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E-Learning, MOOC e Lingue Straniere: Studi, Ricerche e Sperimentazioni
E-Learning, MOOCs and Foreign Languages: Research, Studies and Experiences

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JACQUELINE AIELLO*, ANNA MONGIBELLO**

VOICE RECOGNITION TECHNOLOGY AND EFL STUDENTS: A VIRTUAL ENVIRONMENT EXPERIMENT

Abstract

Voice recognition (or speech recognition) technologies are being increasingly used as language learning tools to provide learners with opportunities to practise their target language autonomously. This paper reports on a pilot project on a virtual environment that included voice recognition software program targeting English pronunciation on the eLearning platform Moodle.

1. Introduction

Voice recognition (or speech recognition) technologies have shown remarkable advancements in recent years¹. The term broadly refers to the use of speech to control a hardware or software device. Initially, the technology was employed as an assistive device for individuals with physical or language disabilities. More recently, applications of these technologies to language learning software programs have opened to computer-based interactive spoken language education systems, a brand-new path in educational environments. Different speech recognition engines can now be used to offer various language learning activities [1], including face-to-face dialogues with virtual characters and simulated 'real-life' situations. The activities are meant to help English as a Foreign Language (EFL) students who perform poorly and have limited opportunities to practice their target language and develop pronunciation and reading skills.

The advantages of implementing language courses with voice recognition technologies in virtual environments as part of blended learning programmes are numerous. For instance, speech recognition software programs provide additional opportunities to practise oral skills without feeling exposed to the judgement of other classmates; also, students can decide for themselves when to exercise and the frequency of their attempts.

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¹ This paper was a collaborative effort: Anna Mongibello wrote section 1 (Introduction) and section 2 (Methodology); and Jacqueline Aiello wrote section 3 (Pre- and post-programme questionnaires) and section 4 (Discussion and conclusion). The authors are grateful to Profs. Oriana Palusci and Katherine E. Russo for this project.

Given the high number of students enrolled in undergraduate programme at the University of Naples “L’Orientale”, offering constant, individualised feedback on oral production in overcrowded classes is not always possible nor easy. However, Italian learners of English struggle with certain aspects of English pronunciation, such as the production of vowels (eg: [2]). For this reason, in 2016 a group of 150 EFL students in their third year of the undergraduate programme in Linguistic and Cultural Mediation was offered the opportunity to join a project funded by the Ministry of Education, University and Research (MIUR) as part of the blended learning project coordinated by Professor Giorgio Banti. The project team was composed by Professors of English Oriana Palusci and Katherine E. Russo who designed and coordinated the project, and e-tutors Jacqueline Aiello and Anna Mongibello who generated the online course on Moodle and monitored students’ activities. The general aim of the project was to provide students with an opportunity to improve their oral English communication skills in a low-anxiety, virtual environment where they could practice the language and receive automatic prompt feedback. The online course was an optional part of the English exam for third year students.

2. Methodology

2.1 Voice recognition technology

While experiences of general language learning within eLearning programmes have been widely documented ([3] [4]), very few experiments have dealt with the use of voice recognition technologies [5]. Even fewer involved EFL students at a university level. Based on our research, none embedded a voice recognition software program on Moodle, the most used Learning Management System at higher education levels.

A thorough investigation of the available technology for Moodle led to SpeechAce, a speech recognition system that can be added to any LTI compliant learning management system. SpeechAce provides syllable and phoneme level feedback to students’ performances as the students simply have to record audio samples following pronunciation exercises that the system automatically processes, showing where the mistake is. The program was set on Standard American English.

Pronunciation exercises were created in accordance with each unit main focus. In Unit 1, for example, students were asked to practise with particularly challenging sounds such as syllabic consonants, consonant clusters and the

difference between voiced and unvoiced consonant sounds. Figure 1 shows an example of exercise testing the correct pronunciation of the voiced consonant sound /dʒ/: the students had to record their voice while pronouncing the word “ingenuity” and then verify their spoken output. An “expert audio” file could also be played as a guide track. After processing the results, the system provided a “checked response chart” that allowed the students to see how they performed in pronouncing each syllable. The chart also provided feedback on the position of lexical stress. The students received an average quality percentage for each attempt and a short automatic message clarifying the level achieved. Exercises could be repeated more than once.



Average Quality: 100%. Good job! Full grade awarded.

Checked Response				Expert Audio		
Syllable	Phoneme (IPA)	Quality (%)	Stress	Syllable	Phoneme (IPA)	Stress
ɪŋ	ɪ	100	OK	ɪŋ	ɪ	
	ŋ	100		ɪŋ	ŋ	
dʒe	dʒ	100		dʒe	dʒ	
	e	99	OK	dʒe	e	
nju	ŋ	100		nju	ŋ	
	u	100	Stress More	nju	u	Primary
ɪ	e	99	Stress Less	ɪ	e	
tʃy	ɪ	100		tʃy	ɪ	
	y	100	OK	tʃy	y	
Average Quality		100%				

Figure 1 - An exercise created with SpeechAce.

