

# Cognitive Enhancement Teen Role Play Forum



Organization: Lawrence Hall of Science  
Contact person: Frank Kusiak  
Contact information: frank\_kusiak@berkeley.edu

## General Description

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### Audience:

Teenagers from middle school to high school. It could also work with young adults who are at university.

### Type of program:

The CETF is a forum where participants use role playing as a means to explore societal and ethical implications of nanotechnology on a topic they'll readily identify with: academic performance. The program can last from a half hour to 2 hours. It was designed as one of several capstone events at the end of a weeklong nanocamp, but can be adapted for many situations.

## Program Objectives

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### Learning Objectives:

#### Role Play Forum on Cognitive Enhancement

- Learners will be able to explore societal and ethical implications of nanotechnology in regards to measuring academic performance.
- Learners will be able to vocalize concerns and ambitions concerning the use of nanotechnology on their own bodies.
- Learners will appreciate that the dilemmas explored in this hypothetical situation are very similar to dilemmas with current technology and medicine.

### NISE Network content map main ideas:

- 1. Nanometer-sized things are very small, and often behave differently than larger things do.
- 2. Scientists and engineers have formed the interdisciplinary field of nanotechnology by investigating properties and manipulating matter at the nanoscale.
- 3. Nanoscience, nanotechnology, and nanoengineering lead to new knowledge and innovations that weren't possible before.
- 4. Nanotechnologies have costs, risks, and benefits that affect our lives in ways we cannot always predict.

[Place an “x” in the brackets above to indicate big ideas covered in the program.]

**National Science Education Standards:**

1. Science as Inquiry

- K-4: Abilities necessary to do scientific inquiry
- K-4: Understanding about scientific inquiry
- 5-8: Abilities necessary to do scientific inquiry
- 5-8: Understanding about scientific inquiry
- 9-12: Abilities necessary to do scientific inquiry
- 9-12: Understanding about scientific inquiry

2. Physical Science

- K-4: Properties of objects and materials
- K-4: Position and motion of objects
- K-4: Light, heat, electricity, and magnetism
- 5-8: Properties and changes of properties in matter
- 5-8: Motions and forces
- 5-8: Transfer of energy
- 9-12: Structure of atoms
- 9-12: Structure and properties of matter
- 9-12: Chemical reactions
- 9-12: Motions and force
- 9-12: Conservation of energy and increase in disorder
- 9-12: Interactions of energy and matter

3. Life Science

- K-4: Characteristics of organisms
- K-4: Life cycles of organisms
- K-4: Organisms and environments
- 5-8: Structure and function in living systems
- 5-8: Reproduction and heredity
- 5-8: Regulation and behavior
- 5-8: Populations and ecosystems
- 5-8: Diversity and adaptations of organisms
- 9-12: The cell
- 9-12: Molecular basis of heredity
- 9-12: Biological evolution
- 9-12: Interdependence of organisms
- 9-12: Matter, energy, and organization in living systems
- 9-12: Behavior of organisms

4. Earth and Space Science

- K-4: Properties of earth materials
- K-4: Objects in the sky
- K-4: Changes in earth and sky
- 5-8: Structure of the earth system
- 5-8: Earth's history

- 5-8: Earth in the solar system
- 9-12: Energy in the earth system
- 9-12: Geochemical cycles
- 9-12: Origin and evolution of the earth system
- 9-12: Origin and evolution of the universe

5. Science and Technology

- K-4: Abilities to distinguish between natural objects and objects made by humans
- K-4: Abilities of technological design
- K-4: Understanding about science and technology
- 5-8: Abilities of technological design
- 5-8: Understanding about science and technology
- 9-12: Abilities of technological design
- 9-12: Understanding about science and technology

6. Personal and Social Perspectives

- K-4: Personal health
- K-4: Characteristics and changes in populations
- K-4: Types of resources
- K-4: Changes in environments
- K-4: Science and technology in local challenges
- 5-8: Personal health
- 5-8: Populations, resources, and environments
- 5-8: Natural hazards
- 5-8: Risks and benefits
- 5-8: Science and technology in society
- 9-12: Personal and community health
- 9-12: Population growth
- 9-12: Natural resources
- 9-12: Environmental quality
- 9-12: Natural and human-induced hazards
- 9-12: Science and technology in local, national, and global challenges

7. History and Nature of Science

- K-4: Science as a human endeavor
- 5-8: Science as a human endeavor
- 5-8: Nature of science
- 5-8: History of science
- 9-12: Science as a human endeavor
- 9-12: Nature of scientific knowledge
- 9-12: Historical perspective

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## Background Information

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### Definition of terms

Nano is the scientific term meaning one-billionth ( $1/1,000,000,000$ ). It comes from a Greek word meaning “dwarf.”

