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The CTE Journal

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Sponsored by Indiana ACTE

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An International Peer Reviewed Career and Technical Education Online Journal

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Editor: James Smallwood, Ph.D. Professor, Applied Engineering & Technology Management Indiana State University

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This is a double blind, external peer reviewed, fee-based international journal sponsored by Indiana ACTE. The scope of the journal is limited to topics related to career and technical education or improving the practice of teaching.

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Indianapolis, IN 46214	College of Education		
Patrick.biggerstaff@wayne.k12.in.us	Purdue University		
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	Education, Room 4148		
	100 N. University Street		
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sdeckard@doe.in.gov	317-888-4401		
317-232-9171			

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Partnering with a CTE Program to Use Technology to Study Healthy Lungs

Edward J. Lazaros

Ball State University

ejlazaros@bsu.edu

Beth A. Blevins

Medtech College

bblevins@medtech.edu

Activity Introduction

In many instances, technology is only associated with communications, transportation, construction, or manufacturing. Medical technologies are often overlooked in the public school technology classroom. In this activity, students will learn about how to use a technological product (Stethoscope) with the help of faculty and students from their district's Career and Technical Education (CTE) health sciences program or another nearby district's program. They will learn how this technological product is used to extend human potential to listen to the human lungs. Specifically, students will listen to how the lungs sound using a stethoscope. Using Internet technology, students will research how to maintain healthy lungs through lifestyle choices. Students will also research the impacts that some technological systems can have on human lungs (i.e. transportation systems that produce pollution, power plants that produce pollution, etc.). Students will use English / language arts skills and word processing technology to write a report about how to maintain healthy lungs.

Review of Literature

Raaschou, Anderson, Hvidberg, Jensen, Ketzel, Sorensen, Loft, Overvad, & Tjonneland (2011) conducted a study titled "Lung Cancer Incidence and Long-Term Exposure to Air Pollution from Traffic". This study used participants from the Danish Diet, Cancer and Health cohort study which was conducted between 1993-1997 using 57,053 men and women between the age of 50 to 64 living in Copenhagen and Aarhus. The researchers checked these study participants for cancer occurrence until June 27, 2006. There were 241 cases diagnosed with lung cancer in the original study by February 16, 2001. By June 27, 2006, an additional 351 lung cancer cases were diagnosed. The study showed an association between lung cancer and residential address in proximity to traffic (Raaschou et al., 2011, p. 865).

The effects of air pollution on health are numerous. Bernstein et al. (2004) conducted a meta-analysis on research discussing the effects of both short and long term effects of pollution on health conditions. Increases exposure to ozone gases is associated with

increases risk of asthma development. In addition, living in close proximity of hightraffic load can increase the risk of asthma related hospitalization. The presences of sulfur dioxide and nitrogen dioxide decreases lung function for both healthy and asthmatic adult subjects within two minutes of exposure. Further meta-analysis by Laumbach and Kipen (2012) demonstrated the effect of traffic pollution and biomass (e.g. wood burning) exposure in developed and not so developed countries. Exposure to both kinds of air pollutants is linked with an increase of various respiratory and cardiovascular conditions such as COPD, childhood and adult asthma, respiratory tract infection, and tuberculosis. It is important to assess the health of lungs, especially those who live near high traffic roads.

Lifestyle choices may also influence healthy lungs. Not smoking and exercising regularly may be common lifestyle choices that can be applied. Dietary intake may also be a lifestyle choice worth considering. Interestingly, Raaschou et al. (2011), referenced the World Cancer Research Fund and the American Institute for Cancer Research conclusions in 2007 as indicating that "fruits probably protect against lung cancer" (p. 865).

A technological device called a stethoscope can be used to listen to the human lungs. The stethoscope was first discovered by Theophile Rene Hyacinthe Laennec (1781-1826). Laennec's inspiration came when he wanted to listen to heart sounds in a young woman. He rolled up a paper notebook making it into a tight roll and much to his surprise; he was able to heart beats better than had ever before. The very first stethoscope was made from wood, either cedar, or ebony manufactured by Laennec, himself (Luderitz, 2009). Wooden stethoscopes were used for many years until rubber tubing was developed (Roguin, 2006). Modern stethoscopes consists of three parts, a bell shaped device with a diaphragm on one side that connects to a single rubber tubing that divides and connects to the ear pieces. Both the tubing and metal headset are hollow. Sounds travel through the hollow tubing and headset where they reach the ears through tight-fitting earpieces (Schunk, N.D.).

