AN INTRODUCTION TO
CONSTRUCTIVISM FOR THE SCIENCE
TEACHER

Constructivism is not “new.”

• Giambattista Vico (1710) - “Verum ipsum factum” - the truth is the same as the made [constructed]. But increasingly popular in education in the last ten years.

• Constructivism is a way of thinking about knowing, a referent for building models of learning, teaching, and curriculum.

• Constructivism is a form of realism.

• What constructivism has to say about that reality is that we can only know about it in a personal and subjective way.

Constructivism

• A test for any model, or knowledge construction, is the extent to which it provides an adequate basis for the accomplishment of goals, i.e., it is viable. (Viability is the test of knowledge against experience).

• **Example: Constructivist Understanding of Gravity**

• Gravity exists and through experience (individual and social) we come to know about gravity.

• Through negotiation, agreement is reached within our social system that the concept of gravity has numerous verifiable properties.
• We construct a model of gravity that is viable in that the model fits experience, but no matter how elegant, that model cannot claim to be an absolute truth.

• The model has evolved (as does all knowledge) through the process of negotiation and consensus building.

• Our model for gravity is a set of assertions about our experiences with gravity.

• As experiences have changed, so too has the model. Each day we test our own version of gravity as we explore the world.

• Constructions are constrained by experience, which comprise subjective interactions with the real world as we have constructed it.

• Since there is no objective account of what gravity really is, we cannot tell whether our model gets closer and closer to an absolute reality. We can only know gravity in a personal, socially mediated way.

**Constructivism Provides Insight Into The Development Of Science**

• Science does not exist as a body of knowledge separate from knowers.

• Science is viewed as a set of socially negotiated understandings of the events and phenomena that comprise the experienced universe.

• Knowledge is accepted by the scientific community as viable because of its coherence with other understandings and its fit with experience. Therefore, scientific knowledge is subject to empirical verification and must be accepted as viable by the
scientific community.

• Scientific knowledge changes over time because goals and problems of society change, leading to new experiences.
  – Technology provides new ways of experiencing.

  **A Popular Misunderstanding That Constructivism Incorporates A Value Position That Any Construction Is As Viable As Another.**

• Such a position is based on the belief that personal viability is the critical issue in constructivism.

• This position ignores the social component of knowledge.
• Knowledge must be viable not only personally, but in the social contexts in which actions are to occur.

• Viability is determined with respect to the individual actions and the extent to which those actions facilitate the attainment of the goals in the social context of action.

• In the classroom, students ought not to retain naive theories or incorrect theories (because it is their construction). The teacher, representing society, has an obligation to educate students, to assist them in learning what is currently regarded by society as viable knowledge (i.e., to have students construct knowledge they do not seem to have, because we think it would be good and useful for them to have it).

  **The Many Faces Of Constructivism.**

• Many science educators study alternative frameworks in science and conceptual change.

• Many practitioners focus on the importance of prior
knowledge in learning (Trivial Constructivism).

• Constructivism is used to emphasize that knowledge could not be separated from knowing.

• Knowledge is personally constructed but socially mediated.

• Knowledge exists only in the minds of cognizing beings, but cognizing beings only exist in a sociocultural sense.

• Individuals construct knowledge in the presence of others who perturb the learning environment and constrain thinking.

• Sometimes it is useful to think of knowledge as an individual construct and sometimes as a social construct, but it is both (Piagetian constructivism emphasizes the individual, while socio- or critical constructivism emphasizes the social).

**Constructivism as a Referent**

• Many use constructivism as a method whereby teachers bases what happens on beliefs that are consistent with constructivism
  – Some practices (lecturing) are then regarded as having little value compared to others (cooperative learning groups).
  – This practice reduces constructivism to a set of methods and diminishes its power as a set of referents to making decisions in relation to actions.
  – Just as constructivism can be used to explain how students make sense of experiences in cooperative learning groups problem-solving activities, so too can it be used to explain why learning occurs in lectures and how lectures can be adapted to improve the quality of learning (e.g., large introductory college courses).

• It is more helpful to see constructivism as a referent for
reflection.

• It can act as a referent for deciding which teaching and learning roles are likely to be more productive in given circumstances.

• Constructivism provides different way to look at student learning.

• *Example:* How can prospective teachers and practicing teachers learn to teach science?

• *Traditional:* What body of knowledge is to be learned by teacher? The focus is on discipline knowledge.

• *Constructivist:* What does the learner already know about teaching and learning and how can this knowledge be represented (not all knowledge has language assigned to it). What experiences should teachers have to enable them to build an understanding of teaching and learning.

**Constructivism and the Curriculum**

• Since all knowledge must be individually constructed, it makes no sense to begin by thinking solely about the disciplines of science in the absence of learners.

• *A learner has to make sense of science through an existing conceptual structure. Whatever science knowledge is constructed will be an interpretation of experience in terms of extant knowledge.*

• What experiences should be provided to the learner in order to facilitate learning?

• How can the learner represent what is already known to give
meaning to these experiences?

• Process and content can not be separated. Process skills are thinking skills used to learn content.

• *Curriculum is embedded in culture and can not be separated, which includes other learners as well as cultural myths, taboos, custom, history, socio-politico-economic milieu, and the influence of others (parents, administrators and other teachers).*

• An objectivist curriculum can be defined as a body of knowledge out there (or on a shelf) that can be transferable to different contexts that vary greatly. When teachers adapt curricula, curriculum designers complain about “implementation infidelity.”

• The teachers role is to mediate learning of students (i.e., focus on the learner rather than the discipline). This contrasts with content coverage and changing topics at scheduled times, irrespective of the extent to which students have learned.

• In the process of making sense of experience (in terms of what is known) learners create perturbations that arise from attempting to give meaning to the experience. The resolution of perturbation leads to an equilibrium state where new knowledge constructed coheres with experience and prior knowledge. . .

• The teacher must consider how to provide opportunities for such testing through negotiation with students and providing opportunities for problem-solving.