

STIMULATING STUDENT LEARNING IN BREADTH COURSES

Inspired by Biology 2002: Genetics in Everyday Life
(but applicable to courses for non-majors in any discipline)

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INTRODUCTION

Many universities enforce student breadth requirements, meaning that students are often forced to take a science credit, despite their lack of interest in science. Studies suggest fundamental differences do exist between major and non-major students taking the same science course, with non-majors showing a lower level of motivation and interest in course content, often because they don't understand how the material is relevant to the real world or to their future career. This can lead to a decreased amount of time spent studying and decreased academic achievement (Knight and Smith 2010).

Non-majors also enter their science breadth courses with very different academic backgrounds. A science breadth course may contain students from any discipline, ranging from fine arts to geography, each student coming with different prior knowledge and different approaches to learning.

Finally, student learning goals may also be fundamentally different between majors and non-majors, with science majors needing to develop a firm grasp on science concepts as a platform for future studies and non-majors needing basic scientific literacy and connection to everyday life (Knight and Smith 2010). All of these issues pose unique challenges and unique opportunities for educators who are designing courses to meet the needs of these non-major students.

I suggest that there are three techniques that can be effectively used to stimulate student learning in breadth courses:

1. Help students develop skills that they can use in other areas of their life (transferable skills). I suggest focusing on two transferable skills: Interdisciplinary teamwork and critical literacy.
2. Use assignments that clearly show how science concepts are related to other areas of life.
3. Allow students to choose topics that are of interest to them for class projects (enquiry-based learning).

KEY CONCEPTS

- One way to engage students who are not intrinsically motivated by learning science is to use science as a tool to develop transferable skills, such as interdisciplinary teamwork and critical literacy.
- Interdisciplinary teamwork skills are increasingly required to solve complex problems in the real world. The failure of many interdisciplinary research projects shows that many professionals are not even able to work effectively in interdisciplinary teams (Bruce, Lyall et al. 2004). Because students taking breadth courses are likely coming from many different disciplines, this presents a unique opportunity for educators to teach students how to approach a problem from multiple viewpoints and how to communicate effectively in interdisciplinary teams.
- Critical literacy is the ability to read texts and distinguish the underlying message (Curriculum Service Canada 2007). It is an important skill not only in the sciences but also in everyday life. Learning to read scientific texts and distinguish between the scientific facts and the author's own opinions and biases will help students better formulate their own opinions of scientific issues, even after the course is over.

- Enquiry-based learning allows students to ask questions and seek answers on topics of interest to them. By allowing students to study a self-chosen, course-related topic, they will be more motivated to learn. An example of this might be a genetics student studying a heritable disease that runs in their family.

ACTIVITY DESCRIPTIONS

The key concepts described above are incorporated into the following three activities, which can accompany the core science content of any course:

1. Critical literacy workshop
2. Interdisciplinary teamwork workshop
3. An interdisciplinary group project on a student-selected science topic

****Note:** While all 3 activities are described below for a general “science” class, all can be easily modified for use in any discipline.

1. Critical literacy workshop

- **Activity objectives:**
 - Students will work in breakout groups to discuss the content and quality of a popular media science article
- **Length:** 50 minutes
- **Necessary supplies:**
 - White board or Power Point projector
 - Handout - *Critiquing an article: Questions to guide your thinking* (see appendix)
 - Popular media articles on a variety of science topics
- **Activity description:**
 - a. *Lecture:* What is critical literacy and why is it important?
 - b. *Group brainstorming:* “Which strategies might a newspaper author use to convey their opinion of a scientific issue?”
 - c. *Lecture:* Common techniques used in media for swaying audience opinion (discuss the handout)
 - d. *Group work:* Each group is given a popular media text on a scientific topic and asked to critique it. Groups will present their findings to the class.

