Make a Memory

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Abstract

The differences between short term and long term memory are commonly studied in neuroscience. We wanted to present the kids with the basic concepts of the two types of memory and their basic pathways in the brain. We created a model in which we used yarn to show the different pathways for various types of memory, and conducted a memory test to explain how short and long term memory work. Overall we placed third out of four models, but had an average score that would indicate that we should have placed last. It was fun interacting with the kids, but more importantly, I think the kids had a good time.

Introduction

Two highly studied forms of memory are the classifications of short-term and long-term memory. Short-term memory usually refers to items that are retained in memory for roughly 15 seconds, without distraction and without rehearsing the items. Miller (1956) demonstrated that the capacity of short-term memory is 7 plus or minus 2 things, and can be increased by creating chunks. These chunks are simply grouping information to make a larger single object. Long-term memory stores items that we retain in memory for a prolonged time. Our constant capacity for forming new memories appears to be endless. Although the characteristics of these two types of memory seem different, most of the same brain areas seem responsible for both types of memory.

Andreason et al. (1995) showed that similar regions were activated in both short-term and long-term memory: right frontal areas, biparietal areas, and the left cerebellum seem important. In addition, Andreason et al. found short-term memory also activated a large portion of the left prefrontal cortex. Andreason et al. used positron emission tomography to diagram these circuits. As demonstrated by Wong (1997), these areas also receive information from perceptive cortices, mesotemporal lobes, and the dorsomedial nucleus of the thalamus. With rehearsal, memories are converted from short-term memory to long-term memory. Information from the various activated regions by Andreason et al. (1995), converges on the hippocampus. The hippocampus is the main relay area for memories in the brain. The memory usually gets packaged and sent back to the brain area from which it came. This is how someone with a damaged hippocampus can still remember things from their past. The hippocampus is involved with converting the memory into long term storage. Analyzing these two types of memory is important, because it allows us to understand how we encode various types of information in our brains.

In the present study, we will use a simple memory test to show kids the difference between short-term and long-term memory. After being presented with a list of items, the kids will have a variable amount of time to rehearse the items and should be able to recall 7 plus or minus 2 items on average. After demonstrating the properties of short-term and long-term memory, we will set-up a model to demonstrate where these pathways lead in the brain. We will allow the kids to move circular pieces of pipe cleaner to interact with the model and get hands on experience with using the model to show these pathways.

In summary, we hope to get the kids involved with how short-term and long-term memory work, and the specific pathways in the brain that contribute to forming each of these types of memory .

Methods

Brain Model. A large model of the brain was used to show the kids the different lobes of the brain. The various lobes were each a different color, with a piece of paper labeling each lobe.

Memory Pathways. A picture of a horizontal section of the brain was blown up and glued to a two-by-three foot board. Small nails were hammered into the board at various locations in the brain where a memory might have an affect. For example, nails were placed in the visual cortex for visual memory, the motor cortex for movement memory, and the amygdala for the emotional aspects of memory. A large nail was placed at the hippocampus to signify its importance as the main consolidator of memories. Yarn was used to show how information enters or leaves the hippocampus. Pink yarn was used to link nails to the hippocampus that would be carrying input information into the hippocampus. We used blue yarn to show outputs of information from the hippocampus, and where the information is finally stored. We thought it would be important to use two different colors to highlight the input and output pathways of the hippocampus. We gave the kids a small piece of paper attached to a small piece of pipe cleaner bent into a circle. The kids were told that they could write down a memory, and we would help them trace the pathway of the memory in the brain. This would help the kids reinforce what they learned. If they traced the pathway correct, they were given a piece of candy for a reward.

Memory Task. Twenty objects were laid out on the table. We covered the items with a towel so the kids would not be able to see any of the objects until we started. We instructed the kids that we were going to lift up the towel, and they would have thirty seconds to remember as many of the items as they could, then the items would be re-covered and they would have one minute to try and recall as many items as the could. We told the kids that the average person could remember seven plus or minus two objects. We rewarded the kids who did exceptionally well with a piece of candy.

Judges. Ninety-six fifth graders were asked to fill out a questionnaire after each presentation, and then vote for the display they thought was the best. Each presentation was about ten minutes long, with an additional five minutes allotted to the judges to fill out their questionnaires. The questionnaires had 5 evaluation questions with a scale of one to five (one being the worst and five being the best). There were two groups of students presenting projects, and two groups of faculty members. The presentations were split into two groups. One faculty and one student group of four presentations each, were assigned to either the green or blue group. Since there was a time limit for the presentations, the students were also split into two groups of forty-eight. Each group voted on a student and faculty project. In total, each student saw eight projects.

