Does the Power Demand of Personal Computers Depend upon the Activity?

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Abstract

Computers demand various quantities of power as different tasks are completed. As the tasks performed by computers become more sophisticated, power demand increases. As power rates continue to climb the amount of nonrenewable energy used will also increase, and in turn increase the amount of greenhouse gases released into the atmosphere.. This study sets out to determine the amount of power required while completing eight different activities common in a typical teenager's week. It also addresses how the power demand of different computer systems, in particular desktops and laptops, vary based on the different activities. The study concluded that: 1. Desktops use more energy than laptops in general, and 2. Most energy is consumed by a desktop while playing multi-media games such as Sims, Spore, and World War Craft; most energy is consumed by a laptop while watching passive media activities.

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Introduction

Computers have become a very important aspect of today's society. Most teenagers today rely on use their computers to complete everyday tasks like writing a paper or checking Facebook. In this tech-savvy society, adolescent computer use has increased. Today, about 90 percent of adolescents use a computer to complete activities like playing games, social media, and completing school assignments (U.S. Department of Education, 2001). Dr. Melissa Nelson determined that over a five year period (1999-2004), teenage computer use has increased by 3-5 hours a week (NDRI, 2011).

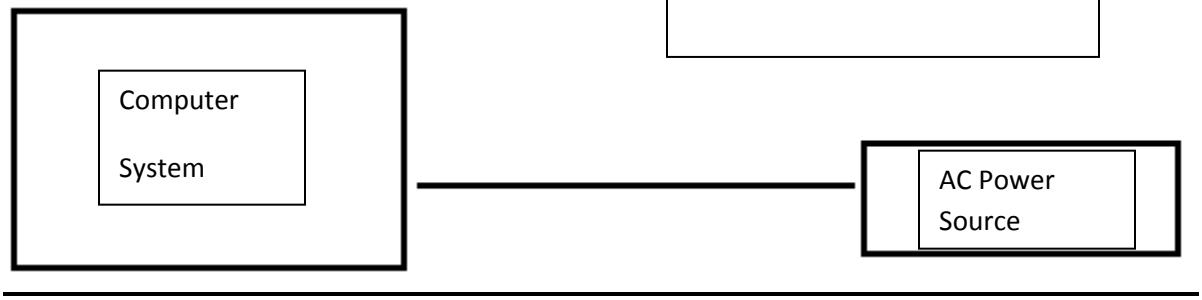
Adolescent computer use is a concern for many reasons, one of which is the environmental impact from increased computer use. Today 85% of the U.S. energy comes from nonrenewable resources such as coal and oil (Hayden, 2011). It has been determined that over the last 150 years CO_2 levels have increased by 25%, and it is predicted that if energy use continues to grow, the world's water level could increase and more severe storms could develop (Union of Concerned Scientists, 2002).

Statement of Purpose

This study sets out to determine the amount of power demanded during eight different activities common in a typical teenager's week.

Methods and Materials

Fig 1 - Equipment Set Up



A power source was connected to the computer being studied, as shown in Figure 1. The power source was programmed to output the mean power demand. One of eight activities listed in Table 1 was performed on the computer with each activity spanning a period of one hour (3600 seconds).The computer systems studied are listed in Table 2.

Table 1 - List of Computer Activities Studied

Activity	**Description**
Facebook (without game)	A person will look at different profiles, pictures, etc. Since Facebook is an active social media site, the profile pictures and comments will change regularly. Also a “pop-up chat” or instant message with a friend occurred for 15 minutes during the activity.

Facebook (with games)	Three different applications were utilized. They were Treasure Madness™, Jungle Jewel – the Temple™, and Mindjolt Games™. Treasure Madness™ and Jungle Jewel – the Temple™ were played for 25 minutes each. For the remaining 10 minutes, the Crazy Cabbie™ game was played with the Mindjolt™ games app.
Multi-Media Game	The multi-media game Spore™. Data was not collected during installation or access to the internet. After the game was installed the icon was clicked and data collection started.
Web Surfing	Bing™, a common search engine, was utilized to search four different terms. The first term was “Life Cycle Analysis Journal Articles”. The next terms were “Life Cycle Analysis Journal Articles + Computers”. The third terms were “Eric Williams + Life Cycle Analysis”. The final term was “LCA Software”. Terms were searched for 15 minutes each.

