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Integration of Case Based Instruction and Positive Learning Gains

Evidence Based Teaching: CNS Large Lecture mini-Faculty Learning Community

Taylor Pupka

Abstract

Large lecture courses require different teaching methods and practices to ensure effective student learning and success. Cultivating critical thinking skills and increasing student engagement and motivation prompts re-evaluation of current teaching methods, examination of evidence-based teaching methods, and implementation of one proposed strategy. Adoption of case-based teaching will take place during Spring 2020 quarter. This evidence supported method will encompass dimensions of learning and foster positive student gains in higher order thinking and engagement.

Introduction

Cal State San Bernardino's Biology 100 Topics in Biology is a General Education (GE) course with an enrollment of 223 students. Each quarter, students attend lecture twice weekly and lab once weekly.

Large lecture courses often result in the instructor taking a passive non-interactive teaching role, perpetuating the traditional lecture method whereby students are seen as "receptacles" to be "filled" by the teacher (Freire, 2014, pg.72). Developments in the study of learning suggest that people learn in three ways:

1. Learning with understanding/Concept scaffolding

The instructor temporarily provides support to facilitate the learner's development. As the learner's abilities increase the scaffolding provided by the instructor is progressively withdrawn. Finally, the learner is able to complete the task or master the concepts independently (Chang, Sung, and Chem, 2002, pg. 7).

2. Building upon preexisting knowledge outside of the classroom

Students come to the classroom with a broad range of pre-existing knowledge, skills, beliefs, and attitudes, which influence how they attend, interpret and organize in-coming information. How they process and integrate new information will, in turn, affect how they remember, think, apply, and create new knowledge. (National Research Council [NRC], 2018).

3. Metacognition/Active Learning

The instructor helps the students take control of their own learning. Teaching practices congruent with a metacognitive approach to learning include those that focus on sense making, self-assessment, and reflection on what worked and what needs improving. These practices have been shown to increase the degree into which students transfer their learning to new settings. (National Research Council [NRC], 2018).

Research and prior personal and professional experience indicate that traditional teaching methods used to instruct students in a large lecture setting are not only outdated and, at times ineffective, they are seriously misaligned with the way people learn, process and retain information. Implementation in the Spring 2020 of case-based instruction with minimal use of the i-clicker and small discussion groups seeks to address and evaluate the three ways in which people learn. Using case studies to solve novel problems allows students to apply their knowledge of the subject in a way that forces critical thinking beyond what they can memorize from notes taken during lecture and a textbook. (Hall, Magee, Clapp, 2016, pg.24).

Methods

Each class session will begin with an open and interactive discussion to evaluate what the students understand to be the goal of that day's lecture, learn what they may already know about the topic, what they expect to learn, and the nexus between the current and prior topics. Periodic related surveys will also be distributed for response. Answers to these questions will have no bearing on their grade but serve as a path forward for instruction. While prior knowledge is crucial to learning, it is important to reiterate that since this is a GE course, it is expected that there is minimal prior knowledge of biological science and its components.

Following is an example of one case study proposed for the Spring 2020 quarter: "Cancer"

Prior to the start of the subject lecture on Ch. 7 "DNA and Replication", students will be provided with the "Cancer" case study. This general case topic focusing on cancer requires that each student apply foundational knowledge gained from the course text, "Biology for a Changing World with Physiology", chapters 7 – 11.

Students are instructed to bring the case study materials to every class as it will be a progressive and accumulative learning process from prior class sessions, mini-lectures, discussions and interactions, and team working groups. During lecture, material will be presented and then applied to questions within the case. The form in which the questions will be answered will vary. Initially, students will be walked through the thought process of how to evaluate case related questions. As their developing and evolving knowledge increases, the "scaffolding" I provide as the instructor will slowly decrease. Students will then utilize class discussion and team learning to explore treatment options and pharmacogenetics. At the end of each lecture, students will be given the opportunity to reflect upon what they learned that day and discuss and clarify any questions they may have.

Following are topics and "Cancer" case-related questions

Ch.7 DNA Structure and Replication

- Where is DNA found?
- Human red blood cells are enucleated.
- Is it possible to isolate DNA from red blood cells?
- What is the difference between genotyping and gene sequencing?

Ch. 8 Genes to Proteins/Ch.10 Types of Mutations

- Significance of proteins?

Ch. 9 Cell Cycle and Division/Ch.10 Types of Mutations

- Significance of checkpoints?
- What harm could a mutation do with regard to cell cycle regulation?

Ch. 10 Mutations/Cancer

- At a cellular level what is cancer?
- What is 23 and me?
- What are acquired mutations?
- What is HER-2?

Ch. 11 Simple Inheritance and Meiosis

- Create a BRACA 1 and 2 pedigree
- What do the genes BRACA 1 and BRACA 2 do in human cells?
- How does this relate to what we have learned up to this point?

Culmination of the case:

- Would you use the same treatment for a HER 2 positive patient and a BRACA 1 or 2 patient?
- What is pharmacogenetics?
- Compare and contrast genetic targeted chemotherapy versus nontargeted chemotherapy.
- What is the significance in relation to side effects?
- Brainstorm with your team as to how you would go about designing a chemotherapeutic agent.
- What would be your limitations?

Conclusion

Implementation of case-based teaching encompasses all three aspects of the ways in which people learn. Prior knowledge doesn't necessarily have to be textbook / lecture learned but can also be anecdotal. Do they know someone who has been diagnosed with cancer? Have they experienced a person who has had chemotherapy? What side-effects and lifestyle changes have they observed about the person? The significance in asking these kinds of questions (initially), is that there is no incorrect answer. This automatically sets forth an environment in which students can contribute without fear of being wrong and fosters engagement. In a large lecture setting for a GE course, the range of prior knowledge can be great and, as such, students will be provided with a solid foundation of information. The topic, organization of the case and careful crafting of relevant question is key to concept scaffolding. The case study itself is a crescendo, gradually increasing in the application of learned knowledge which will also be mirrored increased confident. If the case were to be given without concept scaffolding, student success and learning would be expected to be minimal. Case based teaching taps into metacognition the third way in which people learn. Through the case, initial metacognition is modeled, I walk the students through the various question and demonstrate my thought process in evaluating and analyzing the problem. Students are then encouraged to monitor their progress and reflect / evaluate on their learning. Post implementation in Spring of 2020, I anticipate that my students will be able to demonstrate positive learning gains including but not limited to, critical thinking skills and engagement.

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