uBEATS Teacher's Guide:

Bioethics

(Grades 11-12)

This teacher guide is a supplementary text to support the use of the uBEATS "Bioethics" module for grades (11-12).

To help students develop the knowledge necessary for an incredible future in health care, we created UNMC Building Excellence in Academics Through STEM (uBEATS), an online health science resource for Nebraska students.

UNMC uBEATS modules are short (15 minutes or less), interactive online health science modules to supplement curriculum taught in grades 6 – 12. These do not replace curriculum but are a supplement for teachers and students incorporating evidence-based information and UNMC expert guided material. Each module is chunked into sections with formative and summative assessments with immediate feedback provided.

Tips on how to utilize uBEATS modules:

- Internet access is required to view uBEATS modules.
- For those who have access to one-to-one technology, modules can be used in or outside of the classroom as a topic introduction, extension, or review.
- For classrooms without individual student devices modules can be used in whole group instruction. Formative assessment questions can use the teacher's preferred call and response method and summative assessment questions can be displayed on the board and answered individually by students or printed and distributed to students after viewing the module.

Objectives

- Define bioethics.
- Consider ethical dilemmas in bioethics.
- Develop a personal view of bioethics and a strategy for dealing with ethical situations.

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Introduction

How do Researchers Address Bioethical Dilemmas?

The goal of medical research, whether developing new medications to treat deadly diseases or creating state-of-the-art equipment to improve surgical outcomes, is to improve the quality of life for people. However, when designing treatments for people, how do medical researchers ensure that they are not inadvertently doing harm to the people they are trying to help? In this module we will discuss the important role that bioethics plays in helping to ensure that medical research is conducted in a safe and fair way for all who choose to participate.

What is Bioethics?

The term “bio” refers to living things. The term “ethics” refers to moral principles that govern a person’s beliefs and behavior or how they conduct an activity. Bioethics is a discipline dealing with the ethical implications of biological research and application, especially in medicine. Studying bioethics helps scientists build valid and ethical research studies and, in the case of human research, ensures that human subjects are not exposed to unnecessary harm.

Bioethical Tools

Respect for Persons includes two moral requirements: 1) Acknowledge autonomy, 2) protect those with diminished autonomy.

Beneficence involves two general rules: 1) Do not do harm, 2) Maximize possible benefits and minimize potential harm.

Justice says that equals ought to be treated equally, and it monitors who receives the benefits and who bears the burden. Research benefits ought to be distributed to all who deserve and need them.

Prior Knowledge

Before beginning this module, the student should understand the Next Generation Science Standards (NGSS) featuring Three-Dimensional Learning.

Core Idea LS4.D: Biodiversity and Humans A Framework for K-12 Science Education.

- Human beings are part of and depend on the natural world. Biodiversity—the multiplicity of genes, species, and ecosystems—provides humans with renewable resources, such as food, medicines, and clean water. Humans also benefit from “ecosystem services,” such as climate stabilization, decomposition of wastes, and pollination that are provided by healthy (i.e., diverse and resilient) ecosystems. The resources of biological communities can be used within sustainable limits, but in many cases humans affect these ecosystems in ways—including habitat destruction, pollution of air and water, overexploitation of resources, introduction of invasive species, and climate change—that prevent the sustainable use of resources an

- lead to ecosystem degradation, species extinction, and the loss of valuable ecosystem services.

Science and Engineering Practices NGSS

- Constructing explanations and designing solution
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Crosscutting Concepts NGSS

- Patterns
- Cause and effect

Key Terms/Vocabulary

Ethics, bioethics, ethical dilemma, protocol, Tuskegee Syphilis Experiment, syphilis, penicillin, Golden Rice, vitamin A deficiency, biotechnology, genetic engineering, CRISPR, DNA, genes, in vitro, un utero, embryo, HIV, mosaicism, cloning, The Belmont Report, respect for persons, autonomy, beneficence, justice.

Science Standards

Rationale for bioethics education. A Framework for K-12 Science Education.

- It is also important that curricula provide opportunities for discussions that help students recognize that some science- or engineering-related questions, such as ethical decisions or legal codes for what should or should not be done in a given situation, have moral and cultural underpinnings that vary across cultures. Similarly, through discussion and reflection, students can come to realize that scientific inquiry embodies a set of values. These values include respect for the importance of logical thinking, precision, open-mindedness, objectivity, skepticism, and a requirement for transparent research procedures and honest reporting of findings.
- Students need opportunities, with increasing sophistication across the grade levels, to consider not only the applications and implications of science and engineering in society but also the nature of the human endeavor of science and engineering themselves. They likewise need to develop an awareness of the careers made possible through scientific and engineering capabilities.

Extensions of the lesson

- To help students become more familiar with the Key Terms of this module, the teacher can use the vocabulary list for a classroom Word Wall or integrate the vocabulary into classroom word games during review sessions.
- As student misconceptions become apparent, the teacher may need to reinforce these important concepts:

- The goal of medical research is to improve the quality of life for people, but researchers must ensure that they do not inadvertently do harm in the process.
- Even when researchers believe that they have the best intentions, they must still follow ethical protocols to protect their participants and to fairly distribute the benefits of the study.
- Researchers must respect the rights of each person to make decisions for their own well-being.
- When people have a diminished capacity to make autonomous decisions—due to age, illness, etc.—their rights must be protected.
- The rules of beneficence demand that medical research be designed to do no harm, but even when unexpected harmful consequences do occur, researchers must make every effort to minimize such harm.
- Justice guides the distribution of benefits from a research study. Care must be taken to see that all populations can share in the benefits to which they are entitled.
- The Tuskegee Syphilis Experiment took advantage of participants who were deceived, not informed about the true nature of the experiment, and were not cured by the researchers even though the cure was available.
- Since 2001, all biological research studies must be approved by an IRB (Institutional Review Board).
- Research involving live animals is now monitored by the IACUC (Institutional Animal Care and Use Committee).
- The Golden Rice experiment successfully provided the participants with increased levels of vitamin A. However, the researchers failed to inform the participants that they were receiving genetically engineered food. Although no negative effects have been detected so far, this study has violated ethical guidelines.
- CRISPR is a gene-editing tool that can change the DNA in a developing embryo. Whether such manipulation produces desired results or unexpected negative consequences, the changed DNA can be passed to future generations.

Enrichment

- For information about career opportunities, see UNMC's Careers in Healthcare.
- Students should be watchful in current events for recent news about medical research and medical breakthroughs.
- Search the Internet for examples of case studies involving bioethics.
- To make connections in your community, contact local hospitals, healthcare clinics, nurses, doctors, medical laboratories, ACLU.
- To learn more about the ethics of gene editing, see Jennifer Doudna.
- To explore the ethics of genetic research, see Keolu Fox.
- To watch a presentation about designer babies, see Paul Knoepfler.
- To consider the ethics of permanent modification of species, see Jennifer Kahn.
- To hear suggestions about intentionally causing evolution of new humans, watch Juan Enriquez.