

Chapter 26

WISE Preservice Teachers Discussing Social and Economic Disparities During a Discussion Game Dealing with Nanotechnologies

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Economics is a social science; complex economic phenomena can seldom be understood if presented in a vacuum, removed from their sociological, political, and historical contexts. To properly discuss economic policy, students should understand the broader social impacts and moral implications of economic decisions

(International Student Initiative for Pluralism in Economics, 2014).

From economics...

In September 2013, a book entitled *Le capital au XXI^e siècle* (Piketty, 2013) was published in France. An English translation under the title *Capital in the Twenty-First Century* came out approximately six months later. By June 2014, some 150,000 French copies and 400,000 English copies had been sold (Jaxel-Truer, 2014). This book presents a historical, empirical and comparative study of the rise in economic inequality. In addition to documenting the unequal distribution of wealth, Piketty aimed to identify modes of social organization, institutions and public policies that could lead to fairer democratic societies. Of particular interest for the purposes of this chapter, Piketty presents the dual notion that: 1) underlying the growing economic inequality is a history of the distribution of wealth which “has always been deeply political, and... cannot be reduced to purely economic mechanisms.” (p. 20); and, 2)

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the dynamics of inequality are “shaped by the way economic, social, and political actors view what is just and what is not, as well as by the relative power of those actors and the collective choices that result” (p. 20).

On May 5, 2014, one month after the publication of the English translation of Thomas Piketty’s book, twenty-two¹ associations of economics students signed an open letter calling for a renewal in ways in which economics is taught at university. The signatories, supported by over eighty economics researchers, professors and practitioners (including Thomas Piketty), denounced narrowing of curricula and called for greater pluralism in theoretical perspectives taught. The latter, they stated, should include neo-classically-based approaches as well as the post-Keynesian, institutional, ecological, feminist, Marxist and Austrian traditions, among others, and should address “the multi-dimensional challenges of the 21st century – from financial stability to food security and climate change” (International Student Initiative for Pluralism in Economics, 2014).

... To science education

Science education must not be blind to economic dimensions to which it contributes and by which it is influenced. This is the position expressed by the authors of the collective work entitled *Activist Science and Technology Education* (Bencze & Alsop, 2014), which points to needs for deep-rooted change, “tak[ing] more seriously wider social, political, economic and environmental contexts in which our practices reside and also seek to resist and influence” (Alsop & Bencze, 2014, p. 2).²

In this chapter, it will be seen that, in discussing development and commercialization of nanotechnologies in the context of a game aimed at encouraging socio-political discussion in the area of techno-science, the student participants brought up some of the economic aspects of the subject under discussion. More specifically, the participants referred to limited access to benefits of nanotechnologies, unequal distribution of their costs and benefits, risks of offshoring factories and exploiting child labour and development of medical treatments for profit. We begin the chapter with a presentation of the group discussion game, *Decide*, illustrating that it shares several democratic values with *STEPWISE*. We then briefly describe the socio-political context of the study. Next, we illustrate, through excerpts of the participants’ conversations, how these students expressed their views regarding some economic aspects of the controversy surrounding development and commercialization of nanotechnologies. We conclude by discussing contributions that *Decide* may bring to *STEPWISE*.

¹As of January, 2015, this number had risen to over 65 associations.

²Similarly, the authors of *Risky Business*, published in June, 2014, provide arguments for those who maintain that if science education aims to promote a nuanced and deeper understanding of socio-scientific problems, it cannot disregard the economic and political issues involved (Risky Business Project, 2014). In this report, influential authors Michael R. Bloomberg, Henry M. Paulson and Thomas F. Steyer strongly urge business leaders and investors to play an active role in public discussion (p. 47) and support an aggressive push to bring down carbon emissions.

26.1 Decide: A Game that Prompts Discussion on Inequality and Legitimizes These Discussions

Decide is a group discussion game that broadly shares STEPWISE orientations. First, Decide is distributed under a Creative Commons License (Attribution—Share Alike 3.0 Unported), which means that it is highly accessible and shared free of charge in an altruistic spirit. The user is granted several rights: the game can be copied and adapted as needed, provided that it is attributed to the author or licensor. It can also be distributed (in its original or adapted version), but only under the same license terms. Second, the game's instructions give the players a great deal of leeway, both in terms of the form the discussion will take and its content. For example, the players can focus on any particular aspect of the controversy that they consider to be essential, or exclude any aspect that they deem to be less important. Moreover, the game cards invite the players to consider, in the course of their reflection and discussions, the well-being of individuals, societies and environments. Lastly, not only does Decide invite players to discuss various issues that often are overlooked in science and technology education, but it also legitimizes these discussions. For example, there are game cards that explicitly ask questions relating to the uncertainties involved in the controversy under discussion, respect for human rights, pertinence of public engagement in these debates and in socio-political decision-making processes, costs and benefits associated with the development of new technologies, and different types of inequality (inter-generational; between rich and poor countries; between humans and non-humans).

