Going green: paperless technology and feedback from the classroom

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ABSTRACT

The purpose of this study is to measure the following: student satisfaction with the paperless classroom; student satisfaction with paperless feedback; and costs savings as a result of the paperless classroom.

Traditionally, software courses are paper-intensive because of the large amount of assignments being submitted for grading by students. In an effort to "go green," this study is proposing the electronic submission of software assignments and electronic feedback by instructors using Blackboard's virtual hard drive and USB flash drives. The response from students on their satisfaction with electronic submission and feedback of assignments was overwhelmingly positive. The study also resulted in a 48% cost savings on paper and toner.

Keywords: Paperless, Green, Paperless Classroom, USB flash drives, Virtual Hard Drives
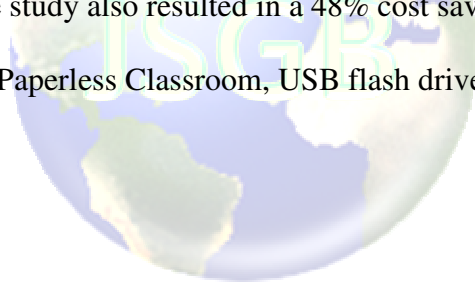
INTRODUCTION

With our economy in a slump and our budgets stretched thin, institutions are trying to devise methods for cost containment. Implementing the paperless classroom not only prepares students for today's technology-driven workplace but also helps our department's budget by reducing paper and toner costs. Obtaining data on the paperless technologies, feedback and cost savings will assist our department and ultimately our university in validating the "going green" concept.

Using web-based technologies for the dissemination of course materials and for the storage of course work provides many benefits to both instructors and students. Lutes and Harriger (2003) conducted a study on the paperless classroom using a web-based tool called Essignments. This tool, much like any web-based software, provides the users with many benefits like 24-hour accessibility from anywhere there is an Internet connection, electronic archival of all files, elimination of stacks of paper, and reduction of lost assignments.

PURPOSE

The purpose of this study is to measure the following: student satisfaction with the paperless classroom; student satisfaction with paperless feedback; and costs savings as a result of the paperless classroom.

Traditionally, software courses are paper-intensive because of the large amount of assignments being submitted for grading by students. In an effort to "go green," this study is proposing the electronic submission of software assignments and electronic feedback by instructors.

Specifically, the research questions being investigated are as follows:

Research Question 1: What level of satisfaction did the students report with the paperless classroom?

Research Question 2: What level of satisfaction did the students report with the paperless feedback used in this study?

Research Question 3: Did the implementation of the paperless classroom result in a cost savings for the department?

The two paperless technologies that will be used for assignment submissions are the Virtual Hard Drive available on Blackboard and USB flash drive s). The paperless feedback that will be used by instructors will be in the form of written comments on papers using Microsoft's tracking and comments features.

BACKGROUND

In 2009, RCC Consulting posted an article about the cost of paper used in the year 2001 for an organization of 100 employees. RCC Consulting used copying, faxing and storage costs as factors to be measured in order to compute the cost of paper. An interesting aspect of their study was that they indicated that the cost of paper ran about .003 cents per sheet which is minor but the majority of the cost had nothing to do with the actual sheet of paper but with what was done with the sheet once it was purchased. They indicated that 45% of the paper is used for photocopying, 35% is used for printing, and 5% is used for faxing with 5% being mailed and 10% being wasted or discarded. Of the paper that is used, 30% is placed into filing cabinets which will eventually be purged. When you consider the cost of equipment and supplies for printers, faxes and storage materials along with the square feet of office space, the cost increases exponentially (RCC Consulting, 2001). According to *INC Magazine*, it costs $20 to file a document, $120 to search for a misfiled document, and $250 to recreate a lost document (K2 Enterprises, 2009; McCorry KJ, 2009). Most of the data that is found in paperless offices is geared toward ensuring a return on investment, in other words, keeping data that is of value or required. Real Estate Offices, Title Companies, Accounting Firms, and Law Firms are just some of the industries that have experimented with converting to the paperless office. The cost of the conversion and the success of such a project have been topics for many articles.

