

Nanoethics and Policy Education Effectiveness



MINES

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Motivation

Nanotechnology (NT), as a new and potentially revolutionary technology, provides the opportunity to examine the complex interaction between society and technology. The Nano-Science, Technology, Ethics, and Policy (NanoSTEP) project at Colorado School of Mines (CSM) seeks to

- (1) Increase engineering students' understanding of society, policy, and ethics
- (2) Use nanotechnology as a framework to better understand the role of ethics and policy education in an engineering curriculum¹

Methods

The study follows the opinions and knowledge of CSM students regarding NT, ethics, and society both before and after a Human Systems (HS) course. HS offers a historical examination of political, economic, social, and cultural systems on a global scale.

Each HS course contained a module on NT, which included a lecture on the history of NT policy in the United States. Two of the four instructors also included articles specific to NT in their course curriculum.

434 students wrote essays at the beginning and end of the HS course responding to the same prompt about a hypothetical scenario in which the leader of an African country is approached by a U.S. corporation seeking to manufacture paints and coatings developed from techniques using NT.



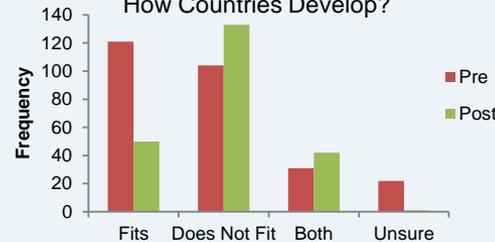
10% of all student responses were read prior to analysis to identify important themes; we then conferred on which themes were most important to follow, and created codes in Dedoose to apply to the responses. A written protocol was agreed upon for the application of each code, including a weight indicating depth of thought, to student responses.

All student responses were then read and coded in Dedoose for each important theme. Quantitative and qualitative analysis was made of student's opinions on:

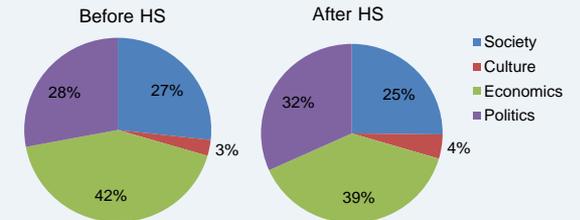
- 1) How this scenario compares to how countries have historically developed
- 2) The risks and benefits of the use of nanotechnology in this scenario
- 3) What constitutes a "human system"

Results

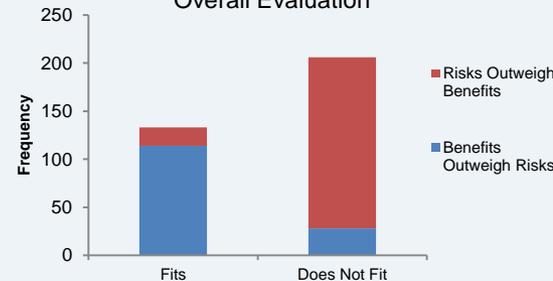
Does Scenario Fit with Historical Models of How Countries Develop?



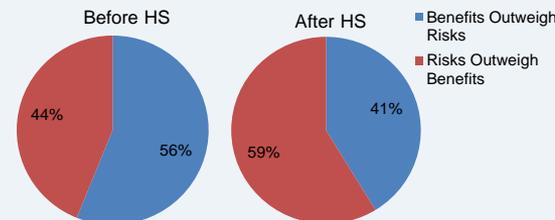
Frequency of Human Systems Themes in Evaluation of Company's Motivations



Coincidence of Historical Model with Overall Evaluation



Cost/Benefit Analysis of Scenario



Discussion

- Students exhibited dramatic changes of opinion with regard to the role of new technologies in historical models of development, and the overall cost/benefit analysis of the scenario.
- Student awareness of relative importance of various human systems did not change as a result of the class.
- Future areas of research may explore the effect of readings specific to NT, and the effects of different coursework.

References

1. Mitcham, Carl, et al. "Nanotechnology Ethics and Policy Education: Learning and Sharing Across Boundaries" *Journal of Nano Education*. Vol. 5, no. 2 (December 2013), forthcoming
2. "Road Construction Site." Photograph. *Development and Cooperation- Europeaid*. European Commission, 2012. Web. 24 Jul. 2013

Acknowledgements

I would like to acknowledge Dr. Jessica Rolston, Dr. Carl Mitcham, and Dr. Corinne Packard for their guidance and contributions. This work was funded by the National Science Foundation, grant EEC-1138257.

