

AC 2008-2093: IMPACT OF REMOTELY ACCESSING COMPUTER SOFTWARE IN A COMMUTER CAMPUS ON FRESHMEN ENGINEERING STUDENTS

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Impact of Remotely Accessing Computer Software on Freshmen Engineering Students in a Commuter Campus

Abstract

Indiana University-Purdue University Fort Wayne (IPFW) is a regional campus of Indiana University and Purdue University and administratively managed by Purdue University. IPFW is the largest public university in northeastern Indiana, serving more than 12,000 students. The civil engineering program is the most recent addition to the Department of Engineering, which offers B.S. degrees in civil, computer, electrical, and mechanical engineering.

Most of engineering students attend college as part time and usually commute to campus. Sometimes, it is hard for them to perform well in homework and assignments due to limited access off campus to computer software needed by their classes. In order to help students in improving their academic performance, a pilot study was conducted in the spring 2007 semester to evaluate the impact of providing students with remote access to proprietary software need for their assignments.

This paper presents the result of the pilot study of remotely accessing engineering software using Citrix server. There were two software packages available for use: AutoCAD and Matlab. The impact of Citrix server on students' performance was evaluated using two surveys: initial and final surveys. Both surveys were conducted in two sections of two freshmen courses taught during the spring semester: Graphical Communications and Spatial Analysis and Computer Engineering Tools for Engineering. Students usually use AutoCAD in the graphic class and Matlab in the engineering tools class. Most the students participated in the survey were freshmen, male, full time students, employed, living off campus with an average commute of 15 miles, do not own a copy of the software, and have Internet access at home.

The paper presents a summary of the findings for both surveys. In conclusion, most of students agreed that remotely accessing software package using Citrix server has reduced their commuting time and provided them with more time to study at home; improved their grades in general and homework grades in particular; improved their grades in all courses in general and Citrix related courses in particular; and their experience with Citrix was excellent and recommend strongly that the college adopts the server permanently.

Introduction

Computer ownership and accessibility and the use of the internet for college students are increasing rapidly. Data shows that a college owns or leases about 0.42 computers per student on average¹. In addition, an FCC survey in 2003 reports that 26.0 million U.S. households had broadband access by the end of year². This provides students living off-campus with excellent access to the internet. However, accessing college software packages are more complicated than browsing the internet and requires special authorizing and software packages from the college. In addition, there is a growing need to access such packages via internet especially for commuting campuses. A study at Saint Louis University found that using Virtual Network Computer (VNC) which is an open source software system to remotely access computer has significantly improved computer science students' access to software³. The current technologies that provide such access are either custom-built for a single or a relatively small set of applications⁴.

There are several used in the market to remotely access software including but not limited to open source software like X Windows and VNC, and proprietary packages such as Microsoft Terminal Services (Remote Desktop) and Citrix MetaFrame³.

In this study the Citrix software was used to deliver applications to users remotely through the Web⁵. This package was installed on the engineering server by February 25, 2007. Three software applications were available on Citrix to access by faculty and students: AutoCAD 2006, Matlab, and MultiSim. In order to assess the use of the Citrix, two surveys were conducted. The preflight or initial survey was conducted in early March just after the students were informed about the server. The second or the final survey was conducted during the final week of the semester just before the final exams.

The surveys were conducted in two freshmen courses taught during the spring semester: ENGR 120: Graphical Communications and Spatial Analysis and ENGR 121: Computer Engineering Tools for Engineering. ENGR 120 is an engineering required course that can be taken by other students toward a university requirement of area IV. However, ENGR 121 is an engineering course and offered strictly for engineering students. Students use AutoCAD software in ENGR 120 and Matlab in ENGR 121. The survey was not conducted in the MultiSim class because the number of students taken the class during the spring semester was low. The total number of students enrolled in ENGR 120 and ENGR 121 was 44 and 34, respectively. The number of sections and enrolment in the spring semester in these classes is usually lower than the fall semester.

Methodology

Since this study uses human subject in the research, both surveys were submitted and approved for exemption by the committee on the use of human research subjects at University of Purdue Institutional Review Boards (IRBs). Students were instructed to fill the survey only one time if they are taking both classes. The IRB requested a letter describing the study and informing students that participating is voluntary and it will have no impact whatsoever on their assessment in the class. A copy of the letter and both surveys are attached at the end of this report.

Objectives and Methodology

The study is an attempt to assess the benefits of remotely accessing software using Citrix. The objectives of the study are to measure the impact of remotely accessing software on improving students' performance and to conduct a casual economic impact on IPFW computer infrastructure. In order to achieve the goals of this study, the following steps were undertaken:

- 1) Develop and conduct initial survey of students' background and usages of the software needed in their classes.
- 2) Develop and conduct final survey of students' usages and their recommendation on the use of the server.
- 3) Measure the impact of the server on student academic achievements
- 4) Documentation of initial cost, usage time, and problems during the installation and implementation of this system.
- 5) Casual cost assessment of the sever usage.

This report is addressing the first three points only. The last two points will be presented in future publication.