Lutes and Harriger discuss a web-based electronic submission system that allows instructors the ability to accept assignments and students to submit those assignments using the Web (Lutes and Harriger, 2003). Focusing on a hands-on developmental framework for both online academic course management and industry-class collaboration in a paperless environment, Wang's study found a very high level of motivation by students for using the paperless environment as well as for acquiring its benefits (Wang, 2009). In 2008, Allen Kupetz posed the question, "Is the Paperless Classroom Possible?" and listed the advantages of going paperless. Although he is cautious to note that "…paperless doesn't mean any less paper. It means simply that technology is giving us new options to reduce or eliminate much of the paper we use today and to enjoy the cost savings that result" (Kupetz, 2008).

This paper does not propose conversion to a completely paperless environment, but simply ventures to create a paperless assignment submission and feedback environment to analyze the students' satisfaction with the learning environment without physical exchange of paper. Students will simply be asked to use either a USB flash drive or a virtual hard drive to submit their work. Instructors will have the majority of adjusting to do as grading all assignments and exams will be direct from the virtual hard drive or from USB flash drives. This grading will require instructors to read and respond to the submitted work electronically.

METHODOLOGY

Students taking software classes in the Applied Business Technology department were taught using a paperless classroom. Two sections of Business Computer Applications, two sections of Microsoft Word, one section of Microsoft PowerPoint and one section of Microsoft Access were used in this study. Students submitted assignments by two methods: USB flash drives and virtual hard drive. Instructors uploaded graded assignments to the virtual hard drive with comments by using Microsoft comments and tracking features. At the end of the semester, students provided their

perceptions about the different methods for submitting work for grading and receiving instructor feedback after their assignments were graded.

In each course, a lesson on file management was taught at the beginning of the semester to encourage good file organization and management as well as to teach the mechanics of the virtual hard drive and the flash drive. Students had little questions about the flash drive as most had prior experience using one. All students experienced a learning curve with the virtual hard drive as this was a completely new technology for every student. One step associated with the virtual hard drive was the need for students to grant the instructor permission to view their work for the course only. In other words, the students could have folders and documents not accessible to the professor if they wished. The instructors had each student sign a permission slip before using their virtual hard drive to document this permission. At the end of the semester and at the request of the instructors, students revoked these permissions for the course folder(s).

FINDINGS

Virtual Hard Drive Findings

To gain a better understanding of the students' satisfaction with the virtual hard drive, a questionnaire was administered. Students enrolled in the courses that used the virtual hard drive had never been exposed to this tool prior to the first day of classes.

Students overwhelmingly reported satisfaction with all aspects of using the virtual hard drive for submitting assignments electronically and for receiving instructor feedback. In terms of assignment submission, 90% strongly agreed or agreed that using the virtual hard drive helped them to better manage their work throughout the semester with 82% reporting that it helped them to be more cognizant of meeting assignment deadlines. The introductory lesson on file management proved to be valuable with 97% reporting that it helped them to better manage their assignments. For all students in this study, the virtual hard drive was a new technology. Even so, 90% of students who participated strongly agreed or agreed that they prefer it over using paper and would like to see more instructors using it, while only 55% reported that they would prefer using USB flash drives, a more familiar technology.

In terms of instructor feedback, 87% strongly agreed or agreed that the electronic feedback helped them to understand their strengths and weaknesses. In spite of this being a new technology, 86% of students who participated reported that they prefer receiving feedback in this manner over using paper and would like to see more instructors using it, while only 45% reported that they would prefer using USB flash drives, a more familiar technology.

The specific findings can be found in the appendix as Table 1: Results of Virtual Hard Drive Questionnaire.

USB Flash Drive Findings

To gain a better understanding of the students' satisfaction with using a USB flash drive, a questionnaire was administered. Students who enrolled in the courses that used the USB flash drive had prior experience with using them for document storage. Students were required to purchase an additional USB flash drive for course assignments only to be submitted to the instructor for grading.