2. Interdisciplinary teamwork workshop

- **Activity objectives:**
 - Students will be able to orally identify the characteristics of effective interdisciplinary teams
 - Students will use a case study approach to identify how expertise from multiple disciplines can be used to understand a real world science problem
- **Duration:** 50 minutes
- **Necessary supplies:** White board or Power Point projector
- **Activity description:**
 - a. *Lecture:* Define discipline, transdisciplinary, multidisciplinary, interdisciplinary
 - b. *Group brainstorming:* “When might it be important to work as an interdisciplinary team? What are some of the benefits of interdisciplinary work?”
 - c. *Lecture:* Characteristics of successful and unsuccessful interdisciplinary teams
 - d. *Group work:* Each group is assigned a real world science problem and asked to discuss how an interdisciplinary team could contribute to the solution. Which disciplines would be needed? What contribution could each make? Each group will share their ideas with the class.

3. Group project: Interdisciplinary understanding of a scientific issue

- **Activity objectives:**
 - Student groups will choose a science topic of interest to all group members
 - Students will work in groups to critique two popular media articles on their topic, according to the principles taught in the critical literacy workshop
 - Student groups will be able to explain the core scientific principles related to their topic
 - Student groups will be able to explain how their scientific issue is influenced by social and economic factors
 - Students will present the information collected in the previous objectives in the form of either a paper or an oral presentation (instructor's choice)
- **When:** The project should be assigned shortly following the workshops on critical literacy and interdisciplinary teamwork.
- **Length:** Students should have at least 3 weeks to complete this project.
- **Activity description:**
 - Student groups will be responsible for choosing a topic of interest to them, which they will have approved by the instructor prior to beginning their research.
 - Part I: Article critique
 - Students will find two popular media articles on their topic and critique them according to the principles taught in the critical literacy workshop. Students are encouraged to find articles that present two different viewpoints on their topic.
 - Part II: Interdisciplinary research project
 - Students will define the state of scientific knowledge on their topic.
 - Students will research how their issue influences and is influenced by social and economic factors.
 - Students will present their findings from Parts I and II as either a written paper or an oral presentation.
- **Adaptations:** The intensity of this project may vary between courses, depending on the instructor's preference and the amount of other course work.

To critique an article means to go beyond just summarizing the information presented by the author. It means to understand which parts of the article are fact and which are the author's opinion. It means to question whether or not the author's opinions are adequately supported by fact. It means understanding the techniques an author might use when presenting their facts or opinions, in order to invoke a certain response in their audience. A critique does not automatically imply a negative evaluation. Upon critiquing an article, you may be very pleased with its content and quality. Critiquing simply implies being aware and asking questions about new information presented to you. Below are some questions to guide your thinking when you are critiquing an article:

What is the article saying?

- Who is the author's intended audience?
- What is the author's main point?
- What arguments does the author use to support the main point?
- What evidence does the author present to support the arguments?
- What is the author's purpose?

What is the *quality* of the content?

- Does the headline or title match the content of the article?
- Do the title or body of the article overuse buzz words?
- Is the argument logical?
- Does the author have any underlying assumptions or possible sources of bias? For example, do they work for an organization with a particular set of values?
- Is the text well organized, clear, and easy to read?
- Have important terms been clearly defined?
- Does the text help you understand the subject?
- Are the author's facts accurate?
- Is there sufficient evidence for the arguments?
- Do the arguments support the main point?
- Does the author take information from or quote an outside source? If so, who did they quote, what are that person's credentials and does that person represent an institution that might have a particular viewpoint on the issue?
- Is the text appropriate for the intended audience?
- Does the text present multiple viewpoints on the issue or only one side?
- Is the author's conclusion clear? Does the conclusion follow logically from the arguments made in the article?
- Has the author used any photos? How do they contribute to the article's message?
- Are there any words or sentences that evoked a strong response from you? What are they? What was your reaction?
- Why did you react the way you did? Where did you first learn about this issue and how might other people, articles or discussions have shaped your view?

References

1. Bruce, A., C. Lyall, et al. (2004). "Interdisciplinary integration in Europe: the case of the Fifth Framework programme." Futures **36**: 457-470.
2. Curriculum Service Canada (2007). "Webcasts for Educators: Critical Literacy."
3. Knight, J. K. and M. K. Smith (2010). "Different but Equal? How Nonmajors and Majors Approach and Learn Genetics." Life Sciences Education **9**: 34-44.
4. Rosen, L. J. and L. Behrens (1994). The Allyn & Bacon handbook. Boston, Allyn & Bacon.