2.2 Participants

One hundred and fifty students initially signed up for the course but only 122 completed all the activities. The group was composed of 104 females and 18 males, whose ages ranged from 20 to 29 and averaged at 20.10, as the pre-course questionnaire showed. The third-year students were all enrolled in the Linguistic and Cultural Mediation programme, a bachelor degree programme, where English language knowledge is assessed through three written and oral English language exams, one per year. Students are generally granted 144 hours of English teaching classroom each academic year in order to prepare for their annual English Language exam. The online pronunciation project was meant to present the students with additional non-mandatory hours of practice and a specific path to improve their oral skills. The online course overlapped with in-class teaching hours, which may explain why a relatively small percentage of students (18.6%) dropped out.

2.3 Course design

The course was divided into six units, each leading through the exploration of some main features of English pronunciation (consonant and vowel sounds, rhythm, intonation and stress). One of the objectives was also to make the participants more aware of the different varieties of English used around the globe and show how cultural appropriations of such global language can affect pronunciation.

Every unit consisted of two parts: a theoretical one which included videos, explanations and examples, and a practical one, made of exercises designed by the e-tutors, exercises using SpeechAce and forums that prompted students to reflect on the course content and to share their experiences and opinions. In addition to the units, an introductory section and a welcome message were also offered in order to explain the general objectives of the course. Students could expect to discover which features of English pronunciation they needed to work on the most in order to communicate more clearly; improve their ability to understand conversations in English; and learn strategies for practicing pronunciation on their own. At the beginning and at the end of the course, students were asked to complete a pre- and post-programme questionnaire that will be discussed in detail in the next section.

The length of the course was three months: it began in March and ended in May. Units were available for twelve days each, then the practical sections were closed. This was decided in order to make sure that the students follo-

wed a progressive path, focusing on one unit and one aspect of English pronunciation per time. The intent was also to create a community of English language learners who grew together and could compare their improvements. In order to make the improvements more visible and encouraging, we asked the students to complete a time capsule task, for which they recorded and stored samples of their own voice for later comparison and self-evaluation.

A total of 75 word-level and sentence-level pronunciation exercises were created using speech recognition technology, each including a native speaker audio file model and a phonetic transcription; an additional 20 exercises were designed using the Moodle timed quiz tool and were meant to assess students' acquired knowledge about English pronunciation features. Seven forum discussions – one for each unit and an initial one where students were asked to introduce themselves – were opened to students' inputs and were monitored by the e-tutors.

Students completed 84% of the exercises, spending on average 18 minutes on each and generating 8100 speech recognition requests.

3. Pre- and post-programme questionnaires

An additional required component of the course, briefly mentioned earlier, was a pre- and post-programme questionnaire. Students took the pre-programme questionnaire at the start of the project in March 2016, and the post-programme questionnaire at the end of the project in May 2016. The questionnaires aimed to collect participants' background information, to glean insights into attitudes towards pronunciation, to measure differences in foreign language anxiety levels (for which items were adapted from the questionnaire in [6]), to gauge whether self-perceived assessments of pronunciation skills improved from the start to the end of the project, and to gather participants' opinions on the project (in post-programme questionnaires only).

Data collected from 108 participants who submitted both pre- and post-programme questionnaires were analysed. Quantitative data were analysed using descriptive statistics and paired-samples t-tests for pre-post programme comparison using SPSS version 23. Thematic and content analysis were used to code open-ended responses and identify common themes and patterns.

3.1 Closed-ended responses

Pre-programme questionnaires asked participants how much they agreed with a series of statements concerning (English) pronunciation. On average, parti-

Participants strongly agreed that pronunciation was important for communication and that they wanted to improve their English accent, and they agreed that sounding as close as possible to native speakers was important, that having a good pronunciation would increase their L2 confidence, and that more emphasis should be given to proper English pronunciation in class. Questionnaires also delved into the foreign language anxiety of participants and, when pre- and post-programme questionnaire anxiety data were compared, statistically significant differences emerged in only one of the five items, which suggests that this programme did not have a great impact on participants' foreign language anxiety levels.

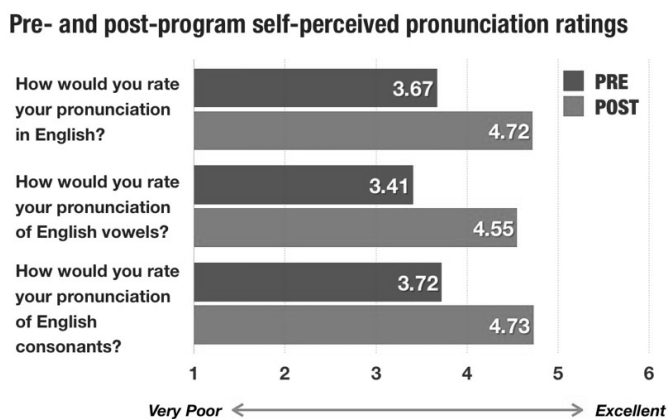


Figure 2 - Self-perceived pronunciation ability ratings in pre- and post-programme questionnaires.