Listening to body sounds through the stethoscope is called auscultation. Based on the Latin verb ausculature means "to listen," ausculation is performed when an examiner is listening to assess heart and lung sounds. Auscultation is a listening skill that improves with clinical experience and is as good as the quality of the stethoscope itself. A doctor or a nurse can listen to heart sounds and lung sounds, as well as additional sounds the body makes with the stethoscope (Ferns, 2007). Listening with a stethoscope can provide important life-saving information. The heart and lungs work closely together to provide oxygen to human bodies. When humans breathe, lungs take in oxygen which is a gas. When a human exhales, the body has already removed waste products and toxins (Antinoro, 2005).

There is a simple thing people can do to help keep the lungs healthy. Daily exercise and a healthy diet can defend against both heart and lung disease. The important link here is that the exercise should be exerting enough energy to raise the heart rate. The World

Health Organization (2011) recommends physical activities that may include playing, games, sports and recreation, in addition to planned activities such as community activities.

Materials for Activity

- Stethoscopes
- Alcohol wipes
- Computer with Internet access
- Web browser
- Word processing software
- Printer

Activity Learning Objectives

- 1. After learning about how to use a stethoscope, the student will listen to a classmate's lungs to ascertain how these human organs sound.
- 2. After listening to how the lungs sound, the student will use Internet technology to research how to maintain healthy lungs through lifestyle choices and to research about the impacts that some technological systems can have on human lungs.
- 3. Upon completing Internet research on maintaining healthy lungs through lifestyle choices and the impacts that some technological systems can have on human lungs, the student will use English / language arts skills and word processing technology to write a report to summarize the findings.

Activity Procedure:

1. With the help of faculty and students from their district's CTE health sciences program or another nearby district's program, the instructor will explain to the students that a stethoscope is a technological device that is used to extend human potential to listen to the human lungs. **See Figure 1.**

Figure 1



- 2. The instructor will request that each student team up with a classmate. Each student team will be provided with a stethoscope.
- 3. The student team will clean the stethoscope prior to use by using alcohol wipes to clean the ear pieces and the flat side of the stethoscope (also called the diaphragm). See Figure 2.

Figure 2



4. After the stethoscope is clean and dry, one student team member will rotate both chest pieces of the stethoscope in a forward position. See Figure 3.



Figure 3

5. The ear pieces will be placed in the ears so that they feel slightly snug. See Figure 4.



- 6. The flat side of the stethoscope (also called the diaphragm) will be placed over the anterior wall of the chest.
- 7. The diaphragm should be auscultated from side-to-side, and top-to-bottom. Compare the sounds from one side with the other. The sounds being omitted will be air flowing in and out, or the different sounds the lungs can make if an individual is sick or if the lungs or airways are obstructed. It is also possible to hear the heart beating. **See Figure 5.**

Figure 5



8. Students will write a description of the sounds that are heard during the experience.

- 9. The instructor will discuss with the students about how lifestyle choices can have an impact on the human lungs.
- 10. The instructor will discuss with the students about how technological systems (i.e. transportation systems that produce pollution, power plants that produce pollution, etc.) can have an impact on the human lungs.
- 11. The student will use a computer with Internet access to research information about how to maintain healthy lungs through lifestyle choices.
- 12. The student will use a computer with Internet access to research information about how technological systems can have an impact on the human lungs. See Figure 6.



- 13. The student will use English / language arts skills and word processing technology to write a report summarizing the findings of the Internet research.
- 14. The finished word processed report should be printed and submitted to the instructor for evaluation.

Activity is in Alignment with ITEEA Standards for Technological Literacy Content Standards (ITEEA, 2011):

The Nature of Technology

Standard 3. Students will develop an understanding of the relationships among technologies and the connection between technology and other fields of study. Technology and Society

Standard 5. Students will develop an understanding of the effects of technology on the environment.

Abilities of a Technological World

Standard 12. Students will develop abilities to use and maintain technological products and systems.

The Designed World

Standard 14. Students will develop an understanding of and select and use medical technologies.

Standard 17. Students will develop an understanding of and select and use information and communication technologies.

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Classroom Energy Consumption Activity

Thomas H. Spotts

Ball State University

tspotts@bsu.edu

Introduction

While there are benefits to having technological devices in schools, large amounts of energy are used to power these devices. This article introduces a brief activity that can be utilized in several different subject areas. In this activity, students will use Mathematical formulas to calculate the amount of energy that electronic technology devices use in the classroom and use research skills to identify the major offenders to energy conservation. Students will determine ways to conserve energy in the classroom. During lean economic times, this activity can serve to reduce energy consumption is something that many school administrators will appreciate. It promotes the notion of 'green' in the classroom. Students will gain an appreciation for the environment and the cost of energy that is used to power technology that students use. Michael Bluejay makes a strong point by saving that saving electricity doesn't just save money; it also saves the environment (Bluejay, 2013). Students need to understand this to become better stewards of our environment. This article provides a basic outline for an activity that can raise awareness of environmental conservation in students, teachers, and administrators. It can also attract the attention of the community to the school's efforts to be "green', and open doors for joint activities in the community.

