Science in a Global Perspective
Understanding the Science Policy Process

M. **Ali** Yousuf[1] (Johns Hopkins University CTY)

and

Cameron Murray[2] (York University)

[1] mali@jhu.edu [2]cmurra@yorku.ca

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YORK UNIVERSITÉ UNIVERSITY

JOHNS HOPKINS CENTER for TALENTED YOUTH

Overview of the Talk

In this talk, we will cover the following topics:

- An introduction to CTY's *Science, Technology, and Public Policy* Course
- A critique of current understandings of "Science Literacy" (see the notes for details)
- A description of the challenges faced by instructors attempting to teach the relationship between science, technology and policy.
- An example of a pedagogical exercise designed by a CTY instructor that addresses these challenges

Introduction

With the progression of science and technology…

Introduction

With the progression of science and technology…

- Scientists and non-scientists alike require sensitivity to the consequences of science at local, regional, national and global levels

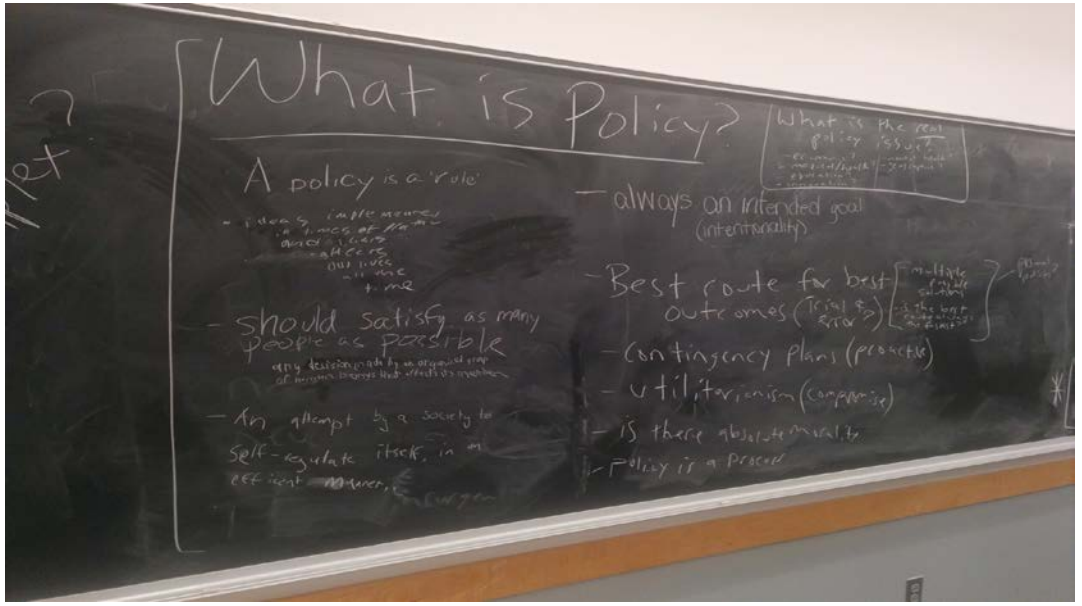
Introduction

With the progression of science and technology…

- Teachers in K-12 education would benefit from developing strategies for teaching science within broader political, cultural, and social contexts

Introduction

- Johns Hopkins University, Center for Talented Youth offers a three-week summer course titled “Science, Technology, and Public Policy” (or SPUB).
- It has been designed to address these concerns in novel and exciting ways.



Introduction

- The course, meant for students in 10-12 grades, is offered at the Princeton University site, in two parallel sessions.
- Daily classes 9AM-12Noon, 1-3PM, 7-9PM for three weeks
- In 2016 it will be offered from June 26 - July 15.

http://cty.jhu.edu/summer/grades7-12/princeton/

Critical Science Literacy

- Scientists and non-scientists both need to play a role in the expansion and advancement of science and technology.
- They must also take seriously the broader cultural and environmental impacts of these advancements.
- “Social responsibility” should be a major goal of science educators

Critical Science Literacy

- Developing critical science literacy is made increasingly difficult due to the global nature of many science and technology innovations and policy debates.