The fact that it ends upstream of any concrete action is a criticism that can be levelled at uses of Decide as a pedagogical tool in the science classroom. In this sense, although it can fit into a STEPWISE approach and contribute to the achievement of STEPWISE goals, it does not, in itself, constitute such an approach because it does not aim to lead to action. In order for this pedagogical tool to draw closer to STEPWISE goals, it could, for example, be used as a starting point to help students identify significant issues underlying a controversy, pinpoint those that interest them in particular, and form an informed opinion about them.³ The students could then be asked to pursue their own investigations and engage in social action. It would also be possible for students who are already familiar with Decide to put together a game kit on a current or local socio-technical controversy that interests them and put it online, or organize sessions of the game with members of their community. In this case, the social

³It was based on this perspective that Romain Martiny developed a Decide game kit on the controversy surrounding the presence of metal dust in the central neighbourhoods of Quebec City (Martiny, 2015), which he then used in the chemistry classes that he taught in a pre-university college program. In addition to appropriating the controversy and learning about the socio-political and economic contexts surrounding it (Pouliot, 2015), the students were asked to give their opinion on actions that could be taken by the actors concerned. They were also invited to watch an excerpt from a television show addressing the issue of metal dust and take a stand on the nature of citizen expertise as well as the ins and outs of the economic arguments put forward by the Port of Québec.

action taken by the students would be to create a Decide game kit, make it available, and use it as tool to raise awareness of and foster citizen involvement in the controversy in question.

26.1.1 Goals and Rules of the Game

Decide is a group discussion game that aims to help players become more fully acquainted with current socio-technical controversies. Distributed free of charge by the FUND organization and accessible online in PDF format at www.play-decide.eu, Decide is based on the Democs group discussion game.⁴ However, it is not played online. It must be printed on paper or cardboard. While the recommended number of players is four to eight, we observed that sessions involving three or four players usually turned out to be the most productive and the most agreeable. Several versions of the game are available—in several different languages (e.g., French, English, Italian and Portuguese) and exploring various socio-technical controversies (e.g. orphan drugs, biomedical tests or climate change). At the time of writing, there were 32 kits available in English (see Appendix for a list).

Each game session involves four phases: a preparation phase and three in-game phases (information, discussion, and shared group response). The **preparation** phase involves preparing the material (printing up the kit and cutting out the cards) and consulting the rules of the game, which are simple and quite flexible. The first phase of the game itself (the **information** phase) lasts approximately 30 min. Essentially, the players learn about the controversy by reading four possible policy positions on the controversy, as well as cards explaining some of the issues involved. One set of cards, called the Story Cards, present the point of view or story of fictitious individuals, bringing out different aspects of the socio-technical controversy under discussion. These fictitious individuals might be business owners, researchers, religious leaders, etc. There are also Info Cards presenting definitions, statistics, current or future applications of the technology, etc. Lastly, the Issue Cards invite the players to think about various issues surrounding the controversy. These cards present thought-provoking questions, quotes and various points of view. The players read several of each of the types of cards and select those they consider to be the most significant, which they then summarize for their co-players. The second phase of the game invites the players to **discuss** the controversy (for approximately 30 min), either taking turns or choosing an open discussion format. If they wish, they can refer to the Story Cards, Info Cards and Issue Cards to back up their arguments. During the third and last phase of the game, the players try to **formulate a shared group response** (this phase lasts approximately 20 min). The players reread the four policy positions presented during the information phase and can add others as they see fit.

⁴Democs was created by the New Economics Foundation (NEF) and aims to foster discussion on public policies.

They then vote individually on all four policies. Lastly, they negotiate and attempt to find some common ground, without necessarily having to reach a consensus. It is possible to upload the results of the game session on the Decide web site.