Results

The results for how each section rated is shown in figures 1-4. Out of four groups in our section, we placed third. This was a little bit of a surprise. As the groups of kids would come by our model, I can only remember 1 or 2 kids that actually seemed interested in our topic. This was shown in the individual ratings, in which the kids actually rated us dead last in our section overall. The kids did not seem to ask a lot of questions, which led me to believe that our model was a little too much for them to understand. I do not blame them. If someone was using terms like hippocampus and episodic, I would have lost interest in the model fairly quickly. Typically, when a kid did ask a question it was to clarify what a term meant or what a structure was. More often then not, the kids had a blank expression on their faces or were too hyped on candy to want to pay attention. Overall, I think we had a good model, but the way we presented it may have been a little much for the kids.

Memory is not where my main interests are, so I was kind of learning along with the kids. My partner did a good job explaining how the various forms of memory work and their pathways in the brain, but it took me a couple of times listening to the model before I understood what was going on. If I was having that much trouble, then I am sure a fifth grader hearing it once, was completely lost. The basis for the model was good, but we needed to find a way to tone down the language so the kids could more easily understand the topic.

Discussion

Looking at the differences between groups, it appears that groups A and B (students) had a higher overall average score then groups C and D (faculty). This was probably due to the students not having as much a background and knowledge in the topic they were presenting, then the faculty members, and therefore were able to talk about the information in simpler terms.

We were group B1 and received third place in the green student group. According to the results however, we had the lowest overall score average and should have placed last in our group. This was probably due to the complexity of our model. For most of the kids, this was probably their first exposure to neuroscience and throwing words like hippocampus and amygdala at them and expecting them to fully understand what we were taking about was probably a little ignorant of us. Our presentation would have been much better if we just examined the specific difference between short and long term memory. I think throwing all of those different pathways at them was a little much, and we understand how they may have been confused.

We had to make a lot of shortcuts in trying to explain our model to the kids. The pathways we were describing are very complex, and for us to say that there is only one input to the hippocampus for a specific type of memory is false. For example, if we wanted to remember what something looked like, information would come into the primary visual cortex and then sent to association areas of the visual cortex and other parts of the brain for object recognition. In our model, we said the information comes into the primary visual cortex and heads straight to the hippocampus where it is encoded into a memory. We failed to mention just how complex the connections in the brain were, so the kids might not get the wrong impression that the brain is a simple structure.

We originally decided to do memory as our topic because it is a popular topic in neuroscience. It is a very complex topic and we decided it would be good to introduce the kids to the topic. My recommendation for future groups looking to present a model on memory would be to concentrate more on the differences between short and long term memory. That being, short term memory is things we hold in memory for about fifteen seconds and long term memory being things we hold for longer. We briefly showed the kids how this worked with the memory test, but failed to explain to the kids that the objects they remembered were recalled because those items were transferred into long term memory as a result of rehearsal. Rehearsal is when we say the item over and over so the item gets transferred from short term to long term memory (Miller, 1956). Presenting them with this memory task and another memory task in which they had to remember long series of numbers would have been a simple way to explain memory. By testing them with the chain of numbers, we would have been able to explain how the average number of items for someone to recall is seven plus or minus two, and the reason some people may have been able to remember a longer chain of numbers then someone else is because the used to concept of chunking. Chunking is simply grouping smaller bits of information together to remember a larger item (Miller, 1956). For example, presenting the numbers 568737262625263748495847 may be hard for someone to recall each number individually, but if we "chunked" numbers into groups of three then it would be easier to remember more total numbers (568-737-262-625-263-748-495-847). This is the same strategy used be commercials trying to get people to call 1-800- numbers.

Overall, I think that exposing the kids to various topics in neuroscience was a good idea and triggered an interest in some of the kids. More importantly, I think the kids had a good time and that is what was the most important.

