STEPWISE Topic Ideas

Humans face many social and environmental challenges. There is, for example, significant worldwide poverty and forms of environmental degradation threatening survival of many of Earth's species. 'STEPWISE,' which stands for 'Science and Technology Education Promoting Wellbeing for Individuals, Societies & Environments,' is intended to address such problems. A fundamental question students are asked to consider is: 'In what ways might you use ('spend') your literacy (a form of 'capital' or wealth) in science and technology for the betterment of other people and living and non-living things?' For students to be able to address personal, social and environmental problems, they first need a broad and deep kind of science education; but, at the same time, they need to practise using it in positive ways for 'people and the planet'; i.e., through WISE Activism activities. This page provides examples of possible STEPWISE topics for teachers (and students). To learn more about STEPWISE, visit: http://www.stepwiser.ca/

WISE Activism

Students need to be encouraged to take action(s) that might improve the wellbeing of individuals, societies & environments. Ideally, students would take personal positive actions and, as well, encourage others to do so. For example, students could:

- switch to re-usable containers (e.g., metal water bottles) for lunches and drinks.
- encourage school students to eat nutritionally sound food (vs. pop & fries, etc.) at school.
- educate people (e.g., teachers, students & community members) about possible dependency effects of various inventions/innovations (e.g., cell phones).
- promote programmes for educating disadvantaged students and members of the public regarding various topics in science and technology and, as well, encourage them to use this education for others.
- encourage politicians to facilitate more bicycle use in cities.
- encourage school administrative personnel to reduce the school's ecological footprint (through both reduced material and energy use).
  - encourage school administrative personnel to implement a strategy for creation of a more natural play/exploration environment surrounding the school - as opposed to one oriented towards competition & environmental compromise.
  - encourage corporate leaders to stop production/consumption of harmful products.

STSE/NoST Education

Students need to learn about characteristics ('nature') of fields of science & technology and about positive and negative relationships between them and societies and environments - such as

- how the profit motive has, apparently, been leading scientists to compromise some of the ideals commonly associated with practices in the sciences; such as preventing research into tropical diseases because people who would benefit from treatments cannot afford to pay for them.
- hazardous side-effects of drugs that companies have been aware existed, but have not disclosed.
- possible causes and effects of Climate Change.
- ideas, with examples, of how various forms of technology perhaps overly guide people in how to think and act; e.g., in communicating less directly with people because of email availability.
- the extent and nature of release of chemical substances (e.g., dioxin) into aquatic environments by industries.
- possible harmful effects of X-radiation on the health of living organisms.
- possible harmful effects of automation on control of labour and distribution of wealth.
- how gender, cultural and racial differences can sometimes limit people's participation in science.

Students' Projects

Students need opportunities in school contexts to conduct science and technology projects for which they control topics & methods (SD) and conclusions (OE). Such projects allow students to self-determine their thoughts and actions and, as well, results from such projects can be used to inform WISE Activism. Students could, for instance, conduct projects that:

- determine effects of environmental toxins (e.g., residue from plastic bottles) on cell health; and, then, make recommendations for addressing concerns.
- develop and field-test devices for safely breathing polluted city air.
- determine the extent to which various sources of household/community electromagnetic radiation harm cells.
- determine effects of noise from popular electronic devices on teenagers' hearing;
- develop an efficient organic waste system for their school.
- determine effects of various smog levels on plant health.
- develop a more natural play/exploration environment surrounding a school - as opposed to one oriented towards competition & environmental compromise.
- determine the extent and possible causes of poverty among the school's student population.
- develop sporting equipment that use less energy to produce, are less likely to break, and work well.
- determine the nutritional level of student lunches over time, perhaps related to WISE Activism.

STSE/NoST Education · WISE Activism · Students' Projects · Skills Education · Products Education

Skills Education

Students need an 'apprenticeship' aimed at helping them to develop 'skills' (e.g., techniques, attitudes, strategies) that might assist them in, eventually, conducting student-directed & open-ended (SD/OE) science inquiry and/or technology projects (*Students' Projects*). Teachers could, for instance, engage students in activities (using contexts/topics having some connection to social justice and/or environmental sustainability) that help them to develop expertise for:

- causal question-asking - using, for example, sets of possible 'cause' (independent) & 'result' (dependent) variables and a template (with examples) for cause-result questioning.
- development of controlled experiments and correlational studies using, for example, sets of possible cause & result variables and relevant materials and after conducting similar inquiries in a more guided way with similar variable lists and possible guidelines for effective inquiry development & evaluation.
- development of socially- and environmentally-sustainable inventions/innovations through, for example, practising invention/innovation challenges using 'found' materials (e.g., packaging, plant fibres, etc.); again, after having the teacher model such innovation/invention with similar materials.
- effective and prudent argumentation (e.g., with support and contradictions to claims) through, for instance, being engaged in debates regarding class members' divergent conclusions from similar inquiries; again, after having the teacher model and analyze the nature of such debates.

Products Education

Students need to develop useful understanding of some key 'products' (e.g., laws, theories & inventions) developed by science and technology. [Note that this outcome could dominate the others and, so, educators need to decide which 'products' are *essential* to teach.] Students could, for example, learn:

- functions of electromagnetism in order to investigate its effects on living cells (e.g., cells in culture). Later, they might make recommendations for protection of cells against electromagnetic sources. [Note that the investigations would be part of *Students' Projects*.]
- about musculo-skeletal structure and function, with the view to making recommendations for protection against sports injuries.
- about pharmaceutical function, with the view towards later investigating possible adverse side-effects.
- how simple and complex machines function, with the view towards using this expertise for developing devices that enable people with physical disabilities to thrive.
- causes of various diseases, such as AIDS, with the view to educating people how to avoid or cure them.

J. L. Bencze, 2008