A nanometer is one one-billionth of a meter. One inch equals 25.4 million nanometers. A sheet of paper is about 100,000 nanometers thick. A human hair measures roughly 50,000 to 100,000 nanometers across. Your fingernails grow one nanometer every second.

(Other units can also be divided by one billion. A single blink of an eye is about one-billionth of a year. An eyeblink is to a year what a nanometer is to a yardstick.)

Nanoscale refers to measurements of 1-100 nanometers. A virus is about 70 nm long. A cell membrane is about 9 nm thick. Ten hydrogen atoms are about 1 nm.

At the nanoscale, many common materials exhibit unusual properties, such as remarkably lower resistance to electricity, or faster chemical reactions.

Nanotechnology is the manipulation of material at the nanoscale to take advantage of these properties. This often means working with individual molecules.

Nanoscience, nanoengineering and other such terms refer to those activities applied to the nanoscale. “Nano,” by itself, is often used as short-hand to refer to any or all of these activities.

Cognitive Enhancement is the study of the human brain to improve its innate ability to create, analyze, and store learned and new information.

**Piezoelectric Material:** When applying mechanical stress to this material, an electrical current is produced. Such materials could potentially power very efficient devices or sensors in the human body as it moves (causing the material to bend/stress and create current).

## Program-specific background

The CETF is a great way to get teens to explore the risks and benefits of nanotechnology. In terms of technical knowledge, this program is fairly light and approachable. Only several topics are addressed and can be easily research by following the references below.

Cognitive Enhancement:

Policy Implications of Technologies for Cognitive Enhancement, Arizona State University Consortium for Science, Policy, & Outcomes.

<http://www.cspo.org/documents/FinalEnhancedCognitionReport.pdf>

## Role Playing Cognitive Enhancement Forum

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This forum plays on very real concerns and fears of students: academic performance and taking standardized tests. The crux of this forum is: if there was a supplement or embedded nanotechnology available to the public that will enhance your cognitive abilities by making you smarter or give you instantaneous access to the internet, how would you or local community handle it? Is it cheating? By taking on roles that are somewhat familiar to them, they can put themselves into the shoes of decision makers whether they are parents, teachers, or principals.

## Materials

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- Roles printed and cut. Make sure to bring enough for the participants. If there are more than 10 people, then assign partners (this is easy for the roles teachers and parents)
- Activity Outline /Overview for you
- Feel free to make up your own roles and post them this activity's catalog page at [nisenet.org](http://nisenet.org)

## Set Up

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**Time:**

Set Up:  
10 Minutes



Activity:  
30-60 Minutes



Breakdown:  
10 Minutes



If you come prepared and everything is printed and cut, set up should be very brief. The roles are found at the end of this document.

Please read the policy paper linked in the resources: it's a great way to start thinking about how other decision makers could handle potential advances in cognitive enhancement.

Also, read through the bulleted questions/scenarios list beforehand. You will be able to keep the conversations going or improvise new questions without awkward pauses.

## Program Delivery

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### Talking points and outline

Each student will receive a card with a brief description of their role. (Teacher, Parent, Student, Principal. The parents and students can be divided by socio-economic class: rich, middle-class, and poor.) They will be given several minutes to read and think about the following ethical dilemma:

**Situation:** Amazing news! Two separate teams of scientists have developed methods to enhance your intelligence with nanotechnology!

Using a combination of bio-compatible nano-circuits and nanotubes that use the piezoelectric effect to provide power, Team Cogno developed an implant that projects information on your cornea. It can store terabytes of information, communicate with other implants, and connect to the Internet. The implant, once arthroscopically installed in your body, is visually undetectable. Unfortunately, it's very expensive, and only the wealthy can afford it. Also, once implanted, the implant can be removed via surgery.

The second team, Team Brainiac, discovered a nano-supplement that enhances a person's brain function by promoting neuron growth and increasing the total surface area of the cerebral cortex. An IQ boost of 35 points is common. The nano-supplement can be taken orally, and although expensive, anyone who really wants it, can purchase it. There are serious, unanswered questions to its long term health effects. (Optional: In fact, there are rumors that it might shorten one's lifespan.)

**Role-Playing:** Have the students think about how their character feels about this news for a minute or two.

Go around the class/group and have everyone introduce themselves and their roles, and have them react to the "news" in character.

From here on out, you will need to allow the group to explore issues as they arise, but at the same time keep them on topic. If they wander into topics not related to nanotechnology or the societal implications of technology/drugs, then ask a new question. For example, it's fine if they talk about steroid use and sports, but shouldn't get into specific situations and specific players; it'll turn into a sports conversation and not a discussion on society.

Start the discussion by posing a question then ask for responses from the group.

