Encouraging effective textbook reading in undergraduate biology courses

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Why textbooks?

The intended role of textbooks and lectures in courses

- Lectures provide an introduction to the material in the textbook and act as a guide to help students focus on the main topics
- Textbooks provide more detailed information and structure on the topic being studied

The actual role of textbooks and lectures in courses

- Textbook content guides course content
- Lecturers use the textbook as a guide for constructing their lectures
- Many students never buy or read the textbook, why?
  - The lecture slides include all information necessary to pass the exam
  - Takes too much time to read
  - Too expensive

How to support learning from textbooks

Many students never buy or read the textbook, why?

- The lecture slides include all information necessary to pass the exam
    - Do they?
    - Should they?
- Takes too much time to read
    - Language difficulties
    - Subject-specific jargon difficulties (scientific literacy)
    - Too much information
    - Difficult to know what information is necessary
- Too expensive

The importance of training scientific literacy

- Many textbooks present knowledge by explaining how it was acquired and, ultimately, we want our students through their studies to gain the ability to understand this process and the results derived from it.

- The number of times a student engages with textbook material has a positive impact on their grade in a course (Wandersee 1988)

- Scientific literacy and scientific inquiry and understanding are closely linked

- Do we train scientific literacy in biology courses at SU?

Wandersee JH (1988) Ways students read texts, Journal of research in science training 25:69-84

Promoting scientific literacy

- Heiner et al. (2014) describe and evaluate a targeted reading approach that aimed to improve how students read and extract information from textbooks in physics and biology courses.

- This approach had two parts: 1) giving students very specific sections of the textbook to read before class and ensuring that these sections were closely related to the material to be covered in the following lecture or class activity and 2) asking them to complete an online quiz with questions that directly referred to page numbers and figures in the textbook.

- The quiz questions mostly focussed on Bloom's taxonomy levels 1 and 2 but had occasional questions that reached levels 3 and 4. They were intentionally not highly challenging as the students were expected to take the quiz before they had attended a lecture on the subject.

- The idea behind this approach was to focus student attention on specific topics, definitions and examples that were directly relevant to the course material to be discussed. By encouraging students to practice with the textbook material (by answering quiz questions) the aim was to increase learning but also to help students to understand how extract important information from the textbook and thereby assist them in becoming independent learners.

Heiner CE, Banet CI, Wieman C (2014) Preparing students for class: How to get 80% of students reading the textbook before class American Journal of Physics 82:989-96

Promoting scientific literacy

- In their evaluation, Heiner et al. (2014) found that students were more likely to perform the textbook reading (79.3% in biology, which the authors claim is double the normal amount in similar courses) and to complete the quizzes (98.7% of the biology students).

- Exam scores correlated well with how often students completed the quizzes. Overall, the study of Heiner et al. (2014) provides strong support for using targeted textbook reading in combination with quizzes to help students effectively learn textbook material.

Heiner CE, Banet CI, Wieman C (2014) Preparing students for class: How to get 80% of students reading the textbook before class American Journal of Physics 82:989-96

Promoting scientific literacy

- Quizzes were also an essential part of an effective approach used by Klionsky (2004) to encourage students to learn actively in an undergraduate cell biology course.

- In their approach, Klionsky gave the students detailed notes (more detailed than what would be in a typical lecture, but less detailed than in a textbook) and then several types of quizzes. One of the quizzes was given to the students before the lecture and was designed to explore how well the students had read and understood the textbook material. The second quiz was given after the lecture and students were placed into groups where the answers were discussed. The lecturer then discussed the answers to the quiz questions with the whole class during a lecture on the relevant topic.

- The primary goal of giving the quizzes was to get the students to engage in more active learning and to be able to assess progress and understanding in real time so that lecture material could be adjusted accordingly.

Klionsky DJ (2004) Talking Biology: Learning outside the book – and the lecture, Cell Biology Education 3:204-211

My experience of promoting scientific literacy

- My approach was tested on students taking the Organism Diversity and Evolution course, which is one of the first university courses taken by many of the students

- Due to scheduling limitations, students were not given pre-lecture quizzes but were given post-lecture assignments that included reading specific parts of the textbook and answering some related questions. The intention of these post-lecture assignments was that students would attend the lecture in the morning and then use the afternoon time for reading and answering the questions.

- Unlike Heiner et al. (2014), I decided not to use an online quiz where students could receive the correct answers, but rather chose to go through the answers to the questions in a session after they had seen the related lecture and had time to do the reading and work on the questions (that is, a day later, similar to the approach used by Klionsky, 2004).

- I motivated the students by telling them that the exam questions would be taken from the discussion questions and this appeared to be a successful, and it also had the added advantage of apparently reducing student anxiety about the exam because they knew what kind of questions they were going to receive and had been able to practice them and to receive feedback about their answers.

- The discussion sessions provided a good opportunity to chat with students informally, which created a good atmosphere where many students felt comfortable discussing their answers to the questions. As a good social environment is important for learning, I was happy that my approach also aided in this aspect.

- I was not able to do any quantitative assessment of my approach but many students said that they were more likely to read the textbook with this approach than they had been in the earlier parts of the course that did not have pre-reading assignments and quizzes. Also, I have never seen so many high scores on the exam questions!

Discussion

- Using and gaining access to textbook material - tips
- Could we improve the possibility of students buying and using textbooks if we used common ones?
- How should we use textbooks?
- Should we consider the cost?
- Do you do something to facilitate or encourage students to use textbooks?