The Nature of Diverse Adolescent Learners and Their Schools

Chapter 3
I. Student Diversity & Demographics

1. Factors responsible for increase in diversity:
   
   • immigration
   
   • higher birthrates among some ethnic groups

2. 1976 to 1996

   • White K-12 1996 = 39 million = 12% decrease from 1976.

   • Africa American increased from 15.5% to 17% = 8 million.

   • Asian Americans & Native Americans = 5% or 2 million
• Largest increase = Hispanic population--6.4 to 14% = 6 million.

A. Factors Affecting Success in Science

1. Generally, students from poor families who attend schools that are poorly funded do not do as well in science as their contemporaries.

2. Students from rural areas are also disadvantaged when compared to students at schools in larger communities.
3. **Risk Factors:**

- *Single parent families*
- *From families below poverty level*
- *At home alone more than 3 hours per day*
- *Are not proficient in English*
- *Have a sibling who dropped out of school*
- *Have parents who are not high school graduates*
4. Socioeconomic status is not the only reason students drop out--students from all backgrounds drop out.

5. Science can either be the key to keeping kids in school or it can contribute to them becoming disillusioned with school.

II. Equity In Science Education

• means that all students have the same opportunity to learn quality science.
1. Two reasons for advancing equity in science ed.

Redis C Economic: Equity in science will result in a better workforce.

KS Social Justice: We have the obligation to prepare all students to function in our modern world.

A. Culturally Based Deficiencies

• Science classes in the US tend to promote the values ascribed to by mainstream, white, male-dominated, middle-class culture.
• Fairness & impartiality on the part of the science teacher are key to an equitable science education for all.

B. Multicultural Science Education

1. Universalist science educators claim that science knowledge has no political, national, or cultural boundaries.

2. Some researchers suggest that the universalist fails to consider knowledge systems developed by non-Western & ancient cultures.
C. Multicultural Science Classroom

• Recommendations for making your science classroom a better place for all students:

텨 Content integration in science ed involves “using examples & contents from a variety of cultures

ContentSize Harmony--culturally diverse students benefit from peer tutoring in small groups.

 настоя Teachers must be careful of their language so as not to offend or make any student feel uncomfortable.
D. Gender & Science Education

1. Gender Identity--science teachers can do much to reinforce the feminine side of science & encourage girls’ participation in science classes.

2. Feminist Science Education--suggestions pages 46-47
III. Exceptional Students

• All should be considered exceptional--however, some perform much differently than typical

A. Inclusion and the Law--1975, 1990, & 1997--Individuals with Disabilities Education Act requires schools to place these students in the “least restrictive environment”. Usually interpreted to mean in the general classroom.

• These students must have an Individualized Education Program (IEP) written.
B. Learning Disabilities & Behavioral Disorders

1. Learning Disabilities--students of average or above average intelligence with learning difficulties. (usually manifested in difficulties with reading and writing)

2. Behavioral disorders--students who engage in disruptive or inappropriate behaviors that interfere with learning.

3. Modification list page 49:
C. Physical Disabilities

3. Students with Orthopedic & Health Impairments.

D. Gifted & Talented Students

1. Easy to overlook in a general science class.
IV. Adolescent Development

A. Physical Development--a great deal of variation in the rate of physical growth in middle school kids.

B. Cognitive Development--Maturation, social transmission, & experience

1. Piaget (maturation was the most critical)

   • four stages of thought:

   ☋ sensory motor

   ✋ preoperational

   🏛 concrete operational--begins at about age six & is necessary for learning in science.
formal operational thought--begins about age 12--individuals at this level can think more abstractly.

• Figure 3.2 is an example of a Piaget test for concrete operational reasoning.

2. Vygotsky (Russian psychologist) believed cognitive development is reliant on the learner’s interactions with other people. (his/her environment)

• Two ideas are important to his theory: private speech & proximal development.
• According to Piaget’s theory: most middle school students are concrete learners & most secondary students are concrete learners or transitioning to formal operations.