26.2 Socio-political Context of the Study

The discursive interactions presented below were produced as part of Audrey Groleau's doctoral research, conducted at Université Laval under the supervision of Chantal Pouliot. These interactions were recorded during two play sessions of the group discussion game Decide, focusing on controversies surrounding development and commercialization of nanotechnologies. Each session took place in French and involved three to four participants,⁵ all of whom were planning to become teachers, were in their last term of a pre-university college program and were enrolled in a sociology of science course.

The empirical component of this study was undertaken in spring 2012 during a major student strike protesting an increase in tuition fees that had been announced by the provincial government. The strike mainly called for a more equitable distribution of wealth among individuals and between generations. In other words, as pointed out by André Drainville (2013) and André Frappier, Richard Poulin and Bernard Rioux (2012), it represented a resistance movement against the neoliberal economic system in place. These events coloured discussions of one of the teams of participants, who referred to this situation when backing up their opinions during the game.⁶

26.3 The Participants Discussed the Controversy Surrounding Nanotechnologies in Economic Terms

Using Decide in the classroom creates an opportunity to discuss, among other possible subjects, the controversy surrounding development and commercialization of nanotechnologies and to explore the various issues involved, including economic issues. In the play sessions discussed here, the students brought up the disparities between the rich and poor. In particular, they shared their views on the offshoring of factories, the exploitation of child labour, the priority given the well-being of Western societies over the common good of all, and profitability.⁷

⁵For a total of 7 participants: 6 female students, 1 male student; 5 participants planned to become elementary school teachers, 1 a phys. ed. teacher, and 1 did not specify the teaching level or discipline.

⁶The excerpts in question are not presented in this chapter. It should, however, be noted that they referred to the ability or inability of citizens to become involved in controversies that concern them.

⁷It should be noted that some of these issues are not addressed in the game kit.

26.3.1 *Limited Access to Products and Services Allowing Individuals to Benefit from Nanotechnologies*

In the following excerpt, the members of the team expressed their views on the possible application of nanotechnologies aimed at reversing, or at least slowing down, the aging process among humans. They predicted that only wealthy individuals would likely benefit from access to this application. They associated this privilege with a form of discrimination that would lead to a widening in the wealth gap between individuals and between the populations of different socio-political regions.

- Rosalie*⁸: *Yeah, well, that [the nanotechnology application making it possible to slow down the aging process] is going to lead to discrimination. Because, like it said in here [in my cards], it's going to be really expensive.*
- Charlotte*: *True.*
- Rosalie*: *It's not going to cost ten dollars to make yourself younger. Plastic surgery is already really expensive.*
- Alice*: *It's going to cost a [inaudible].*
- Charlotte*: *Just imagine! Having yourself made younger, it's going to cost an arm and a leg!*
- Rosalie*: *Yeah, only rich people will be able to afford it.*
- Charlotte*: *Super rich and powerful men, they're the ones who're going to have themselves made younger.*⁹
- Alice*: *And that's going to widen the gap between the rich and poor and between countries too.*
- Rosalie*: *Right.*
- Alice*: *Not every country is going to have ...It's going to be more common in the West. In the East, you won't see much of that.*
- Charlotte*: *True.*

26.3.2 *Unequal Distribution of the Costs and Benefits*

Later on in the discussion, the members of the same team referred again to the idea that inequalities between the populations of various socio-political regions¹⁰ could become more pronounced as a result of development and commercialization of nanotechnologies. Xavier mentioned the unequal distribution of the social, economic and medical costs and benefits associated with development of these technologies. In other words, the following excerpt expresses the view that the development and commercialization of nanotechnologies will take place to the detriment of the populations in Southern countries.

⁸These excerpts have been modified slightly for readability. The names of the participants have been changed to preserve their anonymity.

⁹Although it was not the aim of this chapter to address the way the participants described the individuals that would have access to the benefits of nanotechnologies, Charlotte's comment appears significant as she associates wealth, power and masculinity with the elite who would benefit from nanotechnologies.

¹⁰Here, it is a question of opposition between the countries of the North and South rather than between the East and West.