Students overwhelmingly reported satisfaction with all aspects of using the USB flash drive for submitting assignments electronically and for receiving instructor feedback. In terms of assignment submission, 89% strongly agree or agreed that using the USB flash drive helped them to better manage their work throughout the semester with 94% reporting that it helped them to be more cognizant of meeting assignment deadlines.

The introductory lesson on file management proved to be valuable with 94% reporting that it helped them to better manage their assignments. For all students in this study, the USB flash drive was not a new technology. Even so, 84% of students who participated strongly agreed or agreed that they prefer it over using paper and would like to see more instructors using it. Thirty-nine percent reported a desire to use the virtual hard drive to submit assignments even though it was an unknown technology.

In terms of instructor feedback, 88% strongly agreed or agreed that the electronic feedback helped them to understand their strengths and weaknesses. Most students (84%) who participated reported that they prefer receiving feedback in this manner over using paper and would like to see more instructors using it. Interestingly, 48% of students reported that they would like to receive feedback using the virtual hard drive even though they had no prior experience.

The specific findings can be found in the appendix as Table 2: Results of USB Flash Drive Questionnaire.

Cost Savings Findings

As shown below, fall 2008 copy paper and toner costs for the department were compared to the fall 2009 costs. The costs are for the entire department and not just the classrooms; however, no changes in faculty, course offerings, or office procedures were implemented during this time frame. The only deliberate change was the implementation of the paperless classroom for all sections of the software courses offered in the fall 2009 semester.

August through December 2008
Copy Paper - Total Amount / Quantity
   $170.05 / 5 boxes
   $365.00 / 10 boxes
   $340.10 / 10 boxes
        TOTAL $875.15
Toner – Total Amount/Quantity
   $757.06 / 5 cartridges
        TOTAL $757.06
        TOTAL FALL 2008 Supply Costs $1,632.21
August through December 2009
Copy Paper - Total Amount / Quantity
   $314.50 / 10 boxes
   $349.90 / 10 boxes
        TOTAL $664.40

Toner – Total Amount/Quantity
            $131.87 / 1 cartridge

                        TOTAL $131.87
                        TOTAL FALL 2009 Supply Costs $796.27
                        PERCENT SAVINGS 48%

CONCLUSIONS AND RECOMMENDATIONS

Research Question 1: What level of satisfaction did the students report with the
                                paperless classroom?

Research Question 2: What level of satisfaction did the students report with the
                                paperless feedback used in this study?

Research Question 3: Did the implementation of the paperless classroom result in
                                a cost savings for the department?

        Overall, students responded positively to the paperless classroom. Introducing a new
technology such as the virtual hard drive to entry-level students who were learning new software
could have been disastrous. However, the opposite was the case. Students embraced it and have
indicated an interest in using it in future semesters with future instructors. In fact, students who
participated in the USB flash drive classroom also indicated an interest in using the virtual hard
drive. Both technologies were successfully implemented and embraced by the students.
        In response to research questions 1 and 2, students responded with a high level of satisfaction
with both the paperless classroom and the paperless feedback. They were overwhelmingly satisfied
with using the virtual hard drive and the USB flash drive for submitting assignments and for
receiving instructor feedback on assignments. No desire to return to a paper system was reported.
Therefore, it is recommended that faculty who teach software consider using a virtual hard drive for
submission and feedback in future courses. One consideration to using Blackboard's virtual hard
drive is that students must grant permission to their instructor so that their course folders can be
viewed. It is imperative that this permission be removed at the end of the semester to maintain the
student's privacy.
        In response to research question #3, the department realized a significant cost savings. With
over a 48% cost savings, it is recommended that other courses be evaluated to determine if a
paperless approach might work for some or all assignments.
        Overall, students reported anecdotally that the use of the virtual hard drive gave them peace
of mind. Using the USB flash drive or submitting hard copy assignments at times, resulted in their
losing their homework, whether the dog ate it, or they just lost their USB, their homework was not
available. The virtual drive eliminated that possibility and therefore they felt much more at ease
once they had submitted their assignments.