- Do people who use nano-enhancements deserve entry into prestigious schools and win scholarships; is it cheating? What if everyone in your class had one of these technologies regardless of the technology's legality?

At every step, ratchet up the ethical dilemma...

- If allowed, should teachers grade enhanced students harder? Should entrance exams be changed to reflect the increased ability of test takers? Should enhanced people be evaluated differently? (A big part of this discussion can be informed by their own experiences using or not being allowed to use calculators on tests or taking open book exams. Should they be allowed to use calculators?)
- What if these nano-enhancements give the mentally challenged the ability to overcome their disadvantage?
- What if taking the supplement made someone more sociable? Less sociable?
- How does this technology change our society's expectations on job seekers or a company's hiring practices? How does it change people's jobs?
- What if a nano-enhanced person is able to invent a cure for cancer: does this justify their use?
- How do we take care of people who took the supplement or received nano-implants who develop serious health issues later in life? Who should we hold liable for it?
- What role does the national, state, and local governments have in this? (A variation of this could be: should this be regulated or how should it be regulated?)

Conclusion: One way to transition to a discussion concluding the experience is to ask about current technology: How different is the implant from current mobile technology? How different is the nano-supplement from kids who take Adderall to help them focus? This discussion can happen out of character.

After discussing current technology, ask for any concluding remarks. In order to help this along, you may want to poll the participants to see who would actually try one of these "enhancements." You may note that we all need to make decisions based on what we value, and that not everyone will come to the same conclusion. You need to do your best to stay informed, and think through your decisions before making one.

### **Tips and troubleshooting**

Tip: It's best to have the room set up in a circle or in a U shape. If you have about 15-20, you could also double up on the roles. Some roles are parents, and you can "couple" the kids. Some of the teachers can be paired up, too, as they could be in the same department in the same school or they're "team" teachers. Alternatively, if you have 20 young adults, then you can break them up into two groups around large circular tables.

Tip: Make sure to read through the questions beforehand and phrase each question so it is relevant to your audience. You won't ask every question, but use them to keep the conversation going.

Tip: Don't be afraid to call on people to talk. If they're unsure about the question, rephrase it or ask what they're unsure of. This uncertainty can be the basis of a constructive discussion!

Tip: One thing you will want to emphasize, but it usually comes up organically, is that these treatments do not give people motivation.

Tip: There will become a point that the roles will need to be dropped, and they can talk frankly about their opinions and values. It's up to the presenter to decide this. Be careful, the kids might not feel they can talk freely after they start talking about themselves. It depends on the group.

Tip: Create new roles! College admissions dean, music teacher, grandparents, politician, doctor; make sure to share these in the comments at nisenet.org.

## Universal Design

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This program has been designed to be inclusive of visitors, including visitors of different ages, backgrounds, and different physical and cognitive abilities.

### The following features of the program's design make it accessible:

- [x] 1. Repeat and reinforce main ideas and concepts
- [x] 2. Provide multiple entry points and multiple ways of engagement
- [x] 3. Provide physical and sensory access to all aspects of the program

Refer to the individual program guides for each activity for specific features or modifications

To give an inclusive presentation of this program:

- The forum's perspective is definitely geared towards college bound students. However, as you present this forum, ground it into an experience the kids will be interested in. Will this give people an advantage is skilled trades? Sports? Increased social cognition? If the kids aren't motivated to go into college or a trade school, you may need to poll them beforehand to get a sense of what ethical dilemma faces they may face when confronted with cognitive enhancement.

- There are potential gender issues here: from anecdotal observation, boys seem to be more willing to be early adopters of cognitive enhancements. You may want to specifically bring this issue up to see how the group considers it.
- Iteration, adaption, and sharing on nisenet.org will allow others to present this forum in a more inclusive fashion.



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Appendix A: Roles to cut and hand out to participants.

**Role: High School Student**

**Background:** You're a successful student! You get straight A's, missed a perfect score on the SAT by a slim margin the first time you took it, and are active in several student organizations. You're successful and smart because you work hard and study a lot. Your family is neither poor nor rich, but you have big dreams, and it's important to you get accepted into one of the top three universities in the country.

You fear failure and are very competitive, but have a strong sense of fair play.

**Role: High School Student**

**Background:** You're a good student. You get an assortment of A's and B's, and you don't need to work hard because you've been smart enough to get by. You haven't taken a college entrance exam, yet. You live a comfortable life: your wealthy family provides you with anything and everything you need. However, your parents put a lot of pressure on you to succeed at school and get into a good college. You've done well coasting along the last couple years, but classes are getting harder and your old study (or lack of) habits aren't cutting it.