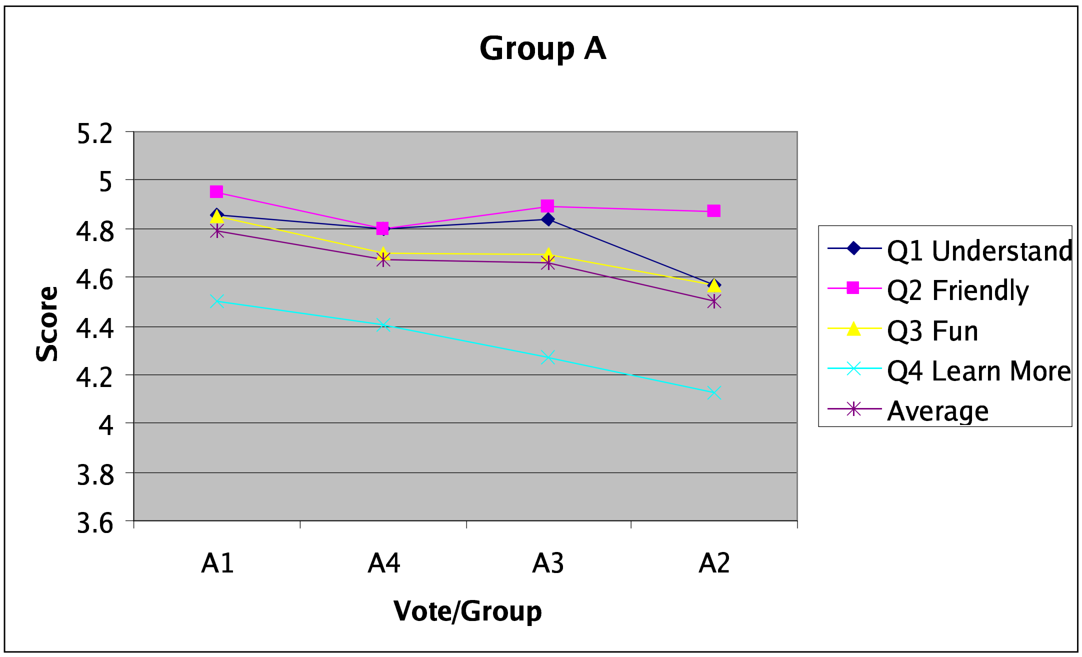

Figure 1. Results for blue student group

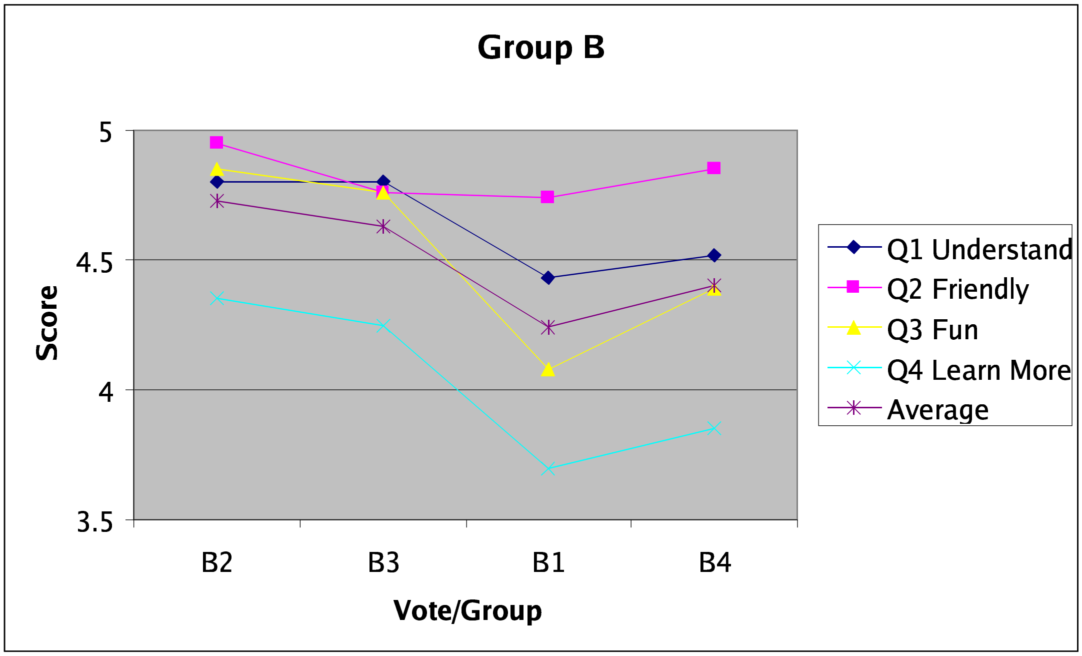

Figure 2. Results for green student group.

