Seed Lesson: Using Psychology to Improve Teaching Practice

When I taught a 7th grade Life Science class about seeds I thought about a number of psychological principles when designing my lesson plans. I wanted to make sure that the students both learned the new content and were interested in what they were learning. I was aided in this process by the fact that seeds are inherently a topic that students in the Ann Arbor community encounter. Theory suggests that presenting students with relevant phenomena will increase their interest in a topic, which will in turn increase their motivation and their learning. However, I could not simply fall back on the fact that my students see seeds all around them – in the food they eat, their school or family gardens, etc.. I needed to design the lesson using techniques that would build upon this advantage.

Constructivist learning theory suggests that "people create (rather than absorb) knowledge from their observations and experiences" (Ormrod 19). Based on this theory student will learn the material best if they can experience and interact with it first hand, rather than just reading about it and talking about it. In order to support this type of learning the 3-Day-Teach was built around the Seed Lab. This lab, completed on the second day of the lesson, involved students getting to draw and dissect their own dry and soaked corn and bean seeds. In the lab the students had the opportunity to touch the beans, stain them with iodine and measure them. Through these direct interactions with the seeds the students would be more able to develop their understanding of the structure of a seed.

Social constructivist learning theory further suggests, "by working together, two or more people can often gain better understandings than anyone could gain alone" (Ormrod 19). During the Seed Lab students worked in pairs, sharing their seeds. This

structure supported conversations about what they were interacting with and created the social learning environment that social constructivism suggests allows best learning. Additionally, note-taking was broken up by opportunities for students to discuss ideas with their table – in groups of four. This structure also supported student learning by creating a structured environment in which students could gain understandings through social interactions.

Constructivism also suggests "learners create knowledge through their interactions with the environment" (Ormrod 19). By bringing the natural environment that students have been interacting with and thinking about their whole lives into the classroom the Seed Lab and dispersal demonstration builds upon students' existing understandings and interest. The lesson presents students with authentic, real-world topics and in doing so helps them to create new knowledge by integrating new material, such as terminology, with the schemas and understandings they have been cultivating throughout their lives.

Students in the 7th grade, around ages 11-13, are at the transition point between Piaget's concrete and formal operational stages of cognitive development. At this stage students are just developing the skills of abstract thinking and applying logical reasoning to non-real-world situations. However, because the classroom has a diverse scope of students at a variety of developmental levels, it is important to design the lesson to be accessible to students who are still at the concrete operational level and need real-world situations in order to apply logical reasoning. The use of the hands-on Seed Lab and the observational activity of the seed dispersal demonstration, in which students watched seeds being dispersed by a fan in the classroom, created the real-world, physical

situations to help students understand the complex ideas of seed structure and seed dispersal.

Because students are gaining new information that might alter the way they think about the seeds that they see in the fall or the new plants that they see in the spring, the students might undergo a process of accommodation. Some students might have to create a new schema for 'seed dispersal' if they had never thought about how plants move from one place to another. Other students might only have to assimilate unfamiliar forms of dispersal, such as floating or passing through an animal's digestive tract, into their already existing schema of 'seed dispersal.' This struggle between assimilating and accommodating new understandings was clear during the lesson when one student tried to explain how apple seeds might be blown from one place to another. She had a strong schema of seed dispersal by wind but was attempting to fit an apple seed, which is dispersed by animals, into her schema rather than modifying her schema to accommodate alternative forms of dispersal.

Monitoring is a key element to developing good classroom management and students will learn more in a classroom that is well managed. Monitoring means circulating around the room and being aware and interactive with what students are doing throughout the lesson. Because the Seed Lab included a lot of individual and group work observing the seeds, there was significant time when I was not in front of the classroom and could have retreated to the prep room or teacher. However, by circulating around the room I ensured that students were on task. The result was that there was very little off-task behavior or talk during the lab activity. This is valuable for student learning because students who are on task will focus better on the material that they are learning and will

therefore process it better to long-term memory. Additionally, psychological research suggests that students are more likely to misbehave when they are not engaged in a task. Ormrod writes, “effective classroom managers make sure that there is little ‘empty’ time in which nothing is going on” (312). By circulating around the room I made sure that group work time was not being wasted and that students knew what task they were accountable for. This reduced the time and incentive for misbehavior and therefore reduced misbehavior in the classroom. Monitoring also allows opportunities for one-on-one interactions between the student and teacher and develops a personal relationship. Each student feels that the teacher knows and values him or her and is therefore more likely to focus on the assignment at hand. A key feature of this lesson was the practice of monitoring to keep students on task and create space for close interactions with students.

