



How Much E-Waste?

E-Cycle Wisconsin Activity

Summary: *Students use multiplication, division and averages to estimate the amount of e-waste in their own communities and learn about electronics recycling opportunities.*

Audience: Grades 6-8

Subjects: **Environmental Studies; Math** (Common Core Standards in Ratios and Proportional Relationship; Statistics and Probability)

Time: 15-minute introduction followed by one 45-minute class period

Supplies: Copies of “How many electronics?” handout – one per student; copies of “Class Results” worksheet – one per student or student team; whiteboard/chalkboard and markers or chalk

Background

The number of electronics we own and subsequently dispose of is huge. Electronics are one of the fastest growing parts of the waste stream. According to the U.S. Environmental Protection Agency, there were 384 million electronics ready for disposal in 2010. Each year we add to that tally. Technology is changing at a rapid pace, driving consumers to want the newest, fastest, lightest products – and leading us to dispose of still-functional devices in order to purchase new ones. Electronics contain both valuable and toxic materials, making it very important to recycle them at the end of their lives. In fact, electronics recycling is the law in Wisconsin.

This activity will help your students grasp how many electronics people accumulate, how that can lead to large amounts of e-waste and how choosing to re-use or recycle electronics can help the environment– all while practicing math skills.

Warm up (done in a class period at least one day before the main activity)

Have students think about the role electronics play in their lives. What types of electronic products do they have in their homes? What do they use them for? Are there any electronic items that they use every day? Have they ever thought about what happens to those electronics when they are done with them? Can students think of any reasons why these items should not go in the trash? (Reusable metals, plastics, glass; valuable precious metals; toxic materials that should not go into landfills; wasted water, energy and labor when new materials have to be mined/refined/processed; it's illegal in Wisconsin).

Hand out the electronics tally chart and ask students to predict:

- How many electronics (based on this list) they each have in their homes - have them consider both working and non-working items.
- Which electronic device they have the most of in their home.

Use individual predictions to come up with an estimated guess of the total number of electronics your class' households. Which electronic item will students have the highest total number of and which device will come in lowest?

Have students fill the tally sheets out at home. Remind them to look in closets, basements and attics for items not currently in use. Also, let them know this is not a competition to see who has the most. In fact, the fewer electronics a student has, the better it is for the environment.

Activity

Ask students to pull out their completed tally sheets. Did anyone accurately predict the number of electronics in his/her home? Are there any electronic items that everyone had? Was anyone surprised by what they found?

1. Hand out the “Class Results” worksheet. If using teams, divide the students into teams. Draw a chart on the board based on the “How many electronics” chart in the student handout. Tally up the class totals for each item and put them in the chart. Have students or teams use proportions to determine percentages for each device. The worksheet will serve as a guide for this activity. (You may need to discuss how to do this as a group.) Once

If you think you will have students who are sensitive about the number of electronics in their households, choose your method for tallying results carefully.

percentages are calculated, work together to create a pie chart on the board that shows the relationship of each electronic item to the total class tally (for example, 25% of the total are TVs, 30% are cell phones, etc.). How does this match up with students’ individual percentages? Are the class tallies and the student tallies proportional? Do the percentages make sense based on what we use in our daily lives?

2. Working as teams or individually, have students return their attention to their worksheets. For each electronic item, have students calculate the average number of that device per household (for example, 1.7 TVs per student household). Using the per-household averages you found in your class, have students estimate how many of each device there might be in your community. To do this, you need to know that the average number of people per household in Wisconsin according to the 2010 Census is 2.4. (Take your community’s population, divide it by 2.4 to get the estimated number of households in your community and then multiply it by the average number of TVs per household you found.) Do the same for each electronic item on the list. You can compare your community with the Wisconsin state numbers by viewing the table below.

How many electronics in Wisconsin?

Device	Avg. per household	Total	Total unused
TVs	3.47	8.2 million	1.7 million (21%)
Computers	2.48	5.9 million	1.8 million (31%)
Cell phones	3.21	7.6 million	3.3 million (44%)

Results from E-Cycle Wisconsin 2013 Household Survey

3. Next, ask students to consider how many of these electronics are **not being used** (perhaps they are broken or the household got a newer model) and may be ready for disposal. For each electronic item, have students calculate the average number of **unused** devices per student household (for example, 0.3 TVs per student household). Using the per-household average you found in your class, try to calculate

how many of each unused device there might be in your community. (Take your community's population, divide it by 2.4 to get the estimated number of households in your community and then multiply it by the average number of unused TVs per household you found.) Do the same for each electronic item on the list. Tally up the total number of unused devices there might be in your community.

4. Have students estimate what portion of unused electronics is recycled in the United States by drawing a representative pie slice on the circle on their worksheets. According to the U.S. Environmental Protection Agency, only 25 percent of electronic waste is recycled in the United States. Have students calculate how many items that would mean within their personal tallies of unused electronics and how many items that would be in the class and community tallies of unused electronics.

Conclusion

In 2013, a survey of Wisconsin households found that between 35 and 50 percent of devices (depending on the device) are recycled at the end of their lives. Many more are donated or given to family or friends. In other words, our state is setting a good example of what to do with old electronics. But we can always do more. And there is good reason to do so: recycling electronics saves huge amounts of energy, water and labor by avoiding the mining of new materials and reducing the amount of processing needed to make materials ready for use. Recycling 1 million cell phones, for example, yields 50 pounds of gold, 550 pounds of silver and 20,000 pounds of copper but no overburden (the rock, sand and dirt covering the desired material), tailings or toxic by-products. More than 90 percent of the materials in our e-waste can be used to make new products – in many cases, new electronics.

