Direct Instruction
A Healthy Place for Both Science Teachers and Students?

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Envision a third-year science teacher and her students exploring a real scientific event, “The Tortoise (Not Turtle!) that Crossed the Indian Ocean,” that she located on NOAA’s phenomenon-based learning website. She provides a brief story about the tortoise and then elicits questions from her students. The students are intrigued. How can a tortoise cross the Indian Ocean when it is a land creature? How did the tortoise survive a 450-mile journey? How did the tortoise keep from starving? How are sea turtles and tortoises related? What kind of weather patterns helped the tortoise stay alive? The final question ties the story to the goal of the lesson: weather patterns.

The true story about the tortoise lifted the students’ imaginations, curiosity, and intrigue to a level higher than if she had engaged in direct instruction by stating, “Today, we are going to cover weather patterns. Weather patterns are … yawn.” The students’ heads fall on the desks. Splat. The earbuds go in their ears. The phones are out. Away go the students on their journey across the TikTok sea.

Direct instruction doesn’t always work. Bold statement, right? What we know about human learning is that students need exposure to a concept at least five to six times before they can begin to move it into long term memory. Hence, the 5E learning cycle (Bybee and Landes 1990) is one of the best instructional models to use if you, as a science teacher, care about long term memory in your students. The learning cycle is inquiry-based and gets the students initially intrigued and wondering about the concept during the Engage phase (such as we just read with the tortoise who crossed the sea) where the students pose questions they want to investigate about a phenomenon.

The Engage phase transitions into the Explore phase, where students uncover the major characteristics of the concept through inquiry. In the case of the tortoise, the students could conduct research on some of the questions they posed with an emphasis on weather patterns. The students might rotate among stations featuring data, information, and situations that help students to learn about this tortoise phenomenon and how weather patterns affected the tortoise’s journey.

The Explore phase morphs into the Explain phase; students can produce a concept map or mind map of the knowledge gained in the Explore phase. In this way they can begin to see the interconnectedness of the factors at play within the weather patterns during the tortoise’s journey. Students and teachers come to a consensus of what weather patterns mean, how they influence water, impact organisms, and involve wind and pressure areas. The students are making meaning of the science they are investigating.

The Elaboration phase follows, and provides students with the opportunity to apply their knowledge of weather patterns in a different way. Depending on their age, the students could be given another scenario to analyze or create an investigation that addresses weather...
patterns in their own geographic location. By applying their knowledge gained in this 5E learning cycle, they are furthering their understanding of exactly how weather patterns are important in their own lives.

Finally, the students embark on the Evaluation phase, demonstrating what they understand about the scenario and weather patterns. The students could create an infographic addressing the questions they initially posed at the beginning of the learning cycle. They could also create a game depicting the tortoise’s journey and the weather patterns that influenced it.

As a result of this learning cycle, students began to build neural pathways into their long term memory because they can relate to the tortoise and, as a result, all the factors had significant meaning for them.

Contrast this to direct instruction. Guided notes. Self-confirmatory labs. Rote memory. There is no attempt to foster students’ intrinsic motivation. There are teachers, department heads, and administrators who seem to think that if the students are seated in rows, quiet, and heads down on a mindless worksheet, then learning is occurring. This is the industrialization model of schooling where we are treating students like line workers, pumping information into their brains thinking the information is sticking (it isn’t.) Freire (2018) addresses this as the “banking system,” in which teachers deposit information into students’ heads, but nothing connects because the information lacks context, meaning, and relevance to the students’ cultural and other identities. We must give our students agency to truly be scientists in our classrooms.

There are now artificial intelligence (AI) robots that could eventually replace direct instruction teachers. These robots can disseminate information, but are not able to build a true rapport with students during an inquiry learning cycle. During a 5E learning cycle, the teacher helps students grapple with the experience by posing questions like “What is your evidence?”; “How do you know?”; “What makes you say that?”; and “If this, why not that?”

At this writing, there are no robots or AI capable of posing and then following up with these sorts of questions. Is a robot pushing out information the best instructional model for our students?

Many proponents of direct instruction believe it cuts down on classroom management issues. Sure, maybe it breeds fear and intimidation among the students, but then their love of learning science plummets. Building relationships with students is what works. If students believe you know them and believe in their abilities, then are more driven to engage in the material and to share their knowledge with you and their peers.

The third-year science teacher introduced earlier was reprimanded by her principal and department chair for not doing direct instruction. The department chair admitted he did not develop a rapport with his students until the spring. How can this individual enjoy teaching? How can he want to come to school each day knowing he is droning on and on for six or seven periods about the same information to a sea of blank stares? Doesn’t this department chair know anything about how the human brain works? Just because you cover it doesn’t mean the students understand it. After all, how many students readily admit they forget whatever they learned six weeks after the traditional unit exam? Many.

Some of the emphasis on doing only direct instruction comes from preparing for all the standardized tests, yet there is data showing that students learning by inquiry do better on these tests than students who just get a “fly by” of the content from the teacher (Geier, et.al. 2008). Many teachers teach the way they were taught. It may have worked for them, but in today’s world, 99 percent of students do not do well with direct instruction as the only instructional method used in science class.

The time to reprimand early-career teachers for having noisy classrooms is over. If the students are not discussing and explaining, then knowing is not happening within them. Quiet classrooms are scary places. It means passive learning is occurring, and we know little is being transferred to long term memory.

Keep these young science teachers teaching. Support their learner-centered methods. Encourage them to be responsive to the cultures in their classrooms. Continue to support their use of phenomenon-based teaching where science comes alive in a real way igniting students’ inquisitiveness. Put the dusty bones of direct instruction away in the storage room.

REFERENCES