Energy Usage in Schools

Schools may be wasting energy in classrooms, and administrators, teachers, and students may not even realize it. Conserving energy is something that everyone should participate in at school. Schools are faced with shrinking budgets, and expanding enrollment due to economic hardships. One way to help this situation is by saving money through reducing energy consumption.

Students need to engage in activities related to energy consumption in the classroom and develop ways to reduce it. This may help out in the long run when it comes to energy conservation. Throughout the school day, students can reflect on ways to reduce energy consumption and discuss these in classes. All disciplines can introduce the subject and consider ways to apply their subject material to conserving energy. Individual students can turn out lights (See Figure 1) when they are not in use, or perhaps even computer equipment being unused can be shut down (See Figure 2) to save energy.

Figure 1.



There are many things that students, teachers, administrators, and janitorial staff can do throughout the day in their school building to help conserve energy (Sanders, 2009, p. 1):

- Turn out the lights lighting is one of the largest users of energy in the classroom, and by turning out these lights when a classroom is unoccupied, the school saves money in the long run.
- Stop water waste hot water requires a great amount of energy. By fixing dripping faucets, one can save water and energy, regardless of whether the water is heated by either gas or electricity. (See Figure 3)

Figure 3.



• Closing doors – leaving doors wide open to a room or building may make it more inviting to come in, but it wastes energy. (See Figure 4)

Figure 4.



• Change thermostat settings – change the thermostat settings in rooms to 78 during warmer months and 68 during cooler months. Doing so will lower the heating and air conditioning use. (See Figure 5)

Figure 5.



The aforementioned tips are just a few of the many steps that can be taken to conserve energy usage in the school. Students can also be assigned to research other less familiar energy conservation tips such as unplugging charging units when not in use or minimizing power to devices that are not regularly used. Additionally, all subject teachers can introduce energy conservation topics to their classwork and perhaps one class can study energy benchmarking as applied to the school system's buildings. Benchmarking involves comparing a building's energy use to accepted standards or best practices. In a school system, this could be utilized to compare buildings energy use in order to seek ways to reduce energy consumption. The U.S. Environmental Protection Agency's (EPA) Star* program offers guidance and has benchmarking tools that could help the school system succeed in saving energy (US EPA, 2014, p.1). It is important to ensure that the students have knowledge as to why they are performing these energy checks (Kruger, 2000, p.1).

Students, teachers, administrators, and janitorial staff should do their part to conserve energy in schools. Simple steps throughout the day can help reduce energy consumption and improve the financial situation in schools. This can make a big difference in the energy cost at the end of each month. The money a school saves could possibly to be reallocated toward improving academics or funding extracurricular programs.

Introduction and Background

This activity gives school students the opportunity to research electricity consumption in the classroom and develop ways to reduce it. Students will use a classroom electricity usage checklist (see Classroom Electricity Usage Checklist) to record information about the types of electronic technologies in the classroom. Mathematical formulas will be used to determine the amount of energy consumed by the electronic technology devices in the classroom. Through collaboration with peers and the teacher, ways to conserve energy in the classroom will be discovered. Students will ascertain specific ways to reduce electricity consumption in the classroom through simple tasks that the students and teacher can commit to doing daily, such as unplugging devices, powering down

computers, turning out some of the lights, closing doors, and adjusting thermostat settings.

Learning Objectives

- 1. After a teacher presentation on electrical consumption, the students will identify electronic devices in the classroom and use the classroom electricity usage checklist to determine the power consumption of the devices.
- 2. Given mathematical formulas and the completed electronic technology usage checklist, the student will determine the estimated monthly electrical use and cost for each device in the classroom.
- 3. After determining the estimated monthly electrical use and cost for each device in the classroom, the students will identify ways to reduce energy consumption in the classroom through simple tasks that the students and teacher can commit to doing daily, such as unplugging devices, adjusting the power levels on devices, and powering down computers at the end of the school day.