- Xavier: *Nanotechnologies are going to be exclusively available to a certain population.*
- Alice: *Yeah.*
- Xavier: *Probably the people in the North, you know, the people in the South aren't going to benefit from them. In fact, they'll probably be the ones to pay for them – they'll pay with their labour and also, I don't know, maybe it's going to be discovered that, to produce nanoparticles, you need a particular mineral that's really rare.*
- Alice: *Yeah.*
- Xavier: *And this mineral will only be found in mines in the South. So you'll have firms that go there specifically to exploit platinum or whatever, and it might be really rare. We don't really know. But I think there's a risk that the gap between the rich and poor will just get wider.*
- Rosalie: *For sure.*
- Xavier: *...in a really big way, I mean, in terms of who gets priority and who gets the rights*
- Alice: *Yeah.*
- Xavier: *Some people will get the rights. So there will be more than just a wealth gap, there will be a gap in terms of who gets the exclusive rights.*
- Alice: *That's true.*
- Xavier: *So **this person** here will be able to live well, you know, have access to a particular treatment – **this** person will benefit from it, but **that** person won't.*
- Alice: *This person will benefit but others won't.*

26.3.3 *The Risk of Offshoring Factories and Exploiting Child Labour*

Decide consists of cards containing questions that aim to launch a conversation about specific issues related to a given controversy. The next excerpt corresponds to the following questions: “Could nanotechnology widen the poverty gap? Might strict regulations in the West cause manufacturers to move to poorer countries, forcing people there to deal with hazards that are prohibited here?” The members of the second team argued that development and commercialization of nanotechnologies could lead to the offshoring of factories. They drew parallels between nanotechnologies and the textile industry, which has set up factories in Asia. They referred to the fact that the cost of labour is lower in Asia and also denounced the fact that children are made to work there.

- Florence: *For sure, it's always like that. I'm a little pessimistic, that's just how I am, but I think humans are sort of screwed up. I'm sure that if regulations are put in place here that aren't put in place in other countries...*
- Olivia: *They're going to go...*
- Florence: *...well, it's going to lead to the same thing, they're going to leave, like they do now, say, if they aren't allowed to exploit, you know, when they make jeans, for example.*
- Olivia: *Yeah, they're not allowed.*
- Florence: *So they go into companies, say, in India, and it costs them...*
- Emma: *Yeah.*
- Florence: *...almost nothing in labour. They go there to exploit young children and then they come here and sell us their jeans at crazy prices and line their pockets with the profit.*
- Emma: *True.*

26.3.4 *Development of Medical Treatments for Profit*

Emma, Olivia and Florence referred twice to the idea that economic profitability is one of the main criteria when it comes to choosing which medical treatments will be developed by the pharmaceutical industry. In one of these excerpts,¹¹ the participants compared two different diseases, one that mainly afflicts rich populations, namely cancer, and another, AIDS, which mainly afflicts less economically privileged populations. They predicted that, while considerable effort will be made to find a cure for cancer, the same will not be true when it comes to finding a cure for AIDS.

Olivia: Well, it's true that we'll find a cure for cancer, but we won't find a cure for AIDS. Because that won't give us anything. It's the children in Africa who have AIDS and we could care less about them.¹² We want to benefit. We want to make a profit so we're going to find a cure for cancer. The people who can afford it will pay, so...

Florence: Yeah, exactly.

26.4 **Concluding Remarks**

In this chapter, we set out to demonstrate that Decide is coherent with an approach based on STEPWISE as it provides the opportunity to address the well-being of individuals, societies and environments. To this end, we examined excerpts of conversations on socio-economic themes in which the participants were critical of certain issues relating to the development and commercialization of nanotechnologies. In particular, the participants discussed the limited access to products and services allowing individuals to benefit from nanotechnologies, the unequal distribution of the costs and benefits of these technologies, the risk of offshoring factories and exploiting child labour, and the development of medical treatments for profit. One of the pertinent contributions of Decide with regard to the philosophical and pedagogical aims of STEPWISE certainly lies in opportunities it provides participants to discuss development of techno-science while considering, in the words of Larry Bencze and Lyn Carter (2011), that “[w]ealth and wellbeing are funneled towards traditional elites, typically at the expense of the vast majority of other people and to the detriment of living and non-living environments” (p. 650).¹³ Because it allows

¹¹ The other excerpt is not presented in this chapter.

¹² It was observed that Olivia takes on the voice of the people who will benefit financially from the production of these treatments (Potter (1996, p. 160–162) refers to this process as “Active voicing”).

¹³ The participants discussed the effects of the development of nanotechnologies on humans and non-humans. For example, one participant said, “*Who benefits from the use [of nanotechnologies]? I think it should be everyone, animals as well as people. I don't think it should be restricted to any one group in particular. [...] Yeah, if we want to avoid the situation where some species go extinct because of them, well, I think everyone should be able to benefit*” (Emma). The fact that the participants dis-

de-punctualization of nanotechnologies (Callon, 1991), namely the identification of actor-networks that interact, Decide can be mobilized during the Teacher Teaches phase of the STEPWISE apprenticeship.

