

Unit: Designing Circuits for Neurodevices

Lesson 3: Neuroethics

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Image credit: [Wikimedia Commons](#).

LESSON OVERVIEW

Activity Time:

Two 55 minute class periods.

Lesson Plan Summary:

In this lesson, students will evaluate their prior beliefs on neuroethics. They will then watch a documentary, then go back and reevaluate their beliefs and how they have or have not changed after viewing.

STUDENT UNDERSTANDINGS

Big Idea & Enduring Understanding:

- **Neuroethics:** Neuroethics is the study of the ethical implications of neurotechnologies. It combines an understanding of neuroscience, philosophy, and the legal system. Neuroethical issues can arise during the design of a device, drug, or therapy, all the way to the impacts it has once used with patients. Neuroethics deals with complex philosophical issues, such as identity, security, privacy, autonomy, fairness, and justice. These type of ethical considerations and decisions are not black and white. There are many different factors that come into play and every person has their own personal beliefs and bias that affect this.

Investigative Phenomenon: There are ethical implications to the design, testing, and use of neurotechnologies, such as drugs, devices, and therapies.

Driving Question:

- How do your own personal beliefs and bias affect your view on neuroethics?

Learning Objectives:

Students will know...

- That one's stance on neuroethical issues is affected by personal beliefs and bias.

Students will be able to...

- Provide a definition of neuroethics and describe an example of a neuroethical issue.
- Share their own personal beliefs and bias as they relate to neuroethical issues and decide whether they have changed after viewing a documentary.

Vocabulary:

- **Atypical:** Not representative of a type or group; unusual or uncommon.
- **Cognitive:** The brain's role in thinking or learning.
- **Deficit:** A deficiency or impairment.
- **Disability:** Human variation is normal, therefore there are differences in the ways that people move, sense, and think. Disabilities are the restrictions created by society that impact people with impairments, such as infrastructure (i.e., lack of wheelchair ramps; movies without closed captioning), beliefs, or biases.
- **Enhancement:** Something that causes an increase in quality or function. Human enhancement is making purposeful changes to the human body in order to increase its physical or mental capabilities, such as supplements, drugs, implants, or other technologies.
- **Impairment:** A state of something being impaired, damaged, or functioning in an atypical way. This includes physical or mental conditions that causes a limitation or difference in the way a person moves, senses, or thinks. Impairments can be physical, sensory, intellectual, or psychological. They can be temporary, long-term, or permanent.
- **Inherent:** Something that is an essential or permanent part of something else.
- **Neuroethics:** The study of philosophical issues related to neurotechnologies. It combines an understanding of neuroscience, philosophy, and the legal system. Neuroethical issues can arise during the design of a neurologically-focused device, drug, or therapy, all the way to the impacts it has once used with patients. Neuroethics deals with complex philosophical issues, such as identity, security, privacy, autonomy, fairness, and justice.
- **Sector:** A portion that is different or distinct from other portions.

- **Society:** The people who live together in a community. Also known as the public.
- **Therapeutic:** Something that helps to heal, repair, or restore a disease or injury.

***Note:** Definitions were inspired by a variety of website resources, including Wikipedia and online dictionaries.*

Next Generation Science Standards:

This lesson does not build toward a specific NGSS Performance Expectation (PE). Rather, it focuses on an element of the [Nature of Science](#) standards.

Science Addresses Questions about the Natural and Material World:

- Not all questions can be answered by science.
- Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions.
- Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge.
- Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues.

TEACHER PREPARATION

Materials

Material	Description	Quantity
“FIXED: The Science/Fiction of Human Enhancement”	1 hour documentary on neuroethics. Available for educational streaming on Kanopy or New Day Films. http://www.fixedthemovie.com/ https://www.newday.com/film/fixe	1
Classroom computer	Classroom computer with projector, internet access, and speakers for showing documentary	1
Student Handouts	<i>Student Handout 3.1: FIXED Pre and Post Survey</i>	1/student

Preparation

1. Make copies of *Student Handout 3.1*, one per student.
2. Obtain a copy of the Fixed Documentary DVD or prepare for streaming. Pre-view the film.