Materials

- Computer
- Calculator
- Notepad

Procedure

- 1. The teacher should share information about ways to conserve electricity in the classroom. The teacher should also discuss basic electrical concepts with the students such as amperage, voltage, and wattage.
- 2. Identify and list all the electronic devices in the classroom on the classroom electricity usage checklist. Give an example of recording wattage for devices in the classroom and estimating monthly usage.
- 3. Students will write down the wattage for each electronic device in the classroom. If wattage is not available, it can be estimated by using amperes (draw) and multiplying that by the voltage use of the appliance.

Watts (Unit of Power) = Volts (Unit of Force) x Amps (Current or Flow)

- 4. Students will estimate approximately how many hours each month the electronic device is used in the classroom. This will be recorded on the classroom electricity usage checklist.
- 5. Using the classroom electricity usage checklist, the students will estimate the wattage per month for each device by multiplying the wattage by the estimated hours per month.
- 6. Students will convert the estimated wattage per month to the estimated Kilowatt hours per month by dividing by one thousand (1,000). The estimated Kilowatt hours will be recorded on the classroom electricity usage checksheet.
- 7. Students will visit this website (<u>http://www.eia.gov/electricity/data.cfm</u>) to find and access individual state tables (**See Figure 6**). Students will use the table to determine the average cost per kilowatt hour of electricity (indicated in cents) in the state where the school is located (**See Figure 7**).

Figure 6.

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			Fuel used in electric generation
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			Cost & Quality of Fuel
			PUH Stocks
			Costs
			Revenue & expenses

Figure 7.

Census Division	Number of	Average Monthly	Average Retail Price	
State	Consumers	consumption (kwin)	(Cents per knowatchour)	
Connecticut	1 447 250	724	17.47	
Maine	202 022	521	16.05	
Marrie	2 561 095	610	10.00	
Massacruseus	2,001,900	600	10.07	
Reversion of the second	120,100	023	10.20	
renoue Islanu	432,102	000	15.60	
Vermont Niddle Mastie	306,919	576	14.90	
Nilouw Adamoc	10,002,061	690	14.84	
New Vork	3,430,037	£01	16.31	
New Tork	0,910,413	561	17.50	
Pennsyvania	5,235,331	042	11.65	
East North Central	19,531,947	779	10.92	
Innois	5,074,861	728	11.27	
Indiana	2,733,611	992	CAES.	
Michigan	4,253,780	644	11.60	
Ohio	4,880,393	878	10.67	
Wisconsin	2,589,295	689	11.94	
West North Central	9,001,636	942	9.14	
lowa	1,324,182	864	9.99	
Kansas	1,209,522	906	9.53	
Minnesota	2,290,881	802	10.04	
Missouri	2,687,756	1,061	8.54	
Nebraska	799,623	1,003	8.52	
North Dakota	322,466	1,150	7.58	
South Dakota	367,206	1,024	8.49	
South Atlantic	25,669,340	1,123	11.32	
Delaware	393,836	917	14.07	
District of Columbia	217,635	712	13.76	
Florida	8,493,591	1,133	12.39	
Georgia	4,061,862	1,132	10.13	
Maryland	2,188,390	1,026	14.98	
North Carolina	4,175,829	1,124	9.99	

8. For each classroom electronic device listed on the classroom electricity usage checklist, the average cost per kilowatt hour of electricity will be multiplied by the kilowatt hours per month (kWh/month X Price per kWh = Estimated cost/month) to determine the estimated cost per month to the school. This information should be recorded on the classroom electricity usage checklist (See Figure 8).

Figure 8.



After determining the estimated cost per month of the classroom electronic devices, students will identify ways to reduce energy consumption in the classroom through simple tasks that the students and teacher can commit to doing daily, such as unplugging devices, adjusting the power levels on devices (See Figure 9), and powering down computers at the end of the school day.

<text>

Discussion and Summary

This activity will benefit teachers, students, and potentially the school system. Teachers will benefit by having an additional conservation lesson included in their curriculum and a potential lead in to becoming involved and gaining recognition in a wider community of sustainability/energy conservation. Students will benefit by becoming more aware of energy consumption and gaining skills toward becoming assets to the community as aware citizens. The school system, if involved on a wider scale (benchmarking the buildings in the system for example), can potentially reduce energy and demonstrate a

cost savings, something attractive to any administrator and school system. This can prove to be a winning situation for all involved.

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Classroom Electronic Device		
Classroom electronic device wattage		
Estimated hours of use per month in the classroom		
Estimated wattage per month in the classroom		
Kilowatt hours per month in the classroom		
Average retail cost per Kilowatt hour in the state where the school is located		
Estimated cost per month to the school		

Classroom Electricity Usage Checklist