IMPLICATIONS

Organizations are adopting the "going green" agenda promoted throughout the country in an effort to save our environment. One example is Citigroup Inc. They have implemented a program that offers to plant a tree for each credit card holder who signs up for paperless statements. Another example is Vanguard Group Inc. They now waive account fees for customers who agree to electronic delivery of statements, fund reports and prospectuses. In addition, Washington Mutual Inc. and Sovereign Bancorp Inc. have begun making donations to environmental groups when customers switch to doing some of their business online (Laise, 2007).

The hope is that this study will result in a reduction of costs for our department and will serve as a model for other programs throughout our university. Not only will this study promote the "going green" agenda, it will also make a significant difference in our classroom supply budget.

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APPENDIX

Table 1: Results of Virtual Hard Drive Questionnaire*

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Uploading my homework to Blackboards' Virtual Hard Drive helped me to better manage my assignments.	26 67%	9 23%	3 8%	1 3%	0 0%
The electronic feedback that I received from my instructor helped me understand my weaknesses/strengths on my assignments.	25 64%	9 23%	5 13%	0 0%	0 0%
Uploading my assignments to the virtual hard drive has made me more aware of meeting assignment deadlines because my instructor is not alerted to late submissions.	19 49%	13 33%	5 13%	1 3%	1 3%
I would like for more instructors to accept my homework assignments using the virtual hard drive.	25 64%	10 26%	1 3%	2 5%	1 3%
How do you prefer to submit your assignments?					
a. paper printout	6 17%	7 20%	7 20%	6 17%	9 26%
b. Blackboards 's Virtual Hard Drive	28 74%	7 18%	1 3%	1 3%	1 3%
c. USB Flash Drive	9 26%	10 29%	6 18%	2 6%	7 21%
Did the introductory lesson on creating assignment folders (file management) on the virtual hard drive help you to better manage your assignments?	24 73%	8 24%	0 0%	0 0%	1 3%
How do you prefer to receive instructor feedback on your assignments?					
a. paper printout	7 21%	10 29%	5 15%	4 12%	8 24%
b. Blackboards' Virtual Hard Drive	26 68%	7 18%	4 11%	0 0%	1 3%
c. USB Flash Drive	7 21%	8 24%	8 24%	3 9%	8 24%
I found uploading assignments to Blackboard's Virtual Hard Drive easier than printing the assignments.	28 74%	6 16%	3 8%	0 0%	1 3%

* Percentages are rounded to the nearest whole number.

Table 2: Results of USB Flash Drive Questionnaire*

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Saving my homework to the USB flash drive helped me to better manage my assignments	21 60%	10 29%	3 9%	0 0%	1 3%
The electronic feedback that I received from my instructor helped me understand my weaknesses/strengths on my assignments.	17 50%	13 38%	4 12%	0 0%	0 0%
Saving my assignments using the USB flash drive has made me more aware of meeting assignment deadlines because my instructor cannot grade my work without it.	18 53%	14 41%	1 3%	1 3%	0 0%
I would like for more instructors to accept my homework assignments on a USB flash drive.	18 53%	9 26%	3 9%	3 9%	1 3%
How do you prefer to submit your assignments?					
a. paper printout	7 23%	3 10%	12 39%	3 10%	6 19%
b. Blackboards 's Virtual Hard Drive	7 25%	4 14%	6 21%	4 14%	7 25%
c. USB Flash Drive	19 61%	7 23%	2 6%	2 6%	1 3%
Did the introductory lesson on creating assignment folders (file management) on the virtual hard drive help you to better manage your assignments?	22 67%	9 27%	1 3%	0 0%	1 3%
How do you prefer to receive instructor feedback on your assignments?					
a. paper printout	10 33%	4 13%	10 33%	2 7%	4 13%
b. Blackboards' Virtual Hard Drive	10 37%	3 11%	7 26%	3 11%	4 15%
c. USB Flash Drive	18 56%	5 16%	2 6%	2 6%	5 16%
I found uploading assignments to the USB flash drive easier than printing the assignments.	25 74%	5 15%	2 6%	0 0%	2 6%

* Percentages are rounded to the nearest whole number.