The Use of Cognitive Science in Pronunciation Assignments

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Research on cognitive science has a long tradition. For decades, one of the most popular ideas in cognitive science literature was its connection with other fields: philosophy, psychology, sociology, anthropology, and linguistics. This article is an effort to show how cognitive science research results can be applied in teaching pronunciation in English to Speakers of Other Languages (ESOL) classes. Specifically, the article will describe six effective learning strategies (spaced practice, dual coding, the use of concrete examples, elaboration, retrieval practice, and interleaving) which have been adapted for the education field from cognitive science (e.g., Tileston, 2004; Fletcher-Wood, 2018) and described in detail in the blog and podcast *The Learning Scientists*. Smith and Weinstein (2016), the authors of *The Learning Scientists* platform, describe these six skills as the most widely researched ones and provide a range of resources for parents, teachers, and students to enhance the learning process. This platform also explains how knowing the science of learning can enhance our lives. Expanding on this topic, I present and justify sample tasks based on *The English Pronunciation Tutor* app (2016). All of them I have been using in my ESOL Speaking and Listening classes.

Spaced Practice

The first effective learning strategy is spaced practice which suggests that spacing out studying over time has positive effects on learning and on memory overall (Benjamin & Tullis, 2010; Toppino & Cohen, 2010) and is especially helpful as the difficulty of the content increases (Benjamin & Bird, 2006; Pyc & Dunlosky, 2010; Toppino, Cohen, Davis, & Moors, 2009). In order to implement this learning strategy in my Speaking and Listening classes, I use pronunciation journals. The required elements of these assignments are pronunciation logs, where students are required to log in the times, days, and results of their practice of a certain pronunciation rule. The students need to practice at least three times with the interval of at least several days before they submit the final version to their instructor (see Assignment Sample 1). I usually allow three to four weeks to work on one Pronunciation Journal while adding shorter pronunciation assignments on the syllabus (see Assignment Sample 2). The other difference between Pronunciation Journals and pronunciation assignments is that the topics for Pronunciation Journals are usually related to suprasegmental features (intonation, stress, rhythm, etc.) and require more time to practice, while pronunciation assignments tend to be focused on sound contrasts.

Assignment Sample 1

In this Pronunciation Journal, we are working on the topic of stress and rhythm.
In order to complete your assignment, you need to follow these steps:

Step 1: Listen and Repeat

1. Listen to the introduction to units 9 and 10 in your Pronunciation App (The English Pronunciation Tutor app).

2. Unit 9 includes 4 lessons and Unit 10 has only 1. Practice listening and recording your target sounds/sentences in the section ***Practice***. Record the days of your practice in this table. Minimum number of practice times: three. Ideally, you should practice once every 5 days.

Units	Lessons	Date	Date	Date	Date
Unit 9	Lesson 1				
	Lesson 2				
	Lesson 3				
	Lesson 4				
Unit 10	Lesson 1 Practice 1				
	Lesson 1 Practice 2				

Step 2: Check Yourself

1. Complete a *Listening Quiz* after lessons 2 and 3 in Unit 9 and record the time and the date of your practice. Record your score as well. You should have at least 3 logs for every lesson practice (not in one day, of course!). Ideally, you should practice once every 5 days.

Unit 9	Lessons	Date / Score	Date / Score	Date / Score	Date / Score
	Lesson 2				
	Lesson 3				

Here is a sample of how your *Listening Quiz* log could look like:

Unit 9	Lessons	Date / Score	Date / Score	Date / Score	Date / Score
	Lesson 2	02/11 – 70%	02/15 – 90%	02/20 – 100%	02/23 – 90%
	Lesson 3	02/11 – 80%	02/15 – 90%	02/20 – 100%	02/23 – 100%

2. The next section, *Speech Recognition*, requires you to read the words from the screen and record yourself saying these words in the app. In the table write down the words the app asked you to repeat (or to "Try Again") as well as the words that were recognized by the app on the first try. Write down every word you think is difficult for you to pronounce. We will be coming back to these words later in your practice.

Do not be shy to write down every word you had a problem with! You can also write your questions for me about the sounds/words in this section. I am here to help you. As with all previous Pronunciation Journals, you should have at least 3 logs for every lesson practice (not in one day, of course!). Ideally, you should practice once every 5 days.