Questionnaires also delved into participants' self-perceived ability in English pronunciation skills. Figure 2 displays the juxtaposition of the pre- and post-programme means. Paired samples t-tests revealed a statistically significant change in the pre- and post-programme mean responses for participants' overall English pronunciation ($t(106) = -11.983$, $p < .001$, two-tailed), English vowel pronunciation ($t(105) = -12.534$, $p < .001$, two-tailed), and English consonant pronunciation ($t(106) = -11.332$, $p < .001$, two-tailed). These findings suggest that participants assessed their English pronunciation skills more favourably after the course.

3.2 Open-ended responses

Participants were also prompted to write open-ended responses about their favourite aspect of the course and whether they would recommend the

experience to a peer. The greatest proportion of students listed SpeechAce as their favourite part, based on their appreciation of the native speaker model and accompanying phonetic transcription, and they most preferred the unit dedicated to vowels, followed by the unit on World Englishes. Participants also noted that they improved and experienced increased awareness of their pronunciation, and they enjoyed the fact that the project – and particularly the voice recognition – provided them with immediate feedback on their pronunciation. For example, one participant wrote “I liked the fact that it shows my mistakes and corrects them immediately,” and another responded: “Thanks to this project, I’m less worried about my pronunciation, because I’ve understood the mistakes that I did previously.” As displayed in Figure 3, of the 106 participants who provided a response, all but one indicated that they would recommend the project to their peers (99%).

Would you recommend this project to a friend?

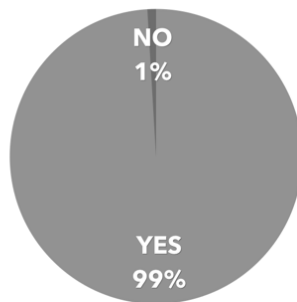


Figure 3 - Post-programme questionnaire responses (frequencies): *Would you recommend this project to a friend?*

We also asked students for suggestions on how to improve the project. In response, roughly 40 percent of participants said nothing should be changed, and roughly 40 percent referred to problems with SpeechAce, such as repetitive exercises, audio glitches, and lagging speed. They hoped these issues could be addressed in future iterations. Participants also expressed a preference for sentence-level (over word-level) pronunciation activities, and a small proportion hoped that the project could cover a wider range of English varieties.

4. Discussion and conclusion

Providing immediate, individualised feedback on oral language production remains an arduous task in many language learning settings. For EFL

learning at many universities, this goal is virtually unattainable because the demand for the language and its use in myriad domains results in a disproportionately high enrolment rate and large class sizes. Still, as exhibited by the participants in this study, language learners value dedicated instruction in oral production, and particularly pronunciation. The eLearning project presented in this paper was designed with this issue in mind.

As part of the eLearning project, participants were guided to review, practice and reflect on different features of English language pronunciation through the use of unit overviews, videos, practice quizzes, games, voice-recognition exercises, and forum interactions. The content ranged from English vowels, to stress, rhythm, and discourse in different English varieties. As a whole, the virtual environment was designed to hone in on and sharpen the oral English production skills of English majors in their last year of undergraduate studies.

The nature of the project and, specifically, the fact that students were allowed and even encouraged to practice by repeating their voice recognition exercises over and over again invalidated the use of these data to measure 'actual' improvement in pronunciation. In lieu of a pronunciation measure, we elicited self-perceived pronunciation proficiency because prior research has suggested that subjective self-perceptions of language competence correlate to objective measures (e.g. [7]), and the construct itself holds great explanatory value. Clément, Baker and MacIntyre posit that, while actual competence might influence communication, "it is the perception of competence that will ultimately determine the choice of whether to communicate" ([8]; see also [9]). An overall average improvement emerged from the comparison of pre- and post-programme self-perceived proficiencies, which is linked to higher self-confidence and willingness to communicate in English. This finding was corroborated by open-ended questionnaire responses. Participants stated that their pronunciation improved and their awareness of their pronunciation increased. They also enjoyed the project and found various foci and aspects useful for their pronunciation development. In particular, although some participants noted that the novel software program had room for improvement, SpeechAce was deemed useful because it provided models of proper pronunciation alongside phonetic transcriptions of the key terms and phrases.

In conclusion, in 2016 and 2017, third year undergraduate EFL students at "L'Orientale" were offered the opportunity to participate in an online community that aimed to develop the oral English production and pronunciation of participants who could work independently and autonomously yet receive immediate feedback. We found that overall this project was easy to imple-

ment, generated a wide array of student data, and was well received by students who felt more competent after having participated in the project. Our experience and findings suggest that voice recognition technology can be an asset in language learning environments and it can help in providing each student in large classes timely, targeted feedback. Future research should pursue ways of improving existing technology and it should explore the outcomes of the implementation of voice recognition within online environments with different populations of language learners.

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