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Neuro 430
Kids Judge Neuroscience Fair 2006 Exhibit
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Writing in the Major Assignment
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V.A.W.B.A.M.

(**V**isual, **A**uditory, **W**ernicke's Area, **B**roca's Area, **A**ngular Gyrus, **M**otor)

Abstract

We use language constantly, and it is such an important part of our lives that it would be nearly impossible for us to survive without it. The role of language in our daily lives proves that there is a need for the public to be better informed about how it is processed in our brains. Ultimately, this understanding could lead to better support of research in speech and language pathologies. At the minimum, this understanding could enable the public to have a more accepting attitude towards people with speech and language disabilities.

The goal of our model was to teach 5th graders the basics of how language is processed in the brain, focusing on six main areas: Visual Cortex, Auditory Cortex, Wernicke's Area, Broca's Area, Angular Gyrus, and the Motor Cortex. Collectively, these areas make up the title of our model: V.A.W.B.A.M. In addition to informing the public (5th graders in this case), it was a learning experience for us as educators. Scientists often have a difficult time conveying their ideas accurately to the public, so they must take care to use language that can be understood by people outside their field of study.

Journalists are no better at understanding scientists than are elementary school students. Therefore, teaching 100 5th graders is a perfect exercise in communicating with the public. The event was a success, and when the day was over, winners were announced. V.A.W.B.A.M. took third place (not far behind the 1st and 2nd place finishers in our group). Upon review of the 5th graders' comments, we saw that our model was well received, and we were successful in teaching the students about the basics of language production and comprehension.

Introduction

Language comprehension and speech production have intrigued people for decades (if not longer). It is ingrained into our everyday lives so deeply that we likely take it for granted. Today, much is known about how language is processed

in the brain, but even more remains a mystery. Language becomes even more amazing when you consider how quickly it is processed. Language is a code of sorts, and when we speak to another person, we select a code (word choice) that we think the listener will understand. This information is then translated into motor movement of the mouth, tongue, and throat. All of this happens in an instant, resulting in an average speech production of 3 words per second. Despite the speed at which speech is produced, we make only 1 word error for every MILLION words! (Caplan, 1995).

Language comprehension and speech production are directly linked to a few specific regions of the brain. Some of the better-known areas include Broca's Area and Wernicke's Area. Most of this knowledge comes from the study of aphasic patients. Patients with damage to Broca's area demonstrate deficits in speech production, and patients with damage to Wernicke's area demonstrate deficits in comprehension. These two areas have been labeled as the core regions involved with auditory perception and repetition of single words. (Price et al., 1996).

More recently, the functional roles of these areas are coming to light. Mechanisms behind speech production are distinct from comprehension. Broca's aphasia seems to affect both modalities, but findings suggest a functional separation between production and comprehension mechanisms. Coinciding production and comprehension deficits are likely the result of their anatomical proximity to each other. (Grodzinsky, 2000).

The Angular Gyrus has also been found to play a role in language. Schizophrenic patients have an asymmetry to their Angular Gyrus, which is thought to be partly responsible for their disorders of language and thought. (Niznikiewicz et al., 2000).

In addition to the above areas, the motor, visual, and auditory cortices play important roles in language. These cortices do much of the decoding, putting the picture together for full comprehension. The motor cortex then directs the physical production of speech by it's projections to the muscles of the face, mouth, tongue, and throat.

For this project, our goal was to teach the students about these 6 areas of the brain. Our model will achieve this by the use of two games in conjunction with an explanation of a brain diagram (to be on the poster). To help the students with the memorization of these areas, presented them with something tangible that represented the function of each brain area.

We expect the students will learn the general location and function of each area, and to leave with a greater appreciation of language comprehension and speech production.

Methods

Our model consisted of several different parts. We had two games for the 5th graders to participate in. The first was a 'poem game'. We recorded Justine reading Sylverstein's poem "Messy Room." We put this on a cd, then played it three times for the 5th graders. While they listened to the recording we had them draw what they heard in the poem.

The second game we had them play was a card game much like 'Taboo'. We made a set of cards with a word in red at the top (such as 'snowflake'). Below this word in red we listed three words in black ('snow', 'ice', 'sky', for example). We would then give one participant the card, and it was their job to get someone in the rest of the group to say the word at the top of the card. However, the participant with the card was not allowed to say any of the words on the card. We had the group do this a few times, handing the card to a different person in the group each time.