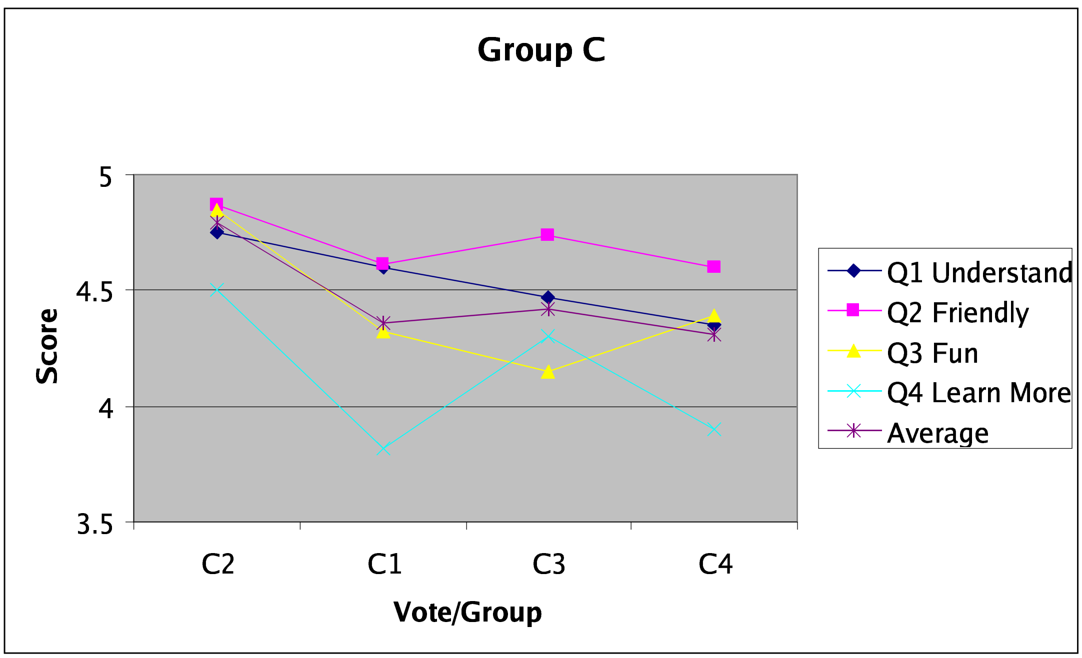

Figure 3. Results for blue faculty group.

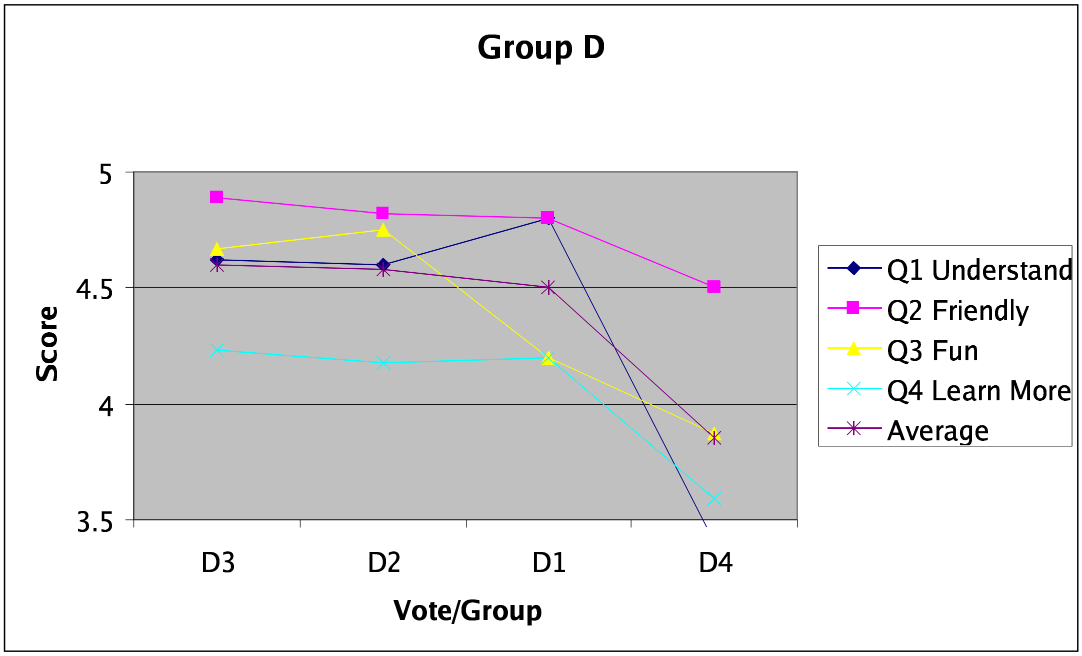

Figure 4. Results for green faculty group.

<u>Work Cited</u>

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