Idle Mode	The settings were changed so that the sleep mode was disabled. After the settings were changed, all windows were closed and the desktop screen sat open.
DVD Movie	“Shrek the Third” was viewed. The DVD was inserted into DVD slot. Depending on the system it might have been necessary to run the DVD part of Windows Media Player. The movie was played in full screen mode.
Internet Movie	The website Hulu.com was used to watch the 1949 version of “Alice in Wonderland”. Hulu.com played commercials in between parts of the movie. This movie was also viewed in full screen mode.
Word Processing Program	. A copy of “Electronic Waste: An Overview” was retyped into the word processing program, “Open Office”.

Laptops	Desktops
HP Pavilion dv7 notebook	Gateway Dx4850-27e
Dell XPS 15z	Dell Studio XPS X8300-1225 NBK
HP Pavilion dv 4t 1	HP Pavilion Slimline
Dell Inspiron 15R- 1009 MRB	Compaq Presario CQ5814
HP Pavilion dv7-6715 us	Dell Inspiron 570

Table 2 - List of Computer Systems Studied

Results

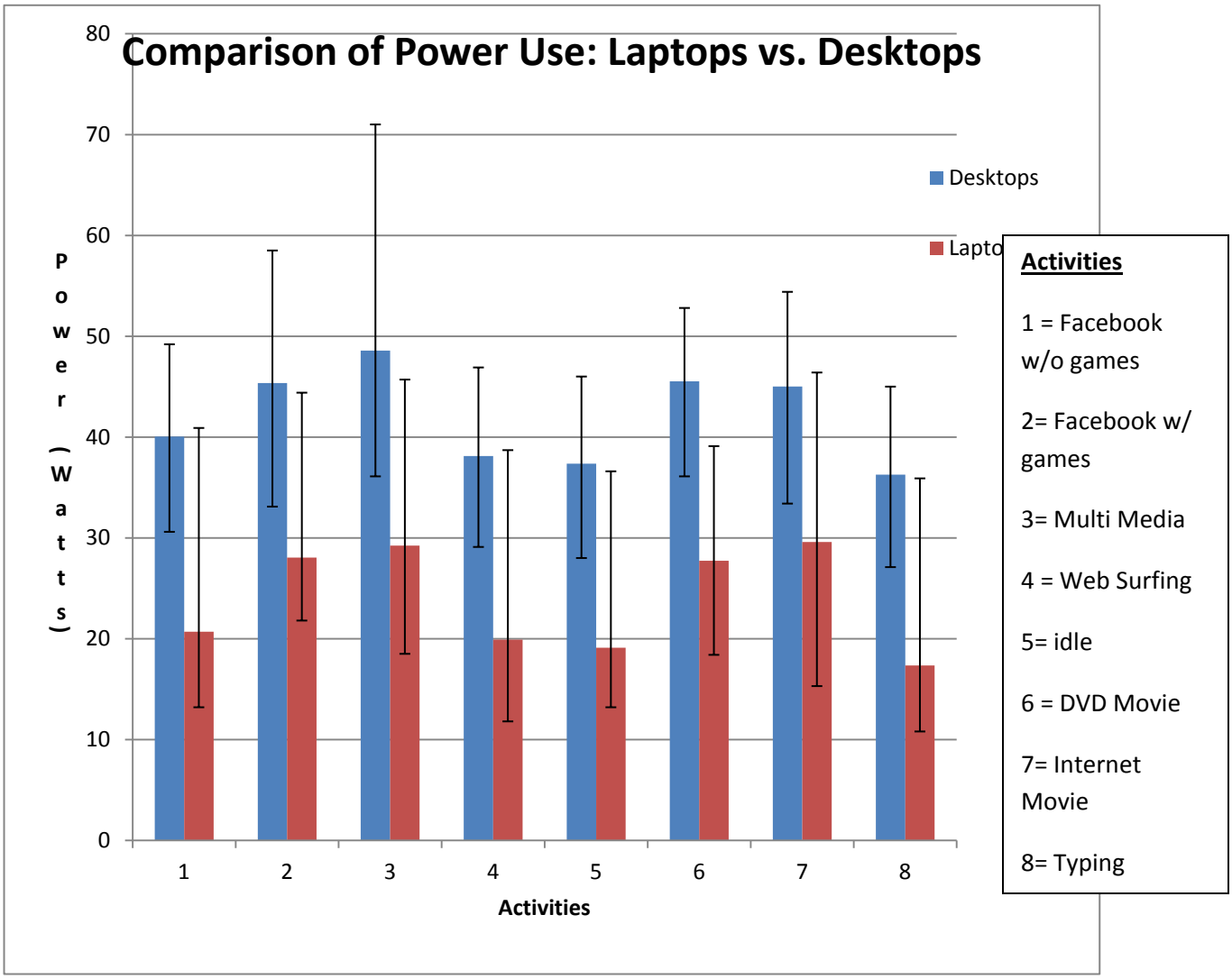


Fig. 2 – Comparison of power use of desktops vs. laptops. The blue bar represents the average of desktops. The red bar represents the average of laptops. The black bar indicates the maximum and minimum of power consumed during each activity.

Average Power Use, in watts

	Activity									
Laptop	1	2	3	4	5	6	7	8	Avg.	Std. Dev.
HP Pavilion dv7 notebook	40.9	44.4	45.7	38.7	36.6	39.1	**46.4**	35.9	41.0	4.1
Dell XPS 15z	15.5	21.8	**26.6**	16.2	14.1	18.9	18.9	11.8	18.0	4.7
HP Pavilion dv 4t 1	13.2	22.8	18.5	11.8	13.2	**38.6**	15.3	10.8	18.0	9.2
Dell Inspiron 15R- 1009 MRB	17.5	23.7	25.9	16.0	13.8	20.2	**28.1**	13.5	19.8	5.6
HP Pavilion dv7-6715 us	16.4	27.6	29.5	16.9	17.9	21.9	**39.3**	14.8	23.0	8.5
Desktops										
Gateway Dx4850-27e	31.0	35.6	36.4	29.1	28.0	**44.3**	43.0	27.4	34.4	6.6
Dell Studio XPS X8300-1225 NBK	48.2	51.0	50.8	46.6	46.0	49.9	**54.9**	45.0	49.1	3.3
HP Pavilion Slimline	41.3	**48.6**	**48.6**	38.9	37.8	44.6	42.6	37.7	42.5	4.4
Compaq Presario CQ5814	30.6	33.1	**36.1**	29.1	29.9	**36.1**	33.4	27.1	31.9	3.3
Dell Inspiron 570	49.2	58.5	**71.0**	46.9	45.1	52.8	51.2	44.2	52.4	8.8
