

Strategies to Advance Learning Outcomes in the Non-Science Major Biology Classroom

As many college science instructors do, I have encountered additional challenges to successfully teaching assigned concepts to non-science majors. To better prepare for these classes, I glance through my notes from prior semesters and find the assignments and activities that have been the most effective. My main objective is to encourage student learning and to improve learning outcomes. The quality of my students' learning is directly related to the quality of the instruction they receive. Thus, I have found the following to be most effective in meeting and exceeding my objectives.

As an instructor, every class represents a diverse group of students, each of whom has a different learning style. Similarly, in each of their classes, each student encounters a new instructor with a different teaching style. To create a more comfortable environment, I start my class with a brief introduction, a syllabus discussion, and a few icebreaker activities. Such activities include a pre-bio test to determine basic science knowledge, a VARK (visual, aural, read/write, kinesthetic) exercise to determine learning styles, and peer interviews where students learn more about their classmates.

Icebreaker Activities

I use a pre-bio test consisting of ten multiple-choice questions about basic biology concepts that I expect my students to know before they enroll in my class. I collect their responses, review the material with the whole class, and go over the correct answers. This helps me understand my students' baseline knowledge before formal instruction begins.

In order to identify an effective personal teaching style, it is important to know how students learn. Exploring teaching styles early on helps me maintain a balance between my personal teaching style and my students' preferred learning styles. I use an online VARK (visual, aural, read/write, kinesthetic) exercise to determine their learning styles. I ask students to complete a VARK questionnaire and share their results with the entire class. As students share their results, I tabulate which portion of the class falls into each of the learning style categories. Most students tend to fall into the read/write and kinesthetic divisions.

During the peer interviews, each student chooses a partner they have not yet met and conducts an interview. Students ask five to six questions including name,

major, and anything else they want to know about their classmate. They note the information and then share it with the entire class, which helps them become more familiar and friendly with their classmates.

Checkpoint Evaluations

Checkpoint evaluations after each lecture provide students with the chance to communicate directly with their instructor. Students need opportunities to get feedback about their learning before they are evaluated with a grade. At the end of each class period, I use multiple-choice questions based on concepts taught during the lecture to determine if the students are learning the material. Each student can use his or her notes and the textbook, and they can discuss the questions with their classmates. Students then self-grade their checkpoint questions and receive explanations for incorrect answers. This allows me to get quick feedback about my students' understanding of the concepts and find out which parts of the discussion are the most difficult for the majority of them.

Student Questions

I have found that every class includes some shy students who exhibit a lack of self-confidence combined with fear and tension. To help them gain confidence, I ask them to write down any questions they have during or at the end of the lecture. Then they write their questions on the whiteboard to open class discussion about the topics. If most of the students share the same concerns, I go over the questions with the whole class.

Collaborative Learning/Poster Presentation

When students collaborate with their classmates, they often experience synergy and perform better. To facilitate collaboration, I use an EcoColumn experiment as a group assignment. The purpose of the experiment is to use the scientific method to evaluate a hypothesis, collect data, evaluate the results, and make a supported conclusion.

Students select their group at the beginning of the experiment and remain in that group until the end of the project. Each group member is responsible for collecting data, taking pictures, discussing results, and preparing data for the poster presentation. I give the students six weeks to perform the experiment and one week to prepare their posters. I provide poster guidelines and details and offer extra time so that students can discuss their projects outside the classroom.

I organize one day of class time as a mini conference day that allows students to experience presenting their findings to a scientific community. I have invited several

faculties, the dean, and students from other classes to attend the mini conferences. On mini conference day, all groups present their experimental data and write about their experience as part of the group project. Once all groups have made their presentations, I comment on their strengths and weaknesses and encourage them to join in the critique. Visiting faculty, the dean, and the students have made positive comments about students' performances, knowledge, and energy levels.

Since incorporating this assignment into my class, I have noticed that my students discuss the ecosystem in much greater depth and detail than had been the case in prior classes. Once students realize the mistakes they made during the process, they hold themselves accountable for losing points. They also tend to work harder and more responsibly. Below are some sample student comments:

- "The EcoColumn is a great experiment to do as a group project."
- "The EcoColumn gave us the opportunity to see how real biologists study."
- "Working in groups also builds communication and teamwork skills."
- "You have to get along with your fellow students to make this project work."
- "The final presentation gave us an opportunity to speak publicly to our fellow students and explain what our EcoColumn did."
- "You actually need to use more than your biology knowledge to complete this project; you need to use your complete college experience."
- "Great experience learning biology."

Integrated Activities

The following activities provide students with the opportunity to discuss lecture concepts and prepare them to search for pertinent scientific articles, videos, and current research.

- Students find news articles about current science topics discussed in class. This provides them with basic information about real-world applications of what they learn.
- I ask students to go online to find information about a unit topic covered in class. Students can also watch videos and complete assigned worksheets in order to receive nominal points. The worksheet is based on major concepts from prior weeks or class discussions. I use true/false and multiple-choice questions, complete-the-blank integrated activity forms, or open-ended questions. For the integrated activity form, students note article title, author, source, and date of publication, then make connections between the article and material learned in class. Here are a few questions I ask them to complete:
 1. Which unit objectives are directly related to this article?
 2. Explain how the material is relevant or important to your everyday life.

3. In a few sentences, explain how information in this article relates to what you learned in biology class.

Term of the Day

To encourage active student participation in every class, I use a "term of the day" concept. During class discussion, I write all of the new terms on the whiteboard and ask each student to pick one term and define it. I give them five minutes to refer to their notes and define the term on a piece of paper. Once the entire class is ready, each student reads his or her answer aloud. I find that this exercise increases student focus, confidence, and active participation.

After using these strategies in my introductory biology course for non-science majors, I found that my students seem to be more confident, have improved collaborative learning skills, actively participate in the classroom, and ultimately have gained basic science knowledge that they can use in their everyday lives.

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