Neurokids – Prism Goggles
October 1, 2007

THEME: This lesson introduces the concept of separate learning strategies, implicit and explicit learning. Students participate in an implicit learning task (beanbag toss) that involves circuits in the cerebellum. This lesson also introduces the role of the synapse in learning.

SCHEDULE: The group leader will start the event by giving the children a brief introduction to ourselves and to our group. Next the group leader will give the kids some background for our demo. This background will include a discussion about different kinds of learning and distinguish between implicit and explicit forms of learning. The beanbag toss activity will be explained and demonstrated for the class. We will then break up into small groups with one volunteer each and let each student try the beanbag toss. We will then come back together in a group and talk about the two different learning strategies that can be used in this activity. We will then let the students ask questions.

INTRO/BACKGROUND: The following is an example of what the leader might say during the introduction, including some specific questions to keep the kids engaged. It does not need to be repeated verbatim, and probably will contain more information that is necessary to explain. It should be useful background for volunteers, for more information see the suggested volunteer readings {to be added soon}.

Can anyone describe what learning is? Scientists like to say that "Learning is the way we acquire information about the world", but this can mean a lot of things, information can mean things like phone numbers, friends names, times-tables, but it can also be things like friends faces, how to make a free throw, or how to draw a picture. When scientists over the last century have thought about learning, they realized something very important, and that is that some kinds of learning are require conscious activity and others happen unconsciously, and they refer to these kids of learning as explicit and implicit learning.

Consciousness can be tricky to talk about, maybe you think you know exactly what we mean by conscious and unconscious activity, but lets look at it a different way. If we asked you to describe how you learned that 6*8 is 48, you could probably describe how math works, that if you took a bunch of M & M's and made a square with 6 rows of 8 M&M's each that you could count each one and make 48. Some things that we learn are easy to talk about, but others are more difficult, take free throws for example, somebody probably showed you how to hold the ball, but how exactly do you know how to make the shot?

Scientists look at it this way, times tables and correct free throws are both kinds of information that can be learned. The type of information that you can easily think about and describe is termed explicit {think explained-explicit}, and the kinds that you kind of just do are termed implicit {less easy to remember, think implied}. Now in everyday life

not everything fits nicely into one category or the other, but for today we're going to stick with that definition.

When you learn something new individual cells in your brain change. One thing that scientists are currently studying is where in your brain specific cells are changing.

Were going to show you a little game that will change a few cells in a part of your brain called the cerebellum. One thing that your cerebellum helps you do is compare what you see with what your body is doing. You have lots of sensors in your muscles that keep track of where your body is. If you move your arm, you know where it's moving even if you cannot see it, or aren't paying attention. A copy of this, along with a lot of other information goes to your cerebellum.

Your cerebellum helps you by comparing what you want to do with what you actually did. So if you're playing a beanbag toss game, and you throw a beanbag at a target then you either hit the target or miss the target. Part of your cerebellum is working like a little computer, and each time you throw a bag, it keeps track of how close you were to the target. It takes the information about how much you missed the target by and uses it to change the way your arm moves the next time you throw.

When you play the beanbag toss game, were going to move where the target appears to be, so you will end up throwing it further away from the target than you would expect, but if you take enough throws your cerebellum will do the work for you and change the way your arm moves without you even having to think about it. And your throws will get closer and closer.

ACTIVITY: Volunteers will lead groups of 4-6 students. Students will be trying to throw a beanbag into a target. Each student will first get an opportunity to practice a few throws and then they will be given a pair of Prism Goggles. Prism Goggles distort the field of vision to about 20 degrees in one direction and make it very difficult to hit the target and beanbags will probably be thrown all over the place. Other students that aren't participating can help collect stray beanbags. While wearing the goggles, each student should get 20-30 attempts to hit the target. Students should be encouraged at this time to "let their brains adapt to the situation" rather than manually adjusting where they aim (many students will attempt to adjust their aim). After they begin to consistently hit the target, ask the student to remove the goggles and throw again. Many of the students will accidentally miss in the opposite direction. Some students may not show these effects of compensation. Allow each student to have his turn to wear the glasses and try the experiment.

DISCUSSION: Once we put on prism goggles, there are two ways to adjust and hit the target. One strategy is explicit, we tell ourselves that our aim is off and try to throw the beanbag where we think the target is, rather than where it appears. This type of strategy quickly adjusts our performance, but requires us to guess where the beanbag should be thrown. For students that use this strategy, when the goggles are removed, and they are

asked to throw again, they will not experience an opposite shift in their aim. When using the implicit learning strategy we throw the beanbag where the target appears to be. This strategy requires several attempts, each time we throw a beanbag, our brain makes a tiny adjustment, in a brain circuit that we do not have conscious control over. The adjustments last for a while which is why after removing the prism goggles, our aim has been adjusted in the opposite direction, and takes a few more trials to re-learn.

Some questions to ask {feel free to add your own}:
Is one kind of learning better than the other? {each have their own benefits, think about the attention demands of explicit learning}
What is an example of an activity that is more effectively learned implicitly/explicitly? {maybe something like soccer/friends names}
Why would we want to learn things without having to pay attention to them?
Are there any subjects in school that are best learned implicitly? {foreign language}