

Ways to Incorporate Case Studies for Teaching and Testing:

Examples from Courses in
Public Health and Evolution

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Case Studies in STEM Courses

- Using case studies
 - Classroom (or online) discussions
 - Take-home exercises or exams
- Developing cases
 - Pre-existing materials
 - Made-up from scratch
- Student learning outcome focus

Getting Ideas for Case Studies

- Documentaries
- News articles
 - Set up news feeds via something like Pulse app (<https://www.pulse.me/>)
- Pop culture
- Previously developed case studies examples
 - Center for Bioethics and Human Dignity (<http://cbhd.org/category/case-studies>)
 - National Center for Case Study Teaching in Science (<http://sciencecases.lib.buffalo.edu/cs/>)

Group Activity: Using News Articles

- Using the News Articles provided
- 1) Identify the areas of science and specific topics addressed in the article
- 2) List 2 – 4 learning outcomes that could be addressed using the articles available
- 3) List some questions raised by these articles

Group Sharing

- Article 1
 - Learning outcomes?
 - Questions?
- Article 2:
 - Learning outcomes?
 - Questions?

Case Studies for Classroom Discussion

- Approach:
 - Provide article to read before class
 - Provide guidelines of questions for pre-class preparation
- Example: Depleted uranium exposure and birth defects in Iraq
- Learning outcomes:
 - Apply principles of risk assessment and public health assessment investigate an environmental health issue
 - Identify formal criteria for the assessment of causality that have or have not been met through the provided research studies
 - Apply principles of epidemiologic study design to investigate an environmental health issue
 - Identify primary, secondary, and tertiary preventative strategies that may be applied as public health measures in the provided example

Example: Depleted uranium exposure and birth defects in Iraq

- Before the class period read through the attached articles. In your groups provide responses to the following.
 1. Look up information on the plausible biological mechanism through which environmental exposure to depleted uranium could contribute to birth defects. Discuss your findings within the context of the four-step risk assessment framework (i.e., hazard identification, dose-response relationship, exposure assessment, risk characterization).
 2. Authors of the WHO report declare that there is not enough evidence indicating a causal relationship between uranium exposure and birth defects. Support or refute this claim based on findings from the other attached article and the documentary footage presented in class.
 3. Discuss how you might devise a research program to address this elusive link between war-related radiation exposure and birth defects. What types of studies would be required? How would you go about designing such studies?
 4. Discuss potential prevention interventions based on exposure-related risk factors (i.e., route and timing of exposure, stage of life, other diseases, special sensitivities) using information gathered from reliable ancillary resources discussing the health risks of depleted uranium exposure. To what form of prevention strategy would these interventions correspond (i.e., primary, secondary, or tertiary)?
- [Congenital birth defects report.pdf](#)
[1752-1505-6-3.pdf](#)
[d-iq20121018_06_en.pdf](#)
[PIIS0140673613618127.pdf](#)

Case Studies for Exams

- Example: Genetic basis of population variation
- Learning outcomes:
 - Identify different systems of genetic inheritance of traits
 - Identify inheritance patterns of dominant and recessive traits
 - Identify types of mutations
- Approach:
 - Write scenario that provides information to answer specific questions
 - Write questions based on scenarios

Example Examine Question

- ▶ *Two species of bird are found that do not interbreed. One population has short beaks , the other has long beaks, but in both populations beak length varies along a continuum. One species of the bird has a spot on the cheek that is either blue or absent, apparently this trait is controlled by one gene and blue is dominant over absent. The allele for absent has a single nucleotide different resulting in a change of amino acid from the blue allele.*
- ▶ *What type of genetic analysis would be used to analyze variation in the trait of beak length?*
- ▶ *What type of genetic analysis would be used to analyze variation in the genetics of the cheek spot?*
- ▶ *What type of mutation is shown by the change from blue to absent?*

Group Activity

- Select one of the news articles and develop
 - Classroom discussion outline
 - Set of 2 – 4 test questions

Group Sharing

Characteristics of Good Case Studies

- Relevant and clear learning outcomes
- Engaging
 - Real-world or sci-fi application
- Concise and informative scenario
- Makes use of information readily available to student
- Student deliverables

Developing Your Own Case Studies

- Decide on a topic and research it
- Generate a clearly defined list of learning outcomes
- If using pre-existing materials:
 - Assign relevant readings to frame the case study
- If developing from scratch:
 - List out possible characters
 - List out important terms/concepts to cover
 - Draft the case
 - List major/minor topics likely to come up in discussion
 - Write up discussion questions
 - Revise

Group Activity: Learning Outcomes

- Choose a topic of interest to your group
- Develop a list of 3 – 5 learning outcomes you would want to address
- Write a short scenario/case that provides information related to your learning outcomes

Group Sharing

- Ideas
- Issues
- Questions

Additional Considerations

- Work backward from learning outcomes
- Appropriate level for student understanding
- Clear student expectations
- Length and timing
 - 90-120 min. for discussion-based case studies
 - Short scenarios for testing situations
- Style of presentation:
 - Interrupted case study method
 - Blocked period for group work
- Classroom arrangement conducive for group work
- Move around, be interactive
- Commit students to deliverables
- Use the board to organize ideas and summarize work

Instructional Resources

- NCCSTS Publications and Case Studies
<http://sciencecases.lib.buffalo.edu/cs/teaching/publications/>
- Herreid, C.F. (2007) Start with a Story: The Case Study Method of Teaching College Science. Arlington, Virginia: NSTA Press.