A STUDENT'S ALTERNATIVE FRAMEWORK OF THINKING

- A student’s expression of an alternative conception is derived from the student’s “alternative framework” of thinking (his or her non-scientific thinking).

- If asked again, he or she may express a conception somewhat different.

WHAT RESEARCH TELLS US ABOUT ALTERNATIVE CONCEPTIONS: KNOWLEDGE CLAIMS FROM RESEARCH RESULTS

(In Chiappetta & Koballa Jr., 2006, p. 131; From Wandersee, Mintzes, & Novak, 1994)

- Learners come to formal science instruction with a diverse set of alternative conceptions about natural objects and events.

- The alternative conceptions that learners bring to formal science instruction cut across age, ability, gender, and cultural boundaries.

- Alternative conceptions are tenacious and resistant to extinction by conventional teaching strategies.

- Alternative conceptions often parallel explanations of natural phenomena offered by previous generations of scientists and philosophers.

- Alternative conceptions have their origins in diverse sets of personal experiences including direct observations and perceptions, peer culture and language, and in teachers’ explanations and instructional materials.

- Teachers often subscribe to the same alternative conceptions as their students.

- Learners’ prior knowledge interacts with knowledge presented in formal instruction, resulting in a diverse set of unintended learning outcomes.

- Instructional approaches that facilitate conceptual change can be effective classroom tools.
SOME TYPICAL ALTERNATIVE CONCEPTIONS IN SCIENCE
(from Weld, 2004, p. 117)

PHYSICS
Forces and Motion
• If no force is being applied, either objects are at rest or, if moving, they are slowing down.
• An object moves in the direction of the force applied to it.

Heat and Temperature
• Heat makes things rise.
• Heat and cold are material substances that can be transferred from one thing to another.

Light/Optics
• Light brightens objects so that they can be seen.
• Eyes play an active role in reaching out to intercept images.

Nature/States of Matter
• Gas molecules are not in constant motion.
• Heating and cooling play no role in particle motion.

Earth/Space Science
• The orbit of the earth is highly elliptical (related to change of seasons).
• The earth is flat.

CHEMISTRY
• Atoms vary in shape.
• Phosphorus atoms are yellow; water molecules are made of small drops (and other transferences of macroproperties to molecular level).

BIOLOGY
Animals and Plants
• Animals are alive, have legs, move, have hair or fur, live outside or in the woods.
• Plants are not alive.
• Plants must eat (get food from the soil).

Continuity
• Some traits come from the mother and others from the father
• Traits can change over time in response to the environment.
A RECOMMENDED INSTRUCTIONAL SEQUENCE FOR CHANGING STUDENTS’ CONCEPTIONS
(In Chiappetta & Koballa Jr., 2006, p. 132; From Driver, 1988)

• **Orientation:** Begin the instruction with a focus on what is believed.
• **Elicitation:** Call on students to explain their ideas of the concept under study.
• **Clarification:** Probe students to clarify their ideas of the concept under study.
• **Conflict:** Create discrepant events that cause the learners to see that their conceptions are incorrect.
• **Construction:** Help students view their ideas differently and to provide more correct explanations.
• **Evaluation:** Assess students’ understandings of the concepts under study.
• **Application:** Provide instances to apply what has been learned, especially to everyday life.
• **Review:** Ask each student to describe how his or her conceptions have changed from the beginning of the instructional sequence to the present.

REFERENCES

