

Activity name: Environmental Risk– What Do You Do With Your Old Computers?

Goals

- to build students' knowledge and skills about releases of polluting materials into the environment
- to apply knowledge and skill in the community context.

Activity	Objectives
What Do You Do With Your Old Computers?	<ul style="list-style-type: none"> • Research hazards resulting from obsolete electronic equipment • Evaluate information resulting from research • Determine possible solutions for the problem

Appropriate for which course(s)? : Grades 9 - 14 environmental science, industrial technology, computer science, health, marketing, economics, biology, and chemistry.

Lesson time: 3 - 5 days.

Contextual learning characteristics: Problem based, diversity, interdependent workgroups, and self-regulated, authentic assessment.

Introduction:

The number of obsolete computers and electronic equipment continues to rise due to increased demand for better and faster equipment. Computers as well as other electronic equipment contain toxic chemicals such as lead, mercury, and cadmium that can be released as a result of breakage. The focus of this activity is to get students to think critically as to what should be done with the computers in their school.

Ideally this activity could be done with a team of teachers of different disciplines. However, reality makes it such that it could be done with just two teachers or in a single classroom with a single teacher. The idea is NOT to set parameters so it could be as extensive (or not) as the instructor was comfortable with.

Objectives: Reference core outcomes at <http://www.ateec.org/curric/core.cfm>

Materials:

Internet access is best, although it is possible to do this with an adequately equipped library. Access to a telephone is helpful. Last, but not less important, is the ability to have a room or same area where groups can work together for an extended period of time.

Preparation:

Some instructors may want to have a predetermined list of computer disposal sites, the name of the local solid waste area, lead contamination sites and procedures, medical texts, OSHA and HazMat reference guides, and EPA guidelines (see resources below). However, locating references could easily be the job of students.

Teacher Activities (based on the steps of risk assessment):

Hazard Identification: Propose that the class has been tasked with handling the problem of ridding the school district of 17,000 outdated computers. Would it be better to just send them to the local solid waste center? And if that is so, what are the environmental implications of this? Or should some other means of dispersal/disposal be used.

Dose Response: Students would then be placed in groups to research various aspects of the problem. Research could be individual or group based. Some possible topics would include addressing:

- possible hazardous computer parts and the amount a computer may contain.
- medical implications of lead, mercury, and cadmium poisoning.
- different disposal options.
- HAZMAT procedures for handling lead, mercury, and cadmium.
- hazards to environment and possible local impact.
- the cost of disposal.
- possible ways to make money in disposing of the computers
- public relations concerns regarding the disposal of computers that are perceived to still be useful.
- marketing techniques/options to aid in recovery of spent money.

These groups can be combined or they could be assigned in graduating order so that those things best left to the end of the project, such as marketing, could be done by a group after other decisions have been made. If the class decides to dump them all in a local river then marketing is not needed. However, if the group decided to try and have a school or district computer sale then the marketing could be done by all groups at the end of the project, perhaps as a kind of competition. Another option is to have each group do all of the researching and then have some type of competition (debate) as to what group has the best idea. The end hope is to have students decide to recycle the computer parts.

Exposure Assessment: Lead is by far the most abundant of the hazardous materials found in computers (6.5% of total weight). However, disposal is only environmentally dangerous if the computer contains lead phosphate, which can leach into the soil and is a listed hazard that would be illegal to put in landfills. Lead itself is not water-soluble and would not pose any real hazard. If the monitors were being broken and lead dust was released some way then that would pose an environmental hazard to the person doing the disassembling. Students should call the local landfill to find out the accepted practices for getting rid of a huge amount of computers. Staff suggested that acceptable limits of

lead phosphate leaching would not exceed 5 mg/l of runoff. The same source stated that acceptable lead exposure limits of humans (based on being a pregnant woman) would be no greater than 15 micrograms/dl.

Risk Characterization: The end objective is for students to make an informed value judgment about what should be done with the old computers using the scientific information they have gathered.

Groups will work on completing assigned objectives in their area of research. The optimal idea would be to involve other classes so that a science class could be involved in the numerous environmental impacts this may have. Again, reality dictates that most classes will not have this luxury. In light of this, groups should be fluid and may be differently established after one objective is completed.

Authentic Assessment:

Several assessment types would be involved. One would be daily participation by individuals. Also, the information obtained by individuals could be assessed by the use of a rubric or by other group members themselves. Groups could be evaluated on the basis of how thorough and accurate their research was and how well it was presented in oral or written form. Ideally this information could be given to the operations director of a school district for real information.

Presentations or proposals could be made directly to the building principal. Minimally, ideas and marketing techniques could be presented to others members of the same class. Display boards may be appropriate as well. The hope of the project is that students will come to the realization that computers do contain hazardous materials, BUT these materials can be recycled.

Related Activities:

This same format could be used to determine how safe (or unsafe) the uses of cellular phones are. The **Risk** is using cell phones every day. The **Dose Response** would be how EM waves can affect human health. How strong are the EM waves emitted by the antenna? **Exposure Assessment** would be investigating the effects of using EM devices close to your head for extended periods of time. How long is to long? **Risk Assessment** would be deciding how safe it is to use cell phones. What are the implications? Should use be limited to some time factor?

Some useful sites to research:

- <http://www.mcw.edu/gcrc/cop/cell-phone-FAQ/toc.html>
- http://massis.lcs.mit.edu/telecom-archives/TELECOM_Digest_Online
- <http://www.zianet.com/mvrc/moulder.html>
- <http://www.electric-words.com/moulder/moulder.html>
- http://www.hyperactive.lcs.mit.edu/telecom-archives/TELECOM_Digest_Online

ATEEC Activities for Real-Life Applications

- <http://www.iago.lib.mcw.edu/gcrc/cop/cell-phone-health-FAQ/toc.html>
- <http://www.amta.org.au/issues/faq.html>
- <http://www.baltzer.nl/winet/contents/3-6.html>
- <http://www.control.com/alist/archive/msg03233.html>

The same risk assessment strategy could be used to determine what to do with disposal of florescent light bulbs, batteries in school, waste products from auto mechanics, etc.

Related Standards:

Reference NSTA National Standards and Science Benchmarks Project 2061.

<http://books.nap.edu/books/0309053269/html/index.html>

Resources for More Information:

- <http://kerr.arborlink.com/computers/recycle.html>
- <http://www.avnetcomputer.com>
- <http://www.fcballast.com>
- <http://www.rochestercomputer.com>
- <http://www.hud.gov/lea/leastand.html>
- <http://www.yale.edu/ynhti/curriculum/units/1997/7/97.07.05.x.html>
- <http://www.greenbiz.com/gbl/editions/07gbl98/feature.cfm>

Student Activity Sheet

List the possible hazards in computers that your group found:

Which hazard is most likely to cause environmental problems? Why?

What is the risk in putting multiple computers in landfills? How could this affect the environment and the health of those around that area?

ATEEC Activities for Real-Life Applications

What are some alternatives to putting the computers in landfills? Why are these alternatives better?

Design a marketing technique for your alternative idea. Make a display board showing the potential hazards of putting multiple computers in a landfill, health and environmental hazards related to computers in a landfill, and your company's idea for what to do with them. Include at least two real sources (landfill operator, HAZMAT instructor, OSHA personnel etc.) that helped you in your decision. Also, any web addresses used should be mentioned. Be sure to have a synopsis of what led your group to the decision you made and why your idea will work.

Activity submitted by Mike Shupe

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