The ABC model of motivation suggests that students will be most motivated to learn when they have a sense of autonomy, belongingness and competence in the classroom. Through the seed lesson students’ inherent interest in the topic, because it is authentic to their everyday experience, was built upon by giving students a sense of belongingness. Belongingness occurs when “students see themselves as important and valued members of the classroom” (Ormrod 307). The practice of monitoring, which was in large part implemented to improve classroom management and student behavior, was also important to giving students a sense of belongingness. As I and the other teachers in the room circulated and had one-on-one conversations with the students, we were showing the students that each of them is important to us. While we were there to teach an entire class it was also important that all of the students know that their ideas and their participation are an essential part of a functioning classroom. Therefore, interacting

individually with the students suggested to them that they belong in the classroom and have an important place in the classroom community.

Belongingness was also developed was by calling on students during group discussions and note taking. A variety of students were called on and they shared their ideas with the whole class. As the teacher I made sure that all of the students were listening to what was said so that the students knew that their ideas were valuable and that they were members of a respectful community. I also made sure to give enough wait time and call on a variety of students so that students would know that they are part of a classroom community and not just a solitary learner. Students' sense of belongingness was further cultivated on the third day when creating the histogram of length measurements. All of the pairs of students had taken measurements and I went around the room asking for each pairs' data and making sure that it was recorded by all of the students. This activity created a valuable graphical representation as well as developing feelings of belongingness because every student's data was valuable and important to the whole class understanding. By incorporating these methods to increase students' sense of belongingness, I increased their motivation to engage in the lesson and in doing so increased their learning potential for these lessons.

My seed lesson was relatively successful. Students were able to carry understanding of material from one day to the next and actively and eagerly shared their new knowledge when I asked them review questions. All of the students completed the lab sheet and notes. These behaviors suggest that my efforts to engage students in the material, motivate them and keep them on task were successful. On the first day of the lesson the discussion of whether seeds are alive was very lively. Students were talking

excitedly and comparing ideas with each other. This active engagement with their peers and the level of exploration that groups had by comparing ideas confirmed the value of using group discussion and social interaction to improve understanding as is suggested by the social constructivist learning theory.

The various levels of cognitive development in the classroom and the need to create lessons that support students both at the concrete and formal operational developmental levels was clear during this lesson. Some students were better able to understand the size change of the seed due to soaking by observing the physical seeds that they had in front of them. Other students appreciated looking at the overall trends in seed size and were able to understand the more abstract representation of a histogram. The inclusion of techniques that supported students who were able to think about concepts more abstractly, while still providing the physical evidence to support students still in the concrete operational stage of development ensured that all students in the class met the objective of comparing soaked and dry seed characteristics.

Reflecting on the struggles of the student discussed above to accommodate new forms of seed dispersal in her 'dispersal by wind' schema, I feel that making the difference between various forms of dispersal and the structure of various seeds more explicit would be helpful. The demonstration for wind-dispersed seeds involved throwing seeds into a fan in the classroom and seeing how they were carried to the other side of the room. It would have been valuable to take a handful of apple or corn seeds, which are not wind dispersed, and similarly throw them into the wind. These seeds would fall directly to the ground. This explicit demonstration of the non-compatibility of

these two forms of dispersal would help students see the need to make accommodations for new information rather than simply trying to assimilate it into their existing schema.

