The Impact on Students of Misconceptions/Preconceptions

Background

- Science students often come into courses with background knowledge (preconceptions) that might hinder their overall understanding of the material (1).
- Teachers have become more aware of this issue at hand and are actively trying to uncover why students have these misconceptions and ways that they can be resolved (1).
- Often quantitative difficulties are easily observable while qualitative difficulties are not. Students can easily memorize formulas and have superficial understandings of the topic (2).

Results

- In a respiratory physiology study it was found that the misconceptions were consistently spread across different schools that were studied (4).
- It was found that experience, language, visual representations, and analogies are potential sources of misconceptions (4).
- In physics educational study regarding force and emotion, it was found that students responses to problems regarding “motion implies a force” involved their preconceptions (2).

Personal Experiences

- When I first came into Bio 141 my freshman year, I knew I was good at biology from high school and thought it would be an easy course. I paid attention in class and took notes, but I waited a few days before the exam to start studying, despite my professors warnings that the material needs to be looked over almost every day. I just memorized the basic concepts assuming I would be able to apply the knowledge on the exam. After getting a poor grade on my first exam I realized that I need to start studying a few weeks in advance and I need to look over the material almost every day. I started going to office hours, making flow charts, and really understanding and being able to apply the knowledge I learned. After applying these tools I was able to understand the material better and I did better on the next exams!
- In Bio 141, I found that applying various concepts that I learned in other classes, i.e. Chem 210 and 212, Phys 212, Chem 110 and 112, and Bioe 201 aided in my learning process immensely. By intergrating concepts in these classes to physiology, I was able to get a better understanding of the material and have a better appreciation for what I was learning. I also really liked doing clicker questions because they allowed me to continually test my knowledge as I went through the class. Using visual aids helped my understanding of complex material.

Applied to Bio 141

- In Biology 141, there are many in-depth topics covered that take integrative learning to understand and the students cannot just simply memorize definitions.
- Many of the physiological concepts cover basic physics, chemistry, and anatomy, so the students must have a broad knowledge of these subjects.
- The students must be able to apply the knowledge they learn in different contexts in the body.
- The class topics build upon each other so students must be able to apply what they learned at the beginning of the semester to a topic at the end of the semester.

Discussion

- Students will only change their preexisting ideas when it is proven to them that they are wrong (3).
- It was found in a study in cardiovascular physiology that sometimes the book exhibit the ‘expert blind spot’ that the expert knows but new learners might not be familiar with and the subject will be overviewed (1).
- Students will rely on their experience and intuition to solve problems instead of listening to what the teacher tells them (2).
- Teachers cannot assume that the students’ mind is a blank slate; so they have to teach to the students in a way that can build information and correct prior knowledge that is wrong (2).
- The biggest source of error that was found was not being able to apply a general model to a specific scenario (1).

Implications

- In the classroom teachers have to be aware of the misconceptions and find effective ways of uncovering and correcting them (1).
- Probing students understanding below the superficial level; this can be accomplished by student interaction, student teacher interactions, and formal assessment tools that gage conceptual understanding (1).
- Recognizing the power of using a general model technique that can be applied to specific situations in later lectures (1).
- Being able to help integrate knowledge from different classes and within the same classroom (1).
- Students will attempt to learn scientific principles so they fit their existing preconceptions of the topic (2).
- Educators should strive for precision and clarity in words and use pictorial representations when possible to aid in explaining a complex topic (4).

References