Post-Secondary Science Teaching Strategies

Student Accessibility and Disability Services

Edgewood College

Overview

- Evidence-based teaching strategies
- Teaching reluctant students

Evidence-based Teaching Strategies

Project-Based Learning (PBL)

- Learning science depends on the experience of learning concrete thoughts initially, and then making those thoughts more complex and more applicable through doing projects
  - Projects must be related to real life situations and students must understand what and why they are learning
  - Teachers explain alternative uses of materials, skills, attitudes, and behaviors learned during the process of doing projects
- Allow students to learn in an integrated way; students remain autonomous during the process and make decisions by themselves
- Highly recommended for
  - Students who do not like traditional learning context
  - Students who are unwilling to learn
  - Students with different abilities

(Bilgin, Karakuyu, & Ay, 2015)

PBL Steps

Assign collaborative working groups	Explain the project assignment	Formulate group project plans	Workshop	Presentation	Evaluation
Students break into groups.	Teachers explain the purpose of the project and guidelines for completing the project. Teachers assign presentation dates for each group.	Students come up with a research question that is relevant to real life situations. Students brainstorm the procedures for research, identify the materials needed to do research, and select ways to present the project. Teachers provide feedback.	Students carry out their plans. Teachers provide feedback to students during the process of carrying out the plans.	Groups present their projects and goals to others.	Non-presenting students provide feedback and ask questions. Teachers provide feedback and ask questions. Presenting students evaluate their performance.

Teachers confer with students regularly to ensure that they are on track and developing their ideas and skills fully.

Exemplification

- Translatability between generality and particularity
  - Examples can shape perception of phenomena, particularly when the exemplum is a concrete manifestation of an unobservable abstraction

Types of Exemplification

	Procedural exemplification	Contextual exemplification	Analytical exemplification
Focus	• Research design • Experimental approaches	• Application of principles • Convergent: general to specific	• Deviation of concepts and principles • Convergent: general to specific
Form	• Abstract representations (schematics, drawings)	• Realistic pictures, videos	• Pictures and graphs
Function	• Introduction to methods • Methodological evaluation • Generation of methodological understanding	• Explaining observations • Entertaining hypotheses • Posing research questions • Generation of conceptual understanding	• Evidence-based claiming • Scientific argumentation • Generation of analytical understandings

Teaching Reluctant Students

Resistance and Ambivalence

- A result of interpersonal interaction; not unwillingness to change
- Disconnection between the student and the learning environment evokes resistance
- The strategy being used is not appropriate for that student, so the teacher must find alternative strategies
- Students have mixed feelings about change even when it is desired, because change requires energy, commitment, and a risk that the change may not work out
- Resistance and ambivalence are normal

Motivational Interviewing (MI) Approach to Teaching

- Learning is a process of change, and teaching is about facilitating change
- Student engagement is the interaction of the student with the learning environment
- Teaching and learning occur in context rather than being independent from the setting
  - Recognize that students do not learn for a number of reasons that can be contextual, social, institutional, political, and can be as much to do with teacher as the student
- MI promotes a non-judgmental constructive and collaborative dialogue between teacher and student
  - Equip students with strategies for taking responsibility for their learning
  - Facilitate change
  - Increase students' self-efficacy
- Resolve resistance and ambivalence
  - Explore the discrepancy between current behavior and future goals
  - Explore the upsides and downsides of current behavior

Motivational Interviewing (MI) Approach to Teaching (continue)

- Demonstrate empathy; understanding and acceptance to facilitate change
- 5 stages of change

1. Precontemplation
   - Students are unaware their behavior is blocking learning
   - Goal: enhance students' motivation to learn and to move students to start thinking about change
   - "Roll with resistance;" no confrontation
2. Contemplation
   - Students are aware that they are not engaged in effective learning behaviors but are not yet ready to change
   - Goal: help students think about how they would like to change and consider possible resources and options available rather than suggest possibilities
   - Encourage students to think for themselves
3. Preparation
   - Students are ready to make a change
   - Goal: develop a plan of what the students think they will have to do in order to study effectively
   - Teachers ask for permission to provide feedback

Motivational Interviewing (MI) Approach to Teaching (continue)

- 5 stages of change (continue)

4. Action
   - Students act upon their plans
   - Goal: support students moving toward action and help them overcome any obstacles
5. Maintenance
   - Students are maintaining new effective learning strategies
   - Goal: help students continue that new behaviors
   - Ask students to reflect on the different outcomes between the old and new methods of learning
   - Encourage students to evaluate their own behavior

- Relapse occurs when students going back to old behaviors
  - Teachers help students view the relapse as a learning experience and not as one that is shameful

Motivational Interviewing (MI) Approach to Teaching (continue)

Benefits:

- Empower students to be responsible for their own
- Help teachers manage their frustration when teaching students who appear not to want to learn

Limitations:

- May not work well with large groups