Listening Comprehension	Posttest	33	5.4848	.83371	.14513	10.511	0.00
	Pretest	33	3.3333	1.05079	.18292		
Total	Posttest	33	24.3939	4.64314	.80827	33.653	0.00
	Pretest	33	14.2727	4.46005	.77640		

The above tabulated results of the paired sample t-test indicated that there were statistically significant differences at 0.05 level between the mean scores attained by the experimental group students on the LS pre/posttest and its main dimensions in favor of the posttest scores. This means that the second null hypothesis was rejected and the alternative one was accepted stating that "*there was a statistically significant difference at 0.05 level between the mean scores attained by the experimental group students on the LS pre/posttest and its main dimensions in favor of the posttest mean scores*".

To authenticate the results attained, the effect size (a way of quantifying the size of the difference between two groups indicating the magnitude of the experimental effect) was computed. The researcher used Eta squared (η2), a measure that describes the proportion of variance associated with or accounted for by each of the main effects, interaction and error in a t-test study.

Put simply, it looks at how much variance in listening skills was a result of the experimental treatment. The results of the (η2) values are depicted in Table 4 below.

Table 4

The effect size of the treatment on the listening skills of the experimental group students.

SST	Eta	Eta Squared
Perception of Connected Speech Features	.707	.500
Listening Comprehension	.755	.570
Total	.749	.560

The usual interpretation of Eta squared is that .01 = small effect. .6=moderate effect, and .14 = large effect. This means that the experimental treatment had a large effect on the listening skills of the experimental group students.

Discussion of Results

To answer the question of the study through testing the first null hypothesis, a comparison between the mean scores attained by the experimental group students and those of the control one on the listening skills pretest was held. The data analysis revealed that the mean scores attained by the experimental group students and those of the control one were 14.27 and 13.15 on the total listening skills pretest, 10.93 and 10.06 in the perception of connected speech dimension and 3.33 and 3.09 in the listening comprehension dimension respectively. Such results indicated that both groups were equivalent and started from the same point before the treatment.

Moreover, a comparison between the mean scores attained by the experimental group students and those of the control one on the listening skills posttest was also held to uncover the effectiveness of the experimental treatment. The data analysis revealed that the mean scores attained by the experimental group students and those of the control one were 24.39 and 13.60 on the total listening skills posttest, 18.90 and 10.27 in the perception of connected speech dimension and 5.48 and 3.33 in the listening comprehension dimension respectively. Such results indicated the experimental group students outperformed those of the control one and that the experimental treatment was effective in developing the listening skills among the 3rd year EFL majors at the Faculty of Education (Cairo), Al Azhar University. As

such, the first null hypothesis was rejected and the alternative one was accepted stating that "there was a statistically significant difference at 0.05 level between the mean scores attained by the experimental group students and those of the control one on the listening skills posttest in favor of the experimental group students".

More answers for the question of the study were provided through testing the second hypothesis. The data analysis of comparing the mean scores of the listening skills pretest and posttest of the experimental group students were 10.93 and 18.90 in the perception of connected speech dimension, 3.33 and 5.48 in the listening comprehension dimension and 14.27 and 24.27 on the total test respectively. Such results yielded that the experimental treatment had a large effect size (0.560 on the total test, 0.500 in the perception of connected speech dimension and 0.570 in the listening comprehension dimension) on developing the 3rd year EFL majors' listening skills at the Faculty of Education (Cairo), Al-Azhar University.

Several interpretations could be given to the superiority of the experimental group students over those of the control one in the listening skills. One interpretation may lie in the fact that exposing the experimental group students to authentic language throughout the nine sessions learning and practicing features of connected speech has significantly developed their listening skills. Put simply, the experimental treatment (the training program based on features of connected speech in an adaptive learning environment) provided the students with a variety of videos, audios and websites for native speakers presenting the features of connected speech in interesting ways. Hence, the students had a great chance to listen to authentic language in a stress-free environment. That might help students get accustomed to the rhythmic pattern of English as it is a stress-timed language which greatly develops students' perceptive skills. In other words, the more students are exposed to authentic language, the more they can comprehend the message they hear.