Our poster detailed each part of V.A.W.B.A.M. by showing a large human brain with arrows indicating the area of the brain represented by each letter. 'V' was for Visual Cortex, 'A' for Auditory Cortex, 'W' for Wernicke's Area, 'B' for Broca's Area, 'A' for Angular Gyrus, and 'M' for Motor Cortex. In addition to a phrase detailing the primary function of each area, we included a small picture of something that would help them remember the function of the corresponding area. For example, for Wernicke's Area, we included a picture of a dictionary. This gave the group a visual aid that related to the area's function in language comprehension. The poster also had two more diagrams of the human brain. We included arrows indicating the pathways involved in hearing speech, understanding it, and responding to it by writing or speaking. Each of the diagrams were related to one of the games that we had the 5th graders play.

In addition to the two games and the poster, we had a set of objects corresponding to each area of the brain involved in speech production and comprehension. For example, we had a dictionary for Wernicke's Area.

Using the games, the poster, and the objects, we explained to the 5th graders these six areas of the brain, their function in speech and language production and comprehension, and emphasized the importance of these areas as they pertained to our everyday lives.

Results

It seemed that the kids enjoyed our model. They were particularly excited for the opportunity to draw, utilizing all the time given to them. They also enjoyed the card game, and they all eagerly volunteered to participate. Our results

according to the kids' score sheets were positive, despite being ranked third out our 4 groups.

In this table, VAWBAM is B2.

Code	Num Votes	Vote Place	Q1 – Understand	Q2 – Friendly	Q3 – Fun	Q4 – Learn More
B3	10	1	4.45	4.9	4.6	3.68
B1	9	2	4.56	4.8	4.52	3.84
B2	4	3	4.24	4.68	4.26	3.56
B4	2	4	3.6	4.16	3.44	3.24

The kids who came to our model did not ask a lot of questions. However, I am not sure that this is demonstrative of a lack of interest in the subject. The kids got the general idea about the areas of the brain that we described, but I have a feeling that some of it was over their heads. To check on how much they understood, we concluded our presentation by asking them questions that pertained to what we had taught. For example, we asked them, "Which area of the brain is Broca's Area?" They then pointed to the area of the brain on our poster. We also asked, "Why is the Motor Cortex important in speech?" They responded with something like "It helps you say words." They generally answered all of our questions correctly, so I have no doubt that our model was a success.

Their written evaluations also demonstrated their new understanding of the subject material. Some of the kids even wrote the specific function of one of the areas that we spoke about. In general, we had a lot of comments, so I assume that the kids were into our model quite a bit. As you can see in the table above, all of our evaluation rankings match our voting ranking. The ranking must be an accurate indicator of how the kids liked our model in relation to the other 3 in our group. Our scores were very near the two groups above ours, but were quite a bit higher than the group below. I am actually quite happy with the scores that we received from them, especially considering the complexity of what we were trying to teach.

Discussion

We taught 5th graders about the visual cortex, auditory cortex, Wernicke's Area, Broca's Area, Angular Gyrus, and Motor Cortex. More specifically, we wanted the kids to know how each of these areas interact with each other to make speech comprehension and production possible. Few people realize how many parts of the brain are responsible for something such as speech. Most of us probably take speech for granted because it comes automatically for us. In reality,

our model taught about six areas of the brain, but it was simplified significantly. We only presented the bare-bones version of language comprehension and speech, but we could not have presented a more complete explanation due to time constraints and the attention span of our audience. We completely ignored some parts of the pathway. For example, we never detailed how sounds reaching the ears get to the brain. Despite gaps in our pathway, we managed to meet our objective of educating the students about the most important parts of the pathway.

The presentation of our model went well, but we ran into a couple of obstacles. We were a little tight on space, so we had to be flexible and a little creative to gather the 5th graders within range of the speaker. We were surprised at the sound level in the room, so speaking over the noise became somewhat of a chore. We were also fortunate that our recording of Justine reading the poem was loud enough to be heard over the noise.

We ran into some time problems with the first two groups that came through our station. With the first group, I spent too much time talking about the areas of the brain, and Ting didn't have time to completely explain the pathways. We also didn't allow enough time for the kids to fill out their score sheets. This may also have contributed to fewer written responses in the first groups. We smoothed things out for the last couple of groups when we did a better job of managing our time.

I think our project could have been improved had we gone more in-depth into a specific part of the brain. We had too much to talk about, so we were forced to just touch on each of the six areas.

References

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