**Role: High School Student**

**Background:** You're an average to below average student. It's hard to study because you have a difficult time grasping the more advanced concepts in your classes, and you have a job after school that limits the time you can study. The little bit of money you make from your job goes straight to your family because they're struggling to make ends meet. You have dreams of being a successful professional, but you don't know how you'll be able to get into or afford a good university. Deep down, you have the heart of an inventor, but your life prevents you from exploring this creative side.

**Role: Parent(s) of a High School Teenager(s)**

**Background:** You and your partner have a comfortable middle class life. You have a salaried job at the local university, and your spouse works at City Hall. Your daughter and son, who are fraternal twins, are juniors in high school. Both of them are above average students, but they're not at the top of their class. You hope they get into a tier 1 school, but you're nervous at the prospect. They keep a balanced social and academic life, but you wish they worked a bit harder academically. You want the best for them, but don't really know how to give them that edge they need.

**Role: Parent(s) of a High School Student**

**Background:** You're a very, very successful entrepreneur who has made millions efficiently distributing organically grown produce. Your business has the smallest carbon footprint of any produce distributor in the United States. You value the importance of saving the environment while also making it profitable. You work six days a week and your partner works five days a week running your charity that helps disadvantaged kids get ahead in life. Your only child, a sophomore in high school, has a slight learning disability and has to forgo a social life in order to keep up with increasingly harder assignments. Your teenager works so hard not to disappoint you, and once told you, "When I grow up, I want to be as successful as you!"

**Role: Parent(s) of a High School Student**

**Background:** You're in a typical blue collar family. Both of you work 9-5 jobs, one at the local Department of Motor Vehicles and the other as salesperson at a local retail store. You don't make a lot of money, but you have enough to get by. One of you finished community college and the other landed a job out of high school because the hiring manager was a family friend. You have two kids, one of whom is in high school. You were never academically inclined, and you're pleased that your kids get by with B's and C's. They don't get into big trouble, and when they graduate, you'll do your best to support them whether they go directly into the workforce, go to trade school, or college. You doubt you can give them much financial support: especially if they choose to go away to college.

**Role: Teacher(s)**

**Background:** You're a math teacher at a public high school. Your students are diverse, but the majority of them come from poor neighborhoods. You see how they struggle with a lack of resources, problems at home, and the pull of dropping out for a full time job or earning money from nefarious sources. Most students want to study and learn, but are too distracted by the small, yet disruptive element within the student body. Even the most motivated students find it difficult to succeed. Many of your students are hard workers, but this usually means they work a job after school. You wish something existed that allowed your students to study less, yet retain more information. If test scores increased, your school might get an infusion of money from government grants or charitable organizations.

**Role: Teacher(s)**

**Background:** You are a well loved high school biology teacher at a well respected private institution. Your school abides by the honor code, and even though you're a realist and still sit in the class when they take a test, you believe your students are honorable and do not cheat. However, any student caught cheating deserves nothing less than expulsion. Your students study hard, but sometimes you're worried that they're ignoring other important aspects of their lives in order to get ahead. Although the principal doesn't address it directly, sometimes it seems he's too focused on test scores and making sure the wealthiest students are happy with their education.

**Role: Principal**

**Background:** You're the principal of the local public high school in an affluent neighborhood. The vast majority of your students come from middle to upper class families. In fact, your school received a lot of local and state-wide attention when a well known, monthly news magazine awarded your school with a high ranking amongst "America's Top Ranked High Schools." The school board expects a lot out of you, and the parents expect the test scores to remain high. Unfortunately, the budget for your school will shrink next year due to a drop in property values (which means less tax revenue for your school district). How will you be able to keep test scores high and meet everyone's expectations?

**Role: Principal**

**Background:** You're the principle for a charter school in a very large city. Your school prides itself in its cutting edge educational technology (A gift by a generous, wealthy benefactor whose billion dollar fund has helped other education institutions). Although the teenagers who attend your school come from a broad cross-section of your community, you specialize in using technology to help youth from disadvantaged backgrounds succeed. The school has been around for about five years, and many in your community question your methods and results.

**Role: Salesperson**

**Background:** You've worked in sales your entire professional life. Even though you got a degree in biology with a minor in chemistry, you got into sales as a summer job. You started selling computers at the local electronics store, and were really good at it! After graduation, you sold cars then moved onto medical equipment. You brag that you could sell E. Coli to someone with mysophobia (someone who suffers from a germ phobia)! Yesterday, you received a job offer from a well respected biotech company that's using cutting edge technology to access the internet, save information, and project information in a unique way. They won't tell you what the product actually is, but they're hinting it'll be huge. Just like the medical equipment you sell, you will be selling it to doctors, but also representing the technology in public. You love to challenge yourself, you're an honest salesman, and you're seeing dollar signs. Your partner, with whom you're raising an elementary aged child, is cautious, and doesn't know if you should change jobs.