CTY'S "Science, Technology, and Public Policy" Course

- CTY's course addresses some of the issues outlined

CTY'S "Science, Technology, and Public Policy" Course

- CTY's course addresses some of the issues outlined
- Global perspective
- Introduction to **public and private stakeholders** in the process of producing and communicating science

Q&A – Public and private stakeholders?

- Middle School Physical Science
- PS1 – New Engineering Material
- PS3 – Energy – Coal/Oil Power Plant
- PS4 – Waves – EM waves and cell phones
- LS3: Heredity – Genetically Modified crops
- ESS3: Earth and Human Activity
- …

CTY'S "Science, Technology, and Public Policy" Course

- Introduction to public and private stakeholders in the process of producing and communicating science
- Students learn how governments fund and regulate science and technology

CTY'S "Science, Technology, and Public Policy" Course

- Cameron Murray, the co-author of this presentation, has taught this course twice (summers 2014 and 2015)
- Days 1 and 2 of the course address students' preconceptions about the course content based on its title
- In order to do this, he has developed four modules:
  - **Module 1:** "What is Science?"
  - **Module 2:** "What is Technology?"
  - **Module 3:** "What is Public Policy"?
  - **Module 4:** "What is Expertise"?

Modules

- Students brainstorm words and phrases that they associate with each of the core concepts (science, technology, policy, expertise).
- After discussion, students read articles to underscore the complexity of having just one definition for any of these concepts.
- The course encourages students to embrace this political, social, and cultural complexity.
- Becoming a “scientifically literate” student requires the acceptance that these terms mean very different things in different social, political and cultural contexts.

Modules (cont.)

- “Expertise” is taught as a way to link the concepts of science, technology, and public policy.
- Expertise is assumed of many in the public sphere (scientists, policymakers, teachers)
- But isn’t this expertise contextual?

Case Studies

After the modules, students examine case studies at various scales (local, national, global)

- Cameron travels the globe in this class.
  - Fukushima nuclear disaster of 2011
  - Bangladesh factory collapse of 2013
  - The AIDS epidemic in the United States and Africa
  - The sustainability movement in Singapore
  - The media landscape in China and Hong Kong
  - The anti-vaccination movement in the United States
- It is a whirlwind tour, but that is kind of the point. Taking the perspective of scientists, policymakers, the general public …

Case Studies

- Discouraging preconceptions about what policy, science, technology, and expertise are in specific context.
- This requires the students to be very specific when they use and engage with these key concepts and terms.
- After learning the basics in initial case studies, students must abandon assumptions of democracy, citizenship, and political participation.
- Again, there are many ways to understand and implement these concepts in our global world.

Case Studies: Goals

- Recognize diversity in how countries govern – both with science and in general
- Through the lens of science and public policy, students gain greater appreciation of different approaches to government and scientific research support.
- Laying the groundwork for Cameron's pedagogical exercise, "**Science Court**."

Case Study: The Emergence of Science Court

- Derived from “Science Policy and the Expectation of Health” by Adam Briggle.
- As a philosopher, Briggle employed academically informed claims about citizenship, activism and American democracy.
- Also providing plenty of statistical evidence and real-world examples to analyze institutional support and public understanding of health research.

Case Study: The Emergence of Science Court

- Briggle outlines inconsistencies in NIH's approach to research proposal assessment
    - Phase 1: academic novelty and rigor
    - Phase 2: **impact to economy and public health**
- Phase 1 instructions on NIH website are detailed and rich but Phase 2 instructions are not.
- Briggle says this indicates priority given to novelty over impact.
- Proposes equal weight to both phases.

Case Study: The Emergence of Science Court

- At the end of the piece, he provides the following suggestion for how to resolve these problems:
  - One way to make this beneficent censorship both practical and democratic is to transform the second stage of peer review into a **science court**.
  - This court would judge the societal worth of all proposals that pass the first stage with a fundable score. The principal actors would be the prosecutor, the defendants, and the jury.