Unit 9		Date / Words	Date / Words	Date / Words	Date / Words
	Lesson 2				

Here is a sample of how your **Speech Recognition** log could look like:

Unit 9		Date / Words	Date / Words	Date / Words	Date / Words
	Lesson 2	*02/11 –* Recognized*: forty, fifteen, sixteen, seventeen* Not Recognized*: thirteen, fourteen, fifty, eighty*	*02/15 –* Recognized*: thirty, forty, fifteen, sixteen, sixty, seventeen, seventy, eighty, nineteen, ninety* Not Recognized*: thirteen, fourteen, fifty*	*02/20 –* Recognized*: thirty, forty, fourteen, fifteen, sixteen, sixty, seventeen, seventy, eighty, nineteen, ninety* Not Recognized*: thirteen, fifty*	*02/23 –* Recognized*: thirty, forty, fourteen, fifteen, sixteen, sixty, seventeen, seventy, eighty, nineteen, ninety, thirteen, fifty* Not Recognized*: No words!*

Step 3: Record Yourself

Finally, record yourself reading all words, sentences, and phrases from the section **Practice** in Unit 9 and Unit 10. Submit your best recording to your instructor.

Students submit all their assignments through Canvas (Learning Management System used at BGSU). In this assignment (Assignment Sample 1) I assess the accuracy and fluency of students' pronunciation on a Likert scale from *Meets Expectations* to *Does Not Meet Expectations* (8 pts scale). It means that even if they have some mistakes in their pronunciation, they can still get the highest score. In addition, the rubric has points associated not only with the recording, but also with the pronunciation log tables (3 pts.), where I assess how many times they practice and whether they use a spacing strategy the way I suggest. This is done to encourage students to use the spacing strategy and to allow them to practice it in a relaxed environment. I also emphasize that because all pronunciation assignments are created for them to improve their pronunciation and make them sound more confident speaking English, I expect them to really do these practice rounds with the app.

Falsification of pronunciation log completion is, first of all, not helpful for their language development; and secondly, is a violation of Academic Honesty Policy. We also discuss with students in class how a teacher can distinguish a student who practiced the assignment according to the requirements from a student who filled out the pronunciation log table without really practicing.

Dual Coding

The second strategy used in the same assignment (Assignment Sample 1) is dual coding, when words are combined with visuals. Research shows that such combination not only helps students make connections, and interpret and integrate information with minimum cognitive processing (Mayer & Anderson, 1992; Vekiri, 2002), but also allows them to retain twice as much information than solely listening to or reading that information (Cuevas & Dawson, 2018). In Listening and Speaking classes, dual coding is used in every *The English Pronunciation Tutor app* section (see Figures 1–4). What I really like about these visuals is that even without detailed instructions students know what they are expected to do based on the visuals. Such intuitive set up allows instructors to go straight to the exercise and save time. In addition to these icons from the app, I include other icons (see Assignment Sample 1, Figures 5–8) in my own personal pronunciation assignments and class activities. These icons have the same goal as those in the Pronunciation app – to help explain the task with the least cognitive effort required from students. I personally prefer using gray icons not to distract students from their most important task – pronunciation practicing. Consistently using those icons makes the directions in assignments more predictable for students and, consequently, easier to follow.
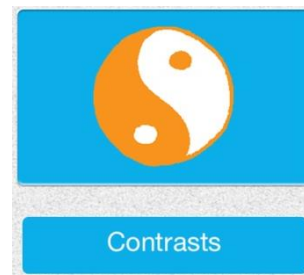

Figure 1. Dual coding in section Practice.

Figure 2. Dual coding in section Contrasts.

Figure 3. Dual coding in section Listening Quiz.

Figure 4. Dual coding in section Speech Recognition.

Figure 5. Icon used for listening tasks.

Figure 6. Icon used for writing tasks.

Figure 7. Icon used for important information.

Figure 8. Icon used for recording tasks.

Concrete Examples

The strategy of using concrete examples is one of the most obvious ones. Illustrative examples are essential for enhancing conceptual learning in any field (Rawson, Thomas, & Jacoby, 2014), and even more so when ESOL students are expected to improve their speaking and listening skills. In addition to using *The English Pronunciation Tutor* app to provide students with examples on pronunciation rules, I also use TedTalks, YouTube videos, and NPR podcasts as illustrations of certain pronunciation rules. For example, excerpts from the TV show *Friends* or *Seinfield* serve as a great addition to the Pronunciation Journal about stress and rhythm (see Assignment Sample 1). Moreover, during class time, I train students to use gestures (Smotrova, 2017) when practicing the same topic. To illustrate, we use clapping to show word stress and tapping to accentuate sentence level stress.

