

# **A BRAIN-BASED APPROACH FOR TEACHING AND LEARNING VOCABULARY: USING EMBODIED SEMANTICS AND MIRROR NEURONS WITH MINDFULNESS, MOVEMENT, AND MUSIC**

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## **ABSTRACT**

*Drawing from discoveries in neuroscience, I show how English language teachers (ELTs) can effectively tap into embodied semantics and the human mirror neuron system by using mindfulness, movement, and music to help English language learners (ELLs) acquire lexical items. I first discuss the dynamics of embodied semantics and the function of mirror neurons, and then I explain how I use these neuroscience-based tools to encourage ELLs to intrinsically acquire English vocabulary through a holistic, mind-body approach.*

## **INTRODUCTION**

The more English language teachers (ELTs) know about the parts of the brain and the various functions of these parts, the more effective they can become in developing their craft. In addition, the more ELTs research discoveries in neuroscience and cognitive psychology and apply these discoveries in their classes, the more their ELLs will benefit.

To help instructors understand the power and beauty of synthesizing brain research with teaching, I will focus on two relatively recent discoveries—those of embodied semantics and mirror neurons—and show how they are used to teach English lexical items. First, I will explain what embodied semantics and mirror neurons are and

how an understanding of their roles in learning can help in teaching vocabulary. Second, I will briefly touch on my *Head-to-Toe Method of Associations for Vocabulary Acquisition* and show how it sets the foundation for the focus of this article. I will, then, explain the embodied semantics and mirror neuron-based activity and show how I employ it to teach and review lexical items in my Intensive English Program and ESL for credit classes at an American university.

## **Embodied semantics**

The concept of embodied semantics has proven to be very exciting in terms of teaching and learning English vocabulary (i.e., single-word lexical items, phrases, and idioms). Embodied semantics essentially involves an intimate connection between the performance of a physical action and the conceptualization of that same action in the sensory-motor regions of the frontal lobe. For instance, according to Aziz-Zadeh and Damasio (2008), the idea of “grasping” an object is conceptualized in the same sensory region that actually controls the “grasping” action. That is, *the idea* of holding a piece of fruit and *the action* of holding it happen in the same sensory-motor area of the frontal lobe. What magnifies the importance of embodied semantics and its location in the brain is that it overlaps with Broca’s area—the section of the brain that focuses on expressing both spoken and written language. Neuroscientists have also discovered this region not only responds to action-related words but idioms as well (Iacoboni, 2009).

Recently, studies were conducted to investigate if second language learners acquired lexical items in the same way as their first language learner counterparts regarding the use of embodied semantics. According to Monaco, Jost, Gygax, and Annoni (2019), “[o]verall, all the reviewed studies investigating sensorimotor

involvement in semantic processing showed that L2 is—at least to some extent—embodied” (para. 55). In short, native and non-native speakers of English reap the benefits of embodied semantics in terms of vocabulary acquisition. Let me now turn to another useful neuroscience discovery that is of equal significance—mirror neurons.

## **Mirror neurons**

The initial discovery of mirror neurons dates back to 1992. Mirror neurons were first observed in Giacomo Rizzolatti’s lab where his researchers were studying movement responses in the premotor cortex of macaque monkeys. Since the breakthrough in Rizzolatti’s lab, mirror neurons have also been detected in humans (Arbib, 2002; Iacoboni, 2009).

Mirror neurons are defined as specific kinds of brain cells that fire or respond when a person both performs an action (e.g., tossing a volleyball) and when he/she watches another person do the same action (i.e., tossing a volleyball); hence, these neurons “mirror” others. This is why we react the way we do when we watch a powerful scene in a movie or vicariously feel excited while watching sports. In short, when we do an action, watch someone else do it, or even think about it, we are employing our mirror neuron system (Randolph, 2016b).

There are five different kinds of mirror neurons that the neuroscience community is currently aware of, and these range from ones that help perform general physical actions (i.e., *broadly congruent mirror neurons*) to ones that react to words in novels (i.e., *word-elicited mirror neurons*). For a detailed survey of the five kinds, see McPherron and Randolph (2014) and Randolph (2013a). The power of mirror neurons sets them apart from other kinds of neurons like motor or sensory neurons, for these two can either help

the brain perform actions or they can observe actions. Mirror neurons, however, can do both (Kilner & Lemon, 2013).

What makes mirror neurons so interesting for ELTs, particularly the word-elicited mirror neurons, is their influence regarding vocabulary pedagogy and reading, for the word-elicited mirror neurons allow us to live vicariously through the written word. All this is very significant in how ELLs encode and learn vocabulary, as we shall see in the method below.