Average	27.7	33.6	35.6	26.7	26.1	33.9	34.6	25.1	31.7	4.4
Standard Deviation	16.0	16.3	18.2	14.7	14.1	14.9	15.5	14.0	13.0	

Activities

1 = Facebook w/o games

2= Facebook w/ games

3= Multi Media

4 = Web Surfing

5= idle

6 = DVD Movie

7= Internet Movie

8= Typing

Table 3- Chart of the Raw Data. The bold faced numbers are the activities that demand the most power for each computer system.

On average laptops were found to demand less power than desktops (see Fig 2). Both laptops and desktops demand the least amount of power while typing (using a word processing program).Figure 2 shows that playing a multi-media game requires the most power for a desktop while watching a movie or TV show requires the most power for a laptop. Overall, playing a multi-media game, playing a DVD movie, and watching an Internet movie demand the most power of both systems.

Figure 2 also show that desktops general use more energy than a laptop expect for the HP Pavilion dv7 notebook which used more power than two desktops.

Discussion and Conclusion

The data indicates that laptops use less energy than desktops. This could be due to the fact that laptops have fewer components than desktops; for example an external mouse, keyboard, and in some cases a disk drive.

On average, both laptops and desktops used more power while playing a multi-media game because the advance graphics call for more power.

What is truly surprising is the fact that watching a movie or TV show on a laptop uses the most energy. One might believe that since watching media isn't an interactive activity it would not use that much energy.

To expand upon the data that was found, students will be surveyed to determine how long they spend on the studied activities. This will help determine the amount of energy that is consumed by students due to computer use. Besides, the amount of energy used, the amount of CO_2 emitted during energy production will also be estimated. This study is important to understand the impact of adolescent computer use on the environment.

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