Elaboration

Building on the previous strategy, I also ask students to elaborate on the examples provided in *The English Pronunciation Tutor* app and discuss their own

examples with their groups or partners in class. Elaboration allows students to question themselves and get even deeper into the topic (McDaniel & Donnelly, 1996; Wong, 1985) as well as allows an instructor to assess how well they can understand the material based on the examples they create.

Assignment Sample 2

Pronunciation Focus: Grammatical Endings

In order to complete your assignment, you need to follow these steps:

1. Listen to Intro 1 and Intro 2 in The *English Pronunciation Tutor* app, Unit 8.

2. Practice listening and recording your target sounds in the ***Practice*** section in all 6 lessons of Unit 8.

3. Complete a ***Listening Quiz*** section in all 6 lessons of Unit 8.

4. Complete a ***Speech Recognition*** section in all 6 lessons of Unit 8.

5. Record yourself reading ALL words from the ***Practice*** section in Unit 8 (all 6 lessons). Attach this recording to this assignment.

6. Add at least one example to every lesson in Unit 8. For example, Lesson 1 in Unit 8 explains when the -s ending is pronounced as [-ɪz]. An example I would add is *peach*. The plural form of this noun is pronounced with [-ɪz] ending (*peaches*). Bring your own examples to class. Be prepared to share them.

Similar to the Pronunciation Journal assignment (see Assignment Sample 1), students submit their recordings on Canvas. Here I assess the accuracy and fluency of students' pronunciation on a scale from *Meets Expectations* to *Does Not Meet Expectations* (4 pts scale). In addition, the rubric has points associated with the examples they bring to class (4 pts).

Retrieval Practice

Retrieval practice, or recalls, can improve deductive inferencing and enhance long-term retention of the material (Eglington & Kang, 2018; Karpicke & Blunt, 2011; Roediger & Butler, 2011). In order to engage in retrieval practice, I always start the new topic by asking students to recall the previous tasks we completed. For example, before introducing sentence-level stress in class, students share with their partners and then with the whole class what they remember about word-level stress.

One more example of retrieval practice is a class discussion after submitting a Pronunciation Journal. In step 2 of Assignment Sample 1, one of the items requires students to take notes on the words/phrases the **Speech Recognition** section in *The English Pronunciation Tutor app* did not recognize as correct ("Try Again" words). In class, students share those words with their partners/groups and discuss what possibly went wrong with their speaking samples that caused the software to not recognize their words. As an instructor, I use this opportunity to emphasize the importance of pronunciation accuracy as well as volume in speaking English, and to help learners practice the correct pronunciation with their peers.

A similar activity can be done with shorter pronunciation assignments (see Assignment Sample 2), when I ask students to add their own examples to every rule in a certain unit in *The English Pronunciation Tutor* app and then be prepared to share those examples in class with their peers. Here, several learning strategies are combined (concrete examples, elaboration, and retrieval practice) to get the best results. Such scaffolding of strategies allow us to recycle pronunciation rules and make connections between different topics. Moreover, short graded and ungraded quizzes as well as student reflections have the same goal – to make sure students can recall the material and better understand it.

Interleaving

Finally, the last strategy on the list is interleaving practice, which encourages switching between ideas. According to research, this strategy facilitates cross-category comparisons and emphasizes contrasts between ideas (Birnbaum, Kornell, Bjork, & Bjork, 2013; Carvalho & Goldstone, 2014; Rohrer, 2012). I often use interleaving in combination with retrieval practice as a class activity after students submit a Pronunciation Journal or a shorter pronunciation assignment. The students are asked to recall their homework assignment and to answer questions about it in an order that does not correspond with the order of how the material was presented in homework. Interleaving can sometimes be used in scaffolding of pronunciation rules as well as during ungraded and graded quizzes.

Conclusion

Cognitive science and its implications for educational settings have received much attention in the past decade, and rightfully so. Six effective learning strategies discussed in this article (spaced practice, dual coding, the use of concrete examples, elaboration, retrieval practice, and interleaving) can be especially helpful for ESOL students in their Speaking and Listening classes. Discussing these strategies with

learners will allow them to make conscious choices about their study habits and transfer these skills to other classes.

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