Case Study: The Emergence of Science Court

- Prosecutor: Argues that proposed research is not in the public interest and represents the interdisciplinary phase in the peer review process, because his or her expertise would not be that of the research proposal under consideration.
- Instead, the argument would include economics, ethics, sociology, and other fields to make a well-founded adversarial case against the research and society.
- The defendant and jury play their standard roles

Case Study: The Emergence of Science Court

- This case study inspired Cameron to actually implement Briggle's proposal as a classroom activity
- Science Court uses role-playing to encourage students to examine science, technology, and public policy within diverse cultural, political, and economic contexts.

Science Court Rules

- The class is organized into three groups.
- Each group is divided into two camps: the defense and the prosecution.
- The instructors serve as “attorneys” for the defense and prosecution.
- Each group is given a proposal from either the Canadian Institutes of Health Research (CIHR) or the United States’ National Institutes of Health (NIH).

Science Court Rules (cont.)

- Groups review proposal and supplemental material for their case
- Use of mobile devices is encouraged!
- Students who aren't presenting act as the jury.
- The jury represents the general public ("Socially Responsible" citizens given the change to decide if a project should be funded.
- Presenters and their attorneys do not have a final say.

Science Court Rules (cont.)

- Each proposal contains issues that are
  - Technical
  - Ethical
  - Culturally specific
- The goal is for students in both the defense and prosecution groups to identify these issues and debate the best ways of addressing the research proposal.
- In the example provided, the key issue is the fact that many Latino communities in the United States do not have access to the internet, and are also less likely than other cultural communities to trust either the government or medical professionals.

Science Court: Outcomes

- Critical science literacy: engagement as citizens and beneficiaries of medical research
- There is no one way to address the relationship between science, technology and policy (even just in the USA)
- This lesson provides a solid foundation for students to recognize the diversity of forms of government and styles of developing technological and scientific innovations at local, regional, national and global scales.

Suggestions for Teachers

1. Physics of fluid flow: Keystone XL pipeline, http://www.cnn.com/2015/11/06/politics/Keystone-XL-pipeline-decision-rejection-Kerry/
2. Human Genetics: No you may not patent human genes, http://venturebeat.com/2013/06/13/supreme-court-no-you-may-not-copyright-human-genes/
3. Public Health: Tuskegee Syphilis Experiments in the United States, https://en.wikipedia.org/wiki/Tuskegee_syphilis_experiment
4. Chemistry / Environment: 2014 Elk River chemical spill, https://en.wikipedia.org/wiki/2014_Elk_River_chemical_spill
5. Geology: Fracking, http://politicsandpolicy.org/article/fracking-economic-boom-or-environmental-danger
6. Biology and Medicine: Should Animals Be Used for Scientific or Commercial Testing? http://animal-testing.procon.org/
7. Medicine: The Vaccination Debate, http://www.scholastic.com/parents/resources/article/parent-child/vaccine-debate

Suggestions for Teachers

8. Information Technology: Internet Censorship in China, https://en.wikipedia.org/wiki/Internet_censorship_in_China , http://www.cfr.org/china/media-censorship-china/p11515
9. Nuclear physics: The Fukushima Meltdown of 2011, https://en.wikipedia.org/wiki/Fukushima_Daiichi_nuclear_disaster
10. Plant Genetics: Can Genetically Modified (GM) crops help to improve food security in India?, http://policyblog.oxfordindiasociety.org.uk/2013/04/08/can-genetically-modified-gm-crops-help-to-improve-food-security-in-india/
11. Biomedical: Biomedical Enhancements: Entering a New Era, http://issues.org/25-3/mehlman/
12. Neuroscience: Smart policy: cognitive enhancement and the public interest, http://www.nickbostrom.com/papers/smart-policy.pdf
13. Energy, A review on global wind energy policy http://www.sciencedirect.com/science/article/pii/S136403211000626
14. Agriculture: Industrial farming pollutes rivers, distorts politics, and hurts rural communities. But it might just save the rainforest, http://www.washingtonmonthly.com/features/2009/0907.grunwald.html