PROCEDURE

Engage: FIXED Pre Assessment Survey (5-10 min)

1. Post the following entry task on the board or in whatever format you use in your classroom.
 - a. *What does the term ETHICS mean to you?*
2. Hand out a copy of *Student Handout 3.1* to each student.
3. Each student will complete Part 1 of the survey honestly and will then set it aside.

Explore: FIXED Documentary (60 min)

4. Students will watch the documentary, “*FIXED: The Science/Fiction of Human Enhancement*.” The running time is 56 minutes plus credits. This viewing may need to be split between two class periods.

Evaluate: FIXED Post Assessment Survey (10-20 min)

5. After watching the film, have each student return to *Student Handout 3.1* and in a different color of ink, retake the survey.

6. Have each student write a brief reflection using Part 2 of *Student Handout 3.1* on what changed or did not change for them upon seeing the documentary.
7. Provide students with the opportunity to discuss their changes they have just written about within their table groups. The following can be used as prompts to help with discussion:
 - a. What shifted or changed for you from before and after viewing the film? Why?
 - b. Was there anything that didn't change for you? Why?
 - c. What was your reasoning for the ratings you gave before and/or after viewing the film? Why do you think that is?
 - d. Were there any similarities and/or differences between you and your group members?
 - e. What most surprised you about the film?
 - f. What questions do you have?
8. After students have had a chance to discuss within their groups, provide the opportunity for students to share their thoughts, comments, questions, etc. as a class.
9. Post the following exit ticket on the board or in whatever format you use in your classroom.
 - a. *Write a one sentence summary of the class discussion on the FIXED documentary.*

STUDENT ASSESSMENT

Assessment Opportunities:

- Teachers can check on student understanding and engagement during the class discussions.
- *Student Handout 3.1* will include a completed pre and post survey and reflective writing

Student Metacognition: Students will be able to see if and how their opinion changed prior to and after viewing the documentary and will be given time to reflect on why this is. This provides students with an opportunity to identify and consider some of their biases about disability.

EXTENSION ACTIVITIES

Extension Activities:

Student could write a paper further detailing their viewpoints and how they have changed or not after viewing the documentary. Students could also have a class debate on the topics covered in the video, requiring them to do identify topics and conduct research.

To further deepen your investigation into the topic of neuroethics, there are many lesson plans available from the Northwest Association for Biomedical Research's Teacher Center. In

particular, the *Ethics Primer* and *Bioethics 101* curriculum units are relevant to the topic of neuroethics.

Northwest Association for Biomedical Research Teacher Center

<https://www.nwabr.org/teacher-center>

In addition, the Center for Neurotechnology (CNT) provides instructional resources and lesson plans related to neuroethics. All of the lesson plans featured on this webpage (<http://csne-erc.org/content/lesson-plans>) have neuroethics lessons embedded in them, however the one listed below most specifically focuses on ethics.

CNT Neuroethics & Philosophy Teaching Resources

<http://csne-erc.org/education-resources-teachers/neuroethics-philosophy>

CNT Curriculum Unit: Neural Engineering & Ethical Implications

<http://csne-erc.org/education-k-12-lesson-plans/neural-engineering-and-ethical-implications>

Adaptations:

This film is not rated. However, the documentary may not work well with younger audiences, so that decision will have to be made by the teacher.

The DVD version of the film includes closed captions, video descriptions, and French, Spanish, English, and Portuguese subtitles.

If it is not possible to show the entire film, a 7 minute extended trailer is available here:

<http://www.fixedthemovie.com/about/trailer/>

If the reading level on *Student Handout 3.1* is too high, use the vocabulary definitions provided at the beginning of this lesson plan to develop a scaffolded version of the document.

TEACHER BACKGROUND & RESOURCES

Background Information: Teachers should view this documentary prior to showing it. A full synopsis of the documentary can be found here:

<http://www.fixedthemovie.com/about/synopsis/>

The 2014 documentary is described by New Day Films as follows:

Through a dynamic mix of verité, dance, archival and interview footage, FIXED challenges notions of normal, the body and what it means fundamentally to be human in the 21st century.

