Use Elements of Cognitive Constructivism to Design Effective Learning Activities

The American Association for the Advancement of Science (2011) and others (Bransford et al., 2000) identify constructivism as a critical learning theory for the design of effective teaching methods. However, this term is often misunderstood and confused with concepts such as "social constructionism" (Hartle, Baviskar, & Smith, 2012).

Cognitive constructivism has four major characteristics. Learning activities become more effective when we include these elements in the design of the activity.

1. ***Activate prior knowledge*** – learning activities should elicit prior knowledge and engage students cognitively and emotionally with the topic. New learning is retained better when it is connected with existing knowledge structures; both new knowledge and existing knowledge can but be active in memory at the same time. Integration will not happen if the prior knowledge is not active and students experience the new knowledge in isolation. Instructors should be able to observe and interpret student's prior knowledge, including assumptions and misconceptions they might bring to the task. Select a meaningful activity that engages and motivates student interest; activities that only check whether students read the text or did their homework are not suitably engaging.
2. ***Create surprise*** – create learning activities that reveal disconnects between prior knowledge and the demands of the current task. Sometimes prior knowledge is incomplete and students are unable to solve a problem without additional knowledge. Sometimes prior knowledge is incorrect (misconceptions and false assumptions) and obstructs problem solving. Learning is most effective when circumstances violate our expectations and predictions (a surprising outcome, new information contradicts prior knowledge or beliefs). When we confront discrepancies created by inadequate information or misconceptions, we experience emotional discomfort (dissonance) that can motivate learning. However, instructors must handle this component with care. Too little discomfort will not motivate students to learn; too much discomfort will direct attention away from the learning activity and toward other behaviors that will reduce or eliminate the discomfort.
3. ***Apply and evaluate the new knowledge*** – students should apply the new learning to a variety of related problems and receive detailed formative feedback. These activities create opportunities to make any corrections needed. Repetition with a variety of problems provides practice and reinforcement for the learning. When possible, construct learning and practice tasks that provide self-correcting feedback as an integral part of the task. Tasks completed as a group frequently create opportunities for students to give effective feedback to their peers while completing the task.

4. ***Include a closing reflective assignment*** – require students to reflect on their learning experience. Students frequently complete learning activities without recognizing what they gained from these activities beyond completing a required assignment. When students can articulate what they have learned and how a learning activity contributed to their learning, they become more motivated to engage in similar learning activities. At the close of a learning activity, ask students to explain what they learned, what they are now able to do, describe how they did it, and describe why the activity was important for their learning.

Resources:

Hartle, R. T., Baviskar, S., & Smith, R. (2012). A field guide to constructivism in the college science classroom: Four essential criteria and a guide to their usage. *Bioscene, 38,* 31-34.

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