It is not common practice to investigate socio-technical controversies in science classrooms by examining economic systems of which they are part. However, in the current period, which Pierce (2013) refers to as the postgenomic era (p. 111), marked by the unequal distribution of wealth (Piketty, 2013) and social and environmental effects of neoliberalism, addressing these concerns in science education has become imperative.

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Appendix: List of Themes Addressed in the Decide Game Kits Available in English

1. Ambient assisted living
2. Animal testing in biomedical research
3. Blood pressure
4. Climate change (3 versions)
5. Cross border health care
6. Diagnosis, information to the patient, genetic counselling
7. Digital world (2 versions)
8. Energy and sustainability
9. Environmental ethics
10. eTRIKS: The value of medical research data and its reuse
11. Global migrations
12. Health technologies: scoping the ‘value of innovation’
13. Healthy diet and lifestyle
14. HIV/AIDS and legal responsibility
15. Human enhancement
16. Integrating community care and medical care
17. Malaria
18. Nanotechnology
19. Neonatal screening
20. Neuro-Enhancement
21. Neuroscience – “brain enhancements”

cussed these effects of nanotechnologies is coherent with Pierce’s view (p. 112) that science education should lead to more democratic relations between humans and non-humans. This conversation also illustrates that Decide can lead participants to consider not only the well-being of individuals and societies but also that of environments (animals or biodiversity).

22. Orphan drugs
23. Patient-team relationships
24. Preimplantation genetic diagnosis (PGD)
25. Science camps
26. Smart cities
27. Stem cells
28. Structuring of healthcare among regions
29. Sustainable use of forests
30. Tuberculosis in Moldova and Romania
31. Xenotransplantation
32. Young people and the media

References

- Alsop, S., & Bencze, L. (2014). Activism! Toward a more radical science and technology education. In L. Bencze & S. Alsop (Eds.), *Activist science and technology education* (pp. 1–19). Dordrecht: Springer.
- Bencze, L., & Alsop, S. (Eds.). (2014). *Activist science and technology education*. Dordrecht: Springer.
- Bencze, L., & Carter, L. (2011). Globalizing students acting for the common good. *Journal of Research in Science Teaching*, 48(6), 648–669. doi:10.1002/tea.20419.
- Callon, M. (1991). Techno-economic networks and irreversibility. In J. Law (Ed.), *A sociology of monsters: Essays on power, technology and domination*. London: Routledge.
- Drainville, A. C. (2013). Present in the world economy: Quebec's students in the springtime. *Globalizations*, 10(6), 785–801. doi:10.1080/14747731.2013.814454.
- Frappier, A., Poulin, R., & Rioux, B. (2012). *Le printemps des carrés rouges: lutte étudiante, crise sociale, loi liberticide et démocratie de la rue* (p. 159). Mont-Royal: M éditeur.
- International Student Initiative for Pluralism in Economics. (2014). *An international student call for pluralism in economics*. Retrieved from <http://www.isipe.net/open-letter/>
- Jaxel-Truer, P. (2014, June 28). Thomas Piketty: Pourquoi ses courbes affolent la planète? M. *Le Magazine Du Monde*, 27–33.
- Martiny, R. (2015). *Création d'un jeu de discussion à propos de la controverse autour des impacts sanitaires et environnementaux des activités portuaires de transbordements de minerais*. Unpublished Master's dissertation, Université Laval, Québec.
- Pierce, C. (2013). *Education in the age of biocapitalism: Optimizing educational life for a flat world*. New York: Palgrave MacMillan.
- Piketty, T. (2013). *Le capital au XXIe siècle*. Paris: Éditions du Seuil.
- Potter, J. (1996). *Representing reality: Discourse, rhetoric and social construction*. London/Thousand Oaks: Sage.
- Pouliot, C. (2015). *Quand les citoyen.ne.s soulèvent la poussière: La controverse autour de la poussière métallique à Limoilou*. Montréal: Carte blanche.
- Risky Business Project. (2014). *Risky business: The economic risks of climate change in the United States*. Retrieved from http://riskybusiness.org/uploads/files/RiskyBusiness_PrintedReport_FINAL_WEB_OPTIMIZED.pdf