• However, you should be prepared--it is possible in a single science class to have 75% of middle school & 50% of secondary students at the concrete level.

• Cooperative learning groups can be useful with a mix of concrete & formal learners.
Introduction

• Many plan science instruction by identifying what they want students to learn.

• Usually spend very little time determining what students know, the science misconceptions they possess.

• Usually spend very little time determining how the students feel about science.

• Learning should be an active process, not a passive process.

• Learning begins with what the students know.
• The knowledge that the students possess usually must be modified.

• Students must find the learning meaningful.

• Students must be encouraged to represent their ideas.

• Because of the varying ideas that students have about science & the difficulty students have in learning science--teachers need to examine many theories of teaching & learning.
Cognitive Approaches & Strategies for Teaching Science

A. Constructivism

1. Central thesis is that humans construct knowledge as opposed to knowledge being transmitted into their minds.

2. Stresses the importance of what is already in the learner’s mind as a place to start.

3. Knowledge is not just out their in books & the teachers’ minds ready to seep into the students.

4. #1 job of teacher = get students to think.
5. Two sources for constructing knowledge:

✎ Personal experience with the physical world.
  > real life lab exercises are an important tool.
  > interactions with objects & events stimulates
    the construction of knowledge.

 אסור Interactions with others.
  > students learn science from other students;
    just as scientists learn from other scientists.
6. Emphasis has been placed on the use of contradictions & discrepant events to motivate students to wonder why & find out.

7. **Constructivism**
   - Places great emphasis upon what the learner already knows.
   - Begins where the learner resides. The students mark the starting point.
   - Study is based both on the ideas of the students & what the teacher has selected for study.
   - Important to keep in mind that constructivism is not the only method.
• Does not automatically guarantee success.

• Teachers must be both a facilitator & a guide for students in lab/activity settings.

B. Affective Learning

• Science teachers must be aware of the attitudes & values that students bring with them to class.

1. Motivation--central element of instruction to achieve a favorable outcome.

   ☐ Intrinsic--comes from personal satisfaction, interest, or curiosity.

   ☀ Extrinsic--associated more with punishments & rewards.
C. Equilibration & Contradictions

1. Piaget used the terms assimilation & accommodation to explain equilibration.

   • **Assimilation**--the process of fitting new information into an individual's prior knowledge.

   • **Accommodation**--the process of modifying existing knowledge to fit new ideas.

2. **Contradictions**--situations that contradict what a student thinks.

   • **Discrepant Events**--discrepant situations that cause students to think. At first these events seem impossible, almost like magic, to the students.
D. Alternative Conceptions & Conceptual Change

1. Problem of learning science--what students know when they come to your classroom

2. Their minds are not empty, unfortunately, what they know may contradict with scientific knowledge.

• Knowledge Claims about Alternative Conceptions--Figure 4.3, page 74
3. Teaching Strategy recommended by Driver to facilitate conceptual change:

• Orientation

• Elicitation

• Restructuring phase: clarification & exchange, exposure to conflict situations, construct new ideas, evaluation

• Application of ideas

• Review change ideas
4. Many students do not have the desire to alter what they believe.

- Four conditions that must be meet in order to improve students’ science concepts:

  ⊆ Students must be dissatisfied with their ideas in order to consider changing them.

  ♂ Students must believe that they can comprehend the conceptions.

  ⋆ Students must perceive that the concepts are plausible.

  ☘ Students must feel that they can find out about the idea.
E. Meaningful Learning & Concept Mapping

- technique that can be used to get students to construct relationships between ideas.

- Recommendations for incorporating concept mapping: page 78
F. Images, Analogies, & Models

1. Images--pictures and diagrams

2. Analogies--a way to get students to make connections between what they know & what we want them to know.

3. Models--DNA, solar system, atom