Including some type of activity to increase student motivation on the first day would also have been valuable. Although students had an interest in seeds because of personal experience, many complained about spending a class period taking notes. I made frequent reference to the value of knowing the material in order to do the lab, and used excitement for the next day's lab to get the students motivated. However, some more directly interesting activities on the first day might have further increased student motivation. Including a fun video or short demonstration on the first day or even having a few different types of seeds on the table for students to look at informally might have helped improve student interest and motivation to take notes.

The seed lesson that I taught was relatively successful in large part due to the successful incorporation of a number of educational practices based in psychological theory. The use of social interaction in the classroom and a variety of representations supported students through social constructivism whether they were at a concrete or formal operational stage of cognitive development. I helped students stay on task and alleviated many classroom management problems by monitoring the classroom. The monitoring, along with the way in which I called on students during class discussion, also helped cultivate a sense of belongingness and classroom community with increased student motivation. Although some slight changes in practice could be made to further increase student motivation and help students to accommodate new information, the lesson was successful and successfully applied psychological theory in order to help students learn.

Description of Mini-Unit

Day 1:
Reading, talk about what is a seed, talk about "is a seed alive?"

- Modeling notetaking for first little paragraph – parts of a seed, and creation of SQ3R notes with general questions: what is a seed coat, what is a young plant, what is the purpose of the stored food, what is suspended animation (10 min)
- 2 groups for each part of seed, groups have 5-10 minutes to read and take notes, and share notes with group (5 min)
- Have volunteers share notes with class, write notes on the overhead so that everyone has all notes (10 min)
- Pose question "Is a seed alive?" Allow groups to discuss for 5 minutes, discuss as whole class and add to notes
- If time: look at picture in book and introduce concept of cotyledon

Day 1 Objectives:

- Students will list the three parts of a seed and describe their function.
- Students will create notes from reading in the textbook.
- Students will explore ideas of whether a seed is alive through discussion.

Day2:
Seed dissection, observing, drawing, labeling

- Take notes on "What is a cotyledon?" if did not do the day before
- One plate with soaked bean, dry bean, soaked corn and dry corn for each pair of kids
- Have handouts ready on table, divided into four quadrants, one per sample
- Have students generate list on overhead of what they need to label "Does anyone remember the parts of a seed?", explain how to measure width and length, show on overhead
- Dry bean and dry corn observations, drawing general shape and measure width and length (5-10 min)
- Demo opening soaked bean. Using video-camera-projector show what parts to look for and sample of what seed will look like when iodine has been applied. Use questions to tell students what iodine does (turns black when reacts with starch, so identifies the part that is stored food). Students draw, measure and observe their soaked bean seed.
- Demo cutting soaked corn, using video-camera to show direction of cut and what to look for; Student draw, measure and observe their soaked corn seed.

Day 2 Objectives:

- Students will identify the parts of a seed on a bean and corn seed and will draw and label their observations.
- Students will determine the role of the cotyledon by applying understanding of the reaction between starch and iodine.
- Students will compare the soaked and dry seed characteristics and suggest what this laboratory change represents in the 'real-world.'

Day3:
Talk about dissection, descriptions of seed, dispersal demo

- Students take out notes, go over labeling (how to label, more complex parts such as seed leaves, cotyledons, stored food (starch); monocot vs. dicot
- Collect length and width data on class histogram. Ask what the mode is for soaked vs. dry bean seeds. "What happened to the size of the seed? Why? What is in the soaked seed that wasn't there before?"
- Put labs in team folders and take out SQ3R notes and do class discussion and notes on:
- "What's the problem with a young tree growing under mom?" Notes: "Why does a seed need to get away from parent plant?"
- How do they get away? Notes: What is seed dispersal?
- Ideas of how seeds are dispersed. Generate list of ideas on overhead. Give tables an example seed: maple (wind); fruit (pooping); milkweed (wind); and have them do heads together and then white board their answer; do demo where release wind dispersed seeds into fan and see them fly.

Day 3 Objectives:

- Students will review the parts of a seed by confirming the labeling of their observations.
- Students will compare the seed length of dry and soaked bean seeds through the use of a histogram model.
- Students will discuss the reasons for and methods of seed dispersal.
- Students will apply their understanding of the methods of dispersal to suggest the method of dispersal of model seeds.