One study, done by Aziz-Zadeh, showed just how acutely these neurons react to visual actions and their corresponding words (as cited in Iacoboni, 2009). Aziz-Zadeh conducted a brain imaging experiment in which she had her subjects both read sentences and watch video segments of head and mouth actions related to reaching for or eating food. She discovered that the mirror neurons responded equally to both reading about and observing the actions (Iacoboni, 2009). The reactions to both activities make sense, as these mirror neurons are located near the premotor cortex; that is, the area where the dynamics of the embodied semantics play a part in our cognition and the performance of our actions.

As I suggested at the onset of this article, the more ELTs are aware of how the brain works, the better we can create effective methods to teach vocabulary. The discoveries of embodied semantics and mirror neurons are pivotal in helping us create useful and constructive ideas that incorporate using the body (i.e., movement) and employing a mental image of the lexical items (i.e., mindfulness). The culminating aspect of music that I use works to solidify the terms by bringing into play both the body and the mind. In short, by making use of these neuroscientific tools, we can create a “whole-

body-brain-mind activity” (Randolph, 2018, p. 2) that will encourage our ELLs to genuinely learn English lexical items.

## **STARTING WITH THE HEAD-TO-TOE METHOD OF ASSOCIATIONS FOR VOCABULARY ACQUISITION**

Before I employ the embodied semantics and mirror neuron-based activity, I always set the foundation of our lexical item learning by using the six basic parts of my own system called the Head-to-Toe Method of Associations for Vocabulary Acquisition. There are over 40 components in this method. I typically use six of these in class to help the ELLs understand the essential feeling and heart of each lexical item. These include the following:

- (1) eliciting a lexical item’s definition by offering example sentences;
- (2) discerning the term’s part of speech;
- (3) assigning the term’s *verbpathy* (i.e., the immediate and intuitive feeling that a term communicates);
- (4) associating a color/smell/taste with the term;
- (5) linking an emotion to the lexical item; and
- (6) associating a specific body part/region/organ with the term.

For a detailed survey of these elements and the process, see Randolph (2016a).

As above, I use these six components to establish a genuine and native-like feel for the lexical items of which I typically teach two to three per lesson. By the end of the week, the students will have learned anywhere from five to 10 new lexical items. I, then, help my students encode the terms at an even deeper level by using the embodied semantics and mirror neuron-based activity. This mind-body-music activity can also be used as a weekly review of the learned vocabulary at the end of the week. So, the

employment is versatile. I now turn to show how I have the students apply this activity to acquire vocabulary (Randolph, 2018). For the purpose of this article, I will use the adjective “meticulous” as our working example.

It should be noted that much of the research on embodied semantics and mirror neurons deals with action-related words and idioms (Iacoboni, 2009). As the premotor cortex is a central area for movement, it is logical that these action-related lexical items would work best. I, however, have found that the following activity works equally well with non-action related items such as “conundrum,” “myriad,” or our working example of “meticulous.”

## **PUTTING EMBODIED SEMANTICS AND MIRROR NEURONS TO USE IN VOCABULARY LESSONS**

### ***Mindfulness***

#### ***Pronunciation—Feeling the lexical item through its sound***

I first repeat the lexical item three to four times together with the students and ask them to do this with their eyes closed. (For lower level students, the instructor may wish to do more repetitions.) Eliciting the information from the first six components of the Head-to-Toe Method of Associations for Vocabulary Acquisition is significant as that fundamental preparation allows the students to feel the term on a visceral or emotional level. This method is much more effective than the standard technique of rote memorization, which often results in forgetting the terms not long after the initial exposure (Bennett, 2019; Willis, 2006).

Mindfulness plays a crucial role in the first step, and that is why I ask the students to close their eyes. I want them to be mindful of how the sound makes them feel. For example, when they practice pronouncing “meticulous,” many students comment on how

it sounds like its meaning: that is, it makes them intuit a need to focus on something or pay attention to details. In short, when we do step one, I emphasize the concept of mindfulness as we feel the term through the sound. And, per our discussion on embodied semantics, that part of the brain is being stimulated and helping to encode the term.

### ***Mindfulness & Muscles***

#### ***Pronunciation and action—Saying and acting out the understanding***

The next step in the process combines the mind and the body. Here, I ask the students to pronounce the lexical item three more times while simultaneously performing a gesture or facial expression that represents the term. Before starting this, I give the students a few moments to think up a gesture or facial expression that exemplifies the term. For example, to illustrate the term “meticulous,” some students gesture making checkmarks as if to show they have carefully gone over the details of something or they squint and look focused to illustrate they are paying close attention to details. The comfortable marriage between mindfully pronouncing the term and acting it out nurtures a very concrete and highly intimate relationship with the term. The lexical item becomes embodied and tangible versus being an abstract sound temporarily memorized (Randolph, 2018).

