**ENGAGE TO ACHIEVE MORE** 

### Using Case Studies for Active Learning in Science Courses

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# The Benefits of Teaching with Case Studies

Humans are natural storytellers and story lovers. At their core, case studies are stories with an educational message, making them a great way to communicate science to students. For case studies to be an effective teaching tool, they have to be intentional. They should help students meet learning objectives, deepen students' interest in a subject, and increase student motivation to learn more about a topic. When used thoughtfully, case studies can drive effective teaching and learning.

There are several reasons for incorporating case studies into a course, including the following three.

**Case studies are active learning activities.** Requiring students to do the work themselves, active learning activities require instructors to create an environment where students can practice their skills. Students practice their understanding of the material and develop skills by actively doing, rather than passively observing a lecture.

Active learning isn't just a buzzword or trendy topic. We know active learning is a good thing for students. <u>A meta-analysis conducted by Scott Freeman in 2014, showed that</u> <u>across 225 studies, exam scores were almost half a letter grade higher when active</u> <u>learning techniques were used</u>. Failure rates were also lower with active learning.

**Case studies contextualize course content for students.** Case studies are such an effective tool because they have a hook – an attention grabber that brings students into your story. By first drawing students into the story, they'll be more motivated to engage with the course content. When students are more interested and engaged, we see higher levels of persistence in STEM.

**Case studies are an easy way to foster collaboration among students.** It's very easy to set up a case study activity to allow students to work collaboratively. Fostering collaborative learning is an inclusive teaching practice that allows students to freely express themselves, receive feedback, and have their ideas and experiences affirmed.



### What Do We Know About Case Studies?

- Faculty report that students think critically, participate more, and learn better with cases.
- Scores on analytic exam questions are better when taught with case method than lecture method.
- Faculty enjoy teaching with cases.
- When asked, students generally report preferring cases over lectures.



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### 4 Ways to Incorporate Case Studies Into Your Course

## 1

### **Humanize Scientists**

You can make scientists more relatable to students and help your students see themselves as scientists by using case studies to humanize scientists. By including scientists in the case studies you select, students might discover role models.

Scientists to include in your case studies can be found in several places. <u>The Story</u> <u>Collider</u> hosts live shows and a weekly podcast about the role science plays in people's lives. It is a fantastic resource for finding scientists' stories to include in your case studies. <u>The Scientist Spotlights</u> Initiative promotes diversity and inclusion in science. Professor Jeff Schinske of Foothill College and Professor Kimberly Tanner of San Francisco State University have developed a searchable database of counter-stereotypical science role models.

### **Explore Life-Saving Discoveries**

Incorporating discussion and analyses of new diagnostic tests, new drugs, and genetic basis for a disease are examples of potential ways to use case studies to explore life-saving discoveries with students.

As an example, you could invite your students to consider medicine or treatment that has received a great deal of media coverage recently. Then invite them to dive into the existing scientific literature that explores the efficacy of that medicine or treatment before asking them to conclude on its effectiveness.

Works

The New Hork Times

### **Demand Surges for Deworming Drug** for Covid, Despite Scant Evidence It

. . . . . . . . . . . .



### Investigate a Scientific Mysteries

You can use cases to investigate scientific or medical mysteries. Who doesn't love a mystery story? While your students probably won't walk away with definitive answers to questions that scientists still can't solve, scientific mysteries make a great option for case studies because they're engaging and they encourage your students to think outside the box.

#### Did Joseph Merrick have Proteus syndrome?

Joseph Merrick, also called the Elephant Man, died in 1890. He was known and exhibited as a "freak" for his deformities. Joseph was a patient at London Hospital. Many now believe that he had a rare condition known as Proteus syndrome. This is an example of a case study that can be used to teach the scientific method or cell signaling. Provide students with a description of Joseph Merrick and his life. Walk them through how to determine whether or not he had Proteus syndrome. Finally, provide guidance to help keep them on track.

### Generate Scientific Explanations

You can base a case study on a scientific question by choosing something that you want your students to generate a scientific explanation for and working backward. For example, you might want your students to consider why smoke inhalation is deadly. Create a hook by telling the story of a nightclub that has tragically burned down and the deaths that were a result of the fire.

When students initially hear the story, they might assume that those deaths were caused by burn injuries or trampling during attempted escapes. They will likely be surprised to learn that many of the deaths at nightclub fires are actually the result of smoke inhalation. This surprise is likely to pique their interest and keep them engaged in a larger conversation about cellular respiration.

### Where to Find Case Studies

**NCCSTS Case Collection** hosted by the National Science Teaching Association (formerly the University of Buffalo)

- Contains over 950 peer-reviewed case studies
- Includes case studies across disciplines, including aerospace, civil engineering, etc.
- Ability to filter by topical area and education level

#### **HHMI Course Source**

- A focus on undergraduate biology and physics education
- Additional resources to incorporate into courses

#### **HHMI BioInteractive**

- Primarily biological case studies
- Additional classroom resources that allow you to turn simple resources like a map or video into case studies

#### **MERLOT**

• Case studies are available as a search term in the MERLOT library of resources

#### **News Stories**

- Stories you read in the news, watch documentaries about, or listen to on the radio can be turned into case studies
- Articles in scientific journals you subscribe to can also be a source of inspiration

#### **Television Shows**

• Medical dramas, nature shows, and docuseries often feature stories that make great case studies

#### **Current events & historical events**

 Choose what you think will resonate most with your students as they may find more recent events more engaging



### Making the Most of Case Studies

Case studies can be a powerful teaching tool to engage students, and students and faculty enjoy them. It's important to keep a few things in mind when using case studies as an active learning activity in your course.

Case studies can be used with majors and nonmajors. Nonmajors aren't majoring in science or your discipline for a reason – they're not entirely interested in it. Case studies can spark that interest and excitement with nonmajors, and they can keep majors engaged and enthusiastic about the subject they've chosen to study.

Like with any other activity or assignment, it's important to clearly define the learning objectives for case studies. Learning objectives help instructors focus their attention. Consider including the learning objectives for a case study as bullet points or questions on any handouts or resources you share with your students.

Reinforcing content that you've already taught with case studies will generally be more effective than trying to use case studies as a way to introduce new topics.

Finally, if you're teaching online and want to incorporate case studies, you may be concerned that your students will simply Google the answer. Consider anonymizing some components like names of famous patients or the names of drugs. Build more scaffolding for your students by adding additional supports to your handout or walking them through the handout. This will help to prevent them from getting frustrated, giving up, and turning to Google.



Photo credit: Klaus Vedfelt/Getty Image



#### Dr. Michèle Shuster, Professor, New Mexico State University

Michèle is a professor in the Department of Biology and the director of the Hower Hughes Medical Institute Program at New Mexico State University. Over her two-decade teaching career, she has mastered the art of using case studies to support active learning and deepen student engagement in science courses. Michèle holds a doctorate in molecular biology from Tufts University School of Medicine and is an author of *Scientific American Biology for a Changing World with Physiology*.

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