These results can be attributed to the instruction of the features of connected speech to the experimental group students since such features are prevalent in natural speech and occur in both formal and informal contexts. Put simply, comprehending connected speech features could be beneficial in many different ways as it enables students to understand spoken language easily and to sound more

comprehensible, intelligible and natural with less marked foreign accent. Teaching features of connected speech in natural contexts gives students a very different picture or idea from the one they are used to inside the classrooms. More specifically, EFL students are used to the standard, careful and slow speech in the classrooms by either the teachers or the instructional materials. Thus, they feel shocked when encountering natural speech in real-life communication. The treatment of the current study addresses such a problem and totally fills such a gap between the language used in the classrooms and the one used in real life which enables students to communicate effectively with others, be native or non-native speakers. This goes in line with many studies (e.g., Abdul-Aal, 2002; Abdul-Aal, 2019; Brown, 2012; Brown and Hilferty, 2006; Ladefoged & Johnson, 2014; Loewen, 2020; Marla, 2014 & Saito, 2012).

A further plausible interpretation for the results may be attributed to the delivery mode of the features of connected speech; the fact that designing and delivering such features in an adaptive learning environment tailored to the proficiency level of students might have a great positive effect on developing students' listening skills. Put simply, the EFL majoring students who participated in the current study belong to generation "Z" who are, by default, visual learners and tech-savvy and are addicted to screens and smart-e-devices. Such students have no idea about any time before the computer, smartphones and the internet which has implications for schools, colleges and families. Having delivered the features of connected speech in an adaptive learning environment making use of the modern digital tools helped students maintain their level of motivation which is a pre-requisite for any success or achievement.

The adaptive learning environment in the current study attended to the interests and needs of students through tailoring it to their level of proficiency, Low, Mid or High. Thus, such an adaptive environment, based on the premise that "one size doesn't fit all", provided tailored instruction and content to the right student at the right time overcoming the problem of a "one size fits all" approach in the traditional education. The adaptive learning environment in the current study personalized learning through identifying and meeting the needs of students as individuals using the data collected during the pretest prior to each session. Each student was assigned to one of three

learning paths, Low, Mid or High, tailored to his proficiency level. The presentation of the content, activities, delivery modes, teaching methods, practice and assessment in each session varied according to the level of proficiency. Moreover, the adaptive learning environment in the current study provided students with extensive practice at both the receptive and productive skills in order to reach a percentage of 75% in each session. Moreover, students were provided with extra resources in each session to substantiate what they have learnt. More importantly, each student could study the content in accordance with his own pace and could also return to it whenever he wanted for more study. Thus, students could use the adaptive learning environment to construct and take control of their own learning.

More importantly, students received immediate feedback after answering each question and doing each task. That might have contributed to developing the students' listening skills through directing and keeping them on the right track throughout all the sessions. It is worth mentioning here that students had to take a posttest after each session to move to the following session. Thus, students could not move to the next session unless they got 75% in the session they are working on. That might be considered as a kind of feedback as students were directed to studying the content of the session again in case they could not pass.

Final interpretation of the study results is that students worked on the adaptive learning environment freely without any constraints of time or place. Students had the opportunity to study the content anywhere, be it at home, on transportation or in college, and any time, be it in the morning, afternoon or evening. Moreover, students had the chance to reflect on their learning and express their opinions about everything in the environment in the "Time for Reflection" section at the end of each session. Many oral and written comments, in both students' first and foreign languages, on the environment and its content were provided by the students throughout the sessions. One student said, "*this is my first time to know about the concept of features of connected speech. I knew only the sounds and some other stuff but not such features*". Another student confirmed, "*No one taught us how native speakers link words together and why. I thought they talked too fast and that's why I could not understand them well. Now, I know what happens and can do it too"*. Another student added,

"*the introductory session helped me a lot get motivated because my previous experience gave me a very negative impression about such training programs. I was astonished by the content and the environment. I could know exactly where I am on the pretest before each session and to what extent I could achieve through my grade on the posttest. This training program gave me a real opportunity for improvement*". Another student said, "*these sessions are amazing. I could watch videos and listen to many audios for native speakers and surprisingly I could understand most of them because I knew what happens in natural speech*". Another student added, "*I feel I can communicate with others more comfortably right now because I feel my perceptive and even my productive skills improved a lot*".