What can students do to make sure that more of their own items are recycled or reused when they are done with them?

Assessment

Have students turn in their worksheets along with a one-paragraph summary of how their results from this activity might be biased. Would we receive the same results in a different part of the state? With a different classroom? What do averages hide and what do they reveal?

Further study

Have students interview family and friends to find out what they have done with old electronics recently and why they chose the method of disposal that they did. Have students research the recycling options in your community. The Wisconsin DNR website has a search function for people to find local electronics collection sites that are registered with E-Cycle Wisconsin. Go to dnr.wi.gov and search "ecycle" to find this list.

Using the information they gathered in interviews and online, have students create targeted posters to inform their classmates about the growing e-waste problem and local recycling solutions.

Resources

U.S. Environmental Protection Agency 2010 Municipal Solid Waste Facts and Figures:

http://www.epa.gov/osw/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf

Electronics Takeback Coalition, "Facts and Figures on E-Waste and Recycling" June 2014:

http://www.electronicstakeback.com/wp-content/uploads/Facts_and_Figures_on_EWaste_and_Recycling.pdf

E-Cycle Wisconsin, dnr.wi.gov search "ecycle"

Keepin' It In the Loop Recycling and Activity Guide, Wisconsin DNR

<http://dnr.wi.gov/org/caer/ce/eeek/teacher/recyclingstudyguide.htm>

Activity based on "Where does it all end up?" Keepin' It in the Loop: Wisconsin Department of Natural Resources. Pub WA-1526 2011. Pgs. 34-35.



Wisconsin Department of Natural Resources
Bureau of Waste and Materials Management
PO Box 7921, Madison, WI 53707-7921
(608) 266-2111 DNRWae-cycling@wisconsin.gov

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How Many Electronics?

Use this chart to help count how many of each item are in your home. Remember to check the basement, closets and attic for items no longer in use. Include things that are working (in use) and things that are broken or old (not in use). Write the total number in each box.

Device	Number In Use	Number Not in Use	Total Number
TV			
Cell phone			
Computer (Laptop and Desktop)			
Tablet/E-Reader			
Printer			
Mp3 player/iPod			
Total Number of Electronics in Your Home (add all totals above):			

What percentage of each electronic device do you have in your home? For example, if you have a total of 10 electronics in your home and 2 of the electronics are TVs, then TVs make up 20% of your electronics. Use the totals above to calculate each device's percentage. The percentages of all devices should add up to 100%.

TVs	Cell phones	Computers	Tablets/E-readers	Printers	Mp3/iPod	TOTAL
						100%

Class Results for "How Much E-Waste?"

Device TOTALS:

TVs	Cell phones	Computers	Tablets/ E-readers	Printers	Mp3/iPod	TOTAL Devices

Class percentages: Calculate proportions for each device based on the class totals, just as you did with your individual totals earlier. Put your results below.

TVs	Cell phones	Computers	Tablets/ E-readers	Printers	Mp3/iPod	TOTAL
						100%

Class averages: Using the class totals, calculate the average number of devices per household. Put your results below.

TVs	Cell phones	Computers	Tablets/ E-readers	Printers	Mp3/iPods

Community totals: Calculate an estimate for the total number of each device in your community's households using the formula below. Put your results in the boxes.

Community population: _____ / 2.4 = _____ households
Multiply the average number of each device in your class by the number above.

TVs	Cell phones	Computers	Tablets/ E-readers	Printers	Mp3/iPod	TOTAL

Unused devices: Calculate the average number of unused devices per student household. Use that number to estimate how many unused devices are in your community.

Class unused device TOTALS:

TVs	Cell phones	Computers	Tablets/ E-readers	Printers	Mp3/iPod	TOTAL

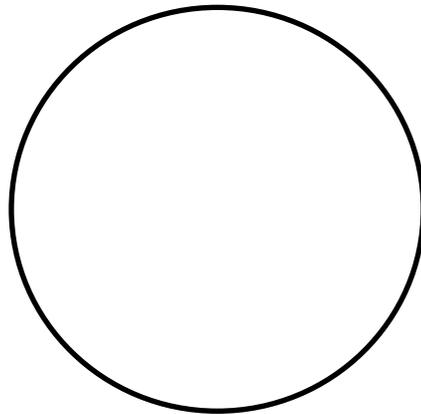
Class unused device AVERAGES:

TVs	Cell phones	Computers	Tablets/ E-readers	Printers	Mp3/iPods

Community unused device ESTIMATES:

TVs	Cell phones	Computers	Tablets/ E-readers	Printers	Mp3/iPod	TOTAL

If the circle below represents all of the unused devices in the United States, what portion do you think will be recycled? Draw a pie slice representing how much of the circle you think will be recycled.



Using the U.S EPA’s estimate on recycling, how many of **YOUR** unused electronics are likely to be recycled?

Using the U.S. EPA’s estimate on recycling, how many electronics are likely to be recycled in your community?

What are your thoughts on how to raise the number of electronics people recycle?

Teacher Review of Activity (for prizes!)

Fill in this form and email it to DNRWAe-cycling@wisconsin.gov or mail it to E-Cycle Wisconsin WA/5, 101 S. Webster St, Madison, WI 53703 to receive prizes for your classroom.

Number of students in your class: _____

Total number of electronics in your class' households: _____

Breakdown of classroom device proportions:

TVs	Cell phones	Computers	Tablets/ E-readers	Printers	Mp3/iPod	TOTAL
						100%

How did your students propose to increase the rate of electronics recycling?

Please provide recommendations to improve this activity:

Thank you!

E-Cycle Wisconsin team