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Key concepts include: ableism; access; adaptive technology; bioethics; biomechatronics; bionics; brain-machine interfaces; differing frameworks of understanding disability; disability arts and culture; emerging human enhancement technologies; exoskeletons; eugenics; genetics; health; humans 2.0; innovation; neuro-enhancement; performance enhancing drugs / smart drugs; prenatal screening; science; technology; transhumanism and more.

For a review of the film which provides helpful framing for each of the film's four acts, see this review:

De Saille, S. (2014). Fixed: The science/fiction of human enhancement. *Journal of Responsible Innovation*, 1(1), 142-145.

<https://www.tandfonline.com/doi/full/10.1080/23299460.2014.882096>

When teaching about neuroethics and neurotechnologies, it can be helpful to have some framing about socioscientific issues in general. These STEM Teaching Tools may be helpful:

Practice Brief #44: Addressing Controversial Science Topics in the K-12 Classroom

<http://stemteachingtools.org/brief/44>

Practice Brief #2: Why Should Students Investigate Contemporary Science Topics—And Not Just “Settled” Science?

<http://stemteachingtools.org/brief/2>

Resources:

Northwest Association for Biomedical Research Teacher Center

<https://www.nwabr.org/teacher-center>

CNT Neuroethics & Philosophy Teaching Resources

<http://csne-erc.org/education-resources-teachers/neuroethics-philosophy>

CNT Curriculum Unit: Neural Engineering & Ethical Implications

<http://csne-erc.org/education-k-12-lesson-plans/neural-engineering-and-ethical-implications>

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Citations: *Student Handout 3.1: Fixed Pre and Post Survey* is used with permission from the curriculum unit, *Neuroethics: Complicating Views*, authored by Hannah Earhart (2016), Center for Neurotechnology.

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Student Handout 3.1: FIXED Pre and Post Survey

FIXED - The Science/Fiction of Human Enhancement

Used with permission from *Neuroethics: Complicating Views* curriculum by Hannah Earhart (2016), Center for Neurotechnology.

Name: _____ Date: _____ Period: _____

Part 1: Survey

Circle the number that most closely reflects how you feel about each statement.

1. Society ought to determine what makes life worth living.

Disagree Agree
1 2 3 4 5 N/A

2. The individual ought to determine what makes life worth living.

Disagree Agree
1 2 3 4 5 N/A

3. All members of society should function at a similar, normal level.

Disagree Agree
1 2 3 4 5 N/A

4. Persons with atypical body structure and cognitive abilities have a deficit.

Disagree Agree
1 2 3 4 5 N/A

5. Functional impairments ought to be addressed by technology.

Disagree Agree
1 2 3 4 5 N/A

6. Society inherently excludes those with disabilities.

Disagree Agree N/A
1 2 3 4 5

7. Being human means being a typical, functioning member of the human species.

Disagree					Agree	
1	2	3	4	5		N/A

8. Artificial implants make an individual less human.

Disagree					Agree	
1	2	3	4	5		N/A

9. Technology is taking us beyond natural human capabilities, which is positive.

Disagree					Agree	
1	2	3	4	5		N/A

10. Scientists and Engineers have a responsibility to pursue human enhancement.

Disagree					Agree	
1	2	3	4	5		N/A

11. The public sector ought to determine who funds scientific research.

Disagree					Agree	
1	2	3	4	5		N/A

12. Research and development should be privately funded.

Disagree					Agree	
1	2	3	4	5		N/A

13. The ethical objections to genetic modification outweigh any positives.

Disagree					Agree	
1	2	3	4	5		N/A

14. All people with a disability have equal access to assistive devices and therapeutic technology.

Disagree					Agree	
1	2	3	4	5		N/A

Part 2: Reflection

Looking at your responses before and after viewing the documentary, why have your opinions changed and/or not changed? Be sure to provide specific examples of where there were changes or not and why.