In a nutshell, the study results revealed the effectiveness of the training program based on features of connected speech in an adaptive learning environment in developing the listening skills among the 3rd year EFL majors at the Faculty of Education (Cairo), Al-Azhar University.

Conclusion

In short, training on features of connected speech in an adaptive learning environment has had an enhancing effect on EFL majors' listening skills. More importantly, such an adaptive learning environment provided learners with personalized learning; learning that attends to the needs and interests of EFL learners, provide them with real exposure to authentic language in natural contexts, free them from place and time constraints and help them become more self-independent in the process of language learning. While more research remains to be done, the outcomes will likely be major advances in developing EFL majors' listening skills through training on features of connected speech in an adaptive learning environment. In this sense, it is hoped that the study has made an original contribution to such an area.

Recommendations

Based on the results obtained in the current study, it is recommended to:

- develop the listening courses at the Faculties of Education in the light of the principles of adaptive learning environments tailoring learning to the learners' needs and interests.
- give due consideration to teaching the features of connected speech in phonetics coursebooks at the Faculties of Education to help learners easily comprehend what they hear and communicate with others effectively.
- provide students with sufficient opportunities of exposure to authentic language in real-life contexts as it helps students be more efficient listeners. Moreover, it helps them tune to the rhythmic pattern of English since being stress-timed language is one of its crucial aspects that students need to be aware of.
- utilize the adaptive learning environment in the current study in teaching the included features of connected speech to the 3rd year EFL majors at the Faculty of Education for Boys (Cairo), Al Azhar University.
- tackle and expand search on features of connected speech by researchers by investigating more features using other advanced pedagogical tools.
- Validate the results of this study in different contexts with different language learners. If future research provides further support for the findings of the current study, the implications for training EFL learners on features of connected speech in an adaptive learning environment for developing listening skills would be significant.
- Even though the current study was conducted in a relatively enough period of time, longitudinal research is key in order to assess the effect of the training program based on features of connected speech in an adaptive learning environment on EFL majors' listening skills after they become real teachers in classes of their own. Further research might examine how the effects of such a treatment influence EFL majors' actual teaching.

Suggestions for Further Research

Due to a few limitations the current study had, some suggestions for further research were addressed:

- A larger number of participants would allow for more conclusive results since the limited size of the study participants (totaling 66 male EFL majors) might not allow for a generalization of the results obtained.
- Since all participants are EFL majors at the Faculty of Education, further research might be needed on participants at the Faculties of Arts, Alsun, and Languages and Translation.
- Further studies are needed to tap the effectiveness of the developed adaptive learning environment in developing listening skills among female EFL majors in different context and education levels as well as future research could be conducted with a focus on the gender as a categorical variable.
- The current study was confined to quantitative analysis as measured by the listening skills test. That was due to time, place and facility limitation in the current study context. Hence, qualitative rather than quantitative analysis should be examined in further research.
- Further longitudinal research should be carried out to develop listening skills through training on features of connected speech in adaptive learning environments since the EFL majors needed more time to get the skills included in the study internalized in their mental processes and automatic behaviors. That is because the treatment lasted for only nine sessions which was not enough to get the highest benefits from the treatment.
- Further research should be conducted to develop such an environment tailoring it to the combination of various variables such as level of proficiency with learning styles, multiple intelligences and level of proficiency, multiple intelligences and learning styles, etc.
- Further research might be needed to include more features presented in an adaptive learning environment.

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