#### ***Pronunciation, gesturing, and sharing—Reinforcing the understanding***

After the individual work, the students now share their pronunciation and gestures with each other. I have them turn and face a neighbor, and then they take turns pronouncing the term while offering a representation of the term through a gesture or facial expression three more times. The combination of the pronunciation and gesture

helps reinforce the intuitive feel of the term. In addition, by watching their classmates perform the term, each student's mirror neuron system will also nurture a deeper and permanent understanding and acquisition of the lexical item (Randolph, 2016b). In short, the dynamics of embodied semantics and the mirror neuron systems are at play, solidifying a natural exposure to the term.

### *Creating scenes in the mind's eye—Producing visual examples*

Next, I ask the students to close their eyes and take three mindful breaths. Then, I ask that they imagine a scene in their mind's eye that employs the lexical item in question. For example, they might create a scene in an office where an accountant is meticulously checking over a report. The basis of these created examples can be autobiographical experiences, personal memories, or based on pure imagination. Instead of first writing these example sentences down, the students are visually creating them in their minds, again stimulating both the embodied semantics and mirror neuron dynamics in the brain. I also like to encourage the students to create these mental images using the emotions and vivid details, for using detailed images and emotions will help them encode the terms and leave a profound impact on their memory systems (Immordino-Yang, 2016; Randolph, 2013b).

### *Sharing examples—Exchanging the perspectives through practice*

The students, then, turn to their neighbor once again and take turns sharing their visual examples. Craik and Lockhart (1972) discovered decades ago that elaborating on the material (as we do here) is a surefire way to help learners acquire the material or task at hand. This is a very effective method because the students use both the neuroscientific tools to develop a personal and detailed relationship with a term and then share it for



extra reinforcement (Bennett, 2019). It is beneficial to share the example with their neighbor as they get even more practice using, hearing, and saying the lexical item. In addition, I ask my students to share their visual examples with the class so that everyone can benefit by hearing the term multiple times and also experience hearing various examples of the term.

### *Written examples—Putting the images in writing*

After the students have created their visual examples and shared them with their neighbor or the class, I ask them to write these on a designated worksheet for vocabulary. Writing these examples down immediately following the class activity has three crucial benefits (Randolph, 2018). First, the students are able to record the visual examples while they are fresh in their minds. This helps them capture the content of the example and also correct any grammatical errors that may have occurred while giving the spoken examples. Second, as they do these in class, they are often inspired to use themselves, classmates, the instructor, or a class-related incident as examples. This makes the examples and the lexical items more personal and tangible (Randolph, 2020). And third, they write these without the urge to go online and use internet-based examples. This builds their confidence and also shows the students how powerful their own imagination is.

### ***Music***

#### *Culminating the experience through music—Enhancing the understanding through emotion*

Music is a vital part of who we are as humans; thus, making it a natural device for learning (Levitin, 2007; Randolph, 2019). To this end of making music a part of the lexical learning process, I ask that my students find a piece of music that represents or

matches the meaning of each vocabulary term. This step is done as homework, and they often have the weekend to do it as I frequently use this seven-step method on the last day of class for the week. This step is not only fun for the students, but it sparks their need and desire for creativity (Csikszentmihalyi, 2013). Furthermore, it helps my students encode and learn the lexical items at yet an even deeper level because of music's ability to elicit memories and emotions—two extremely powerful learning tools. This activity is also effective as it ties in nicely with the dynamics of both embodied semantics and mirror neurons.

The piece of music can match the meaning of a term through its melody, its lyrics, or the way the song is played. For instance, with respect to our example, “meticulous,” one student chose Lenka’s song “Everything At Once” because of how it details the various similes about animals and other things. Another student chose Beethoven’s Fifth Symphony because he felt the notes meticulously matched his heart rate while listening to it.

The part of the vocabulary worksheet for this is relatively simple. I have the students write down the lexical item with an arrow pointing to the song’s title. Then, they offer a one- or two-sentence explanation of why they selected that song to represent the vocabulary term. It should be noted that students are free to select a song from their home country if they feel it best matches the lexical item in question.

## **CONCLUDING REMARKS**

All too often, learning vocabulary can be an arduous chore. Students are frequently given a list of terms to memorize, and frequently these terms are forgotten days, or, in many cases, even hours after the students have taken a test or quiz on the

meanings of the terms (Bennett, 2019; Ebbinghaus, 1885/1913; Willis, 2006). On the other hand, this does not have to be the case. By employing discoveries in neuroscience like embodied semantics and mirror neurons, and by tapping into those specific neural regions where these systems work, we can help our ELLs encode, learn, and retrieve lexical items with enthusiasm and ease. I have shown how the use of mindfulness, movement, and music help students learn and reinforce their knowledge of lexical items with a deep understanding. After using this seven-step method, the students not only employ the lexical items correctly, but they also transfer them into their long-term memory as they build on their lexical understanding of the English language.

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