Survey Analysis

Population

As shown in Tables 1 and 2, the total number of students in both classes was 78 with 20 students taking both classes. There were 50 students filled both the initial and the final surveys. The number of students taking both classes and filled the initial and the final surveys was 19 and 20 students, respectively. These students were counted twice when finding the total number of students attending both classes as shown in Table 1. Therefore, the actual total number of students in both classes is 59. Similarly, there were 20 students filled the final survey attending both classes. Therefore, the percentage of students' participation in the initial and the final survey is about 85% of the total population of students in both classes.

The total number of students enrolled in ENGR 120 and ENGR 121 was 44 and 34, respectively. The initial survey was filled by 18 students taking only ENGR 120, by 13 students taking only ENGR 121, and 19 students taking both classes. The final survey was filled by slightly different combination of students. There were a total of 17 students enrolled only in ENGR 120, 13 students only in ENGR 121, and 20 students enrolled in both classes.

Initial Survey

There were 47 (94%) engineering students participated in this survey. In addition, 39 (78%) students were freshmen, 7 (14%) sophomore, 2 (4%) junior and 2 (4%) senior. There were 43 (86%) male, 6 (12%) female, and 1 (2%) without a selection. Full time students were 40 (80%) and only 9 (18%) were part time students. Most of the students, 35 (70%), were employed, 13 (26%) were not employed, and 2 (4%) without a selection. Out of the 35 employed students, there were 9 (18%) students working full time, 15 (30%) working part time for 20 or more hours per week, and 9 (18%) were working part time for less than 20 hours per week.

Table 1: General Distribution of Enrolled and Participating Students

Students		Total Enrolled	Survey Filled			
			Initial		Final	
			No.	%	No.	%
ENGR 120	Sec. 1 (am)	23	10	43%	10	43%
	Sec. 2 (pm)	21	9	43%	12	57%
	Total	44	19	43%	22	50%
ENGR 121	Sec. 1 (am)	16	15	94%	14	88%
	Sec. 2 (pm)	18	16	89%	14	78%
	Total	34	31	91%	28	82%
Total		78	50	64%	50	64%

Table 2 shows more detailed info about the students who participated in the study.

Table 2: Detailed Distribution of Participating Students in the Study

Class		No. of Students									
Survey	Enrollment	ENGR 120				ENGR 121				Total	
		Sec. 1 (am)	Sec. 2 (pm)	Total		Sec. 1 (am)	Sec. 2 (pm)	Total			
				No.	%			No.	%	No.	%
Initial	Class only	9	9	18	95%	5	8	13	42%	31	62%
	Both classes	1	0	1	5%	10	8	18	58%	19	38%
	Section Total	10	9	19	100%	15	16	31	100%	50	100%
Final	Class only	9	8	17	77%	7	6	13	50%	30	60%
	Both classes	1	4	5	23%	7	8	15	50%	20	40%
	Section Total	10	12	22	100%	14	14	28	100%	50	100%

There were 26 (52%) working and full time students. Out of the 26, there were 3 (6%) students employed full time, 13 (26%) students employed 20 hours or more and 10 (20%) students working less than 20 hours per week.

There were 41 (82%) participant students living off campus and only 9 (18%) living on campus. The range of commute distance for students living off campus was between 1 and 60 miles with average of 15.6 miles. Almost all students have computer at home or has access to one off campus. All students have Internet access as follows:

- 1) Dial up 8 (16%).
- 2) DSL 10 (20%)
- 3) Cable 17 (34%)

- | | |
|--------------------|---------|
| 4) Satellite | 1 (2%) |
| 5) LAN (On Campus) | 9 (18%) |
| 6) Other (FiOS) | 4 (8%) |

Only 24 (48%) students owned AutoCAD, 12 (24%) owned Matlab, and 11 (22%) owned both programs.

Lab Usage: AutoCAD

- 1) During weekdays: only 32 (64%) students used the lab from 1-8 hours per week with an average of 3.3 hours per day. The lab overall average usage of all students was 2.1 hours per day. There were 22 students commuted to the lab between 1 and 8 times to work on AutoCAD with an average of 3 times per week. The overall average commuting for all students was 1.3 times per day.
- 2) During weekends: only 18 (36%) students used the lab from 1-6 hours per week with an average of 1.9 hours per day. The lab overall average usage of all students was 0.7 hours per day. Only 12 students commuted to the lab to work on AutoCAD between 1 and 3 times with an average of 3 times per day. The overall average commuting for all students was 0.3 times per days.

Lab Usage: Matlab

- 1) During weekdays: only 30 (60%) used the lab from 1-12 hours per week with an average of 4.3 hours per day. The lab overall average usage of all students was 2.6 hours per day. There were 22 students commuted to the lab between 1 and 8 times to work on Matlab with an average of 3.5 times per week. The overall average commuting for all students was 1.6 times per day.
- 2) During weekends: only 19 (38%) students used the lab from 1-6 hours per week with an average of 2.9 hours per day. The lab overall average usage of all students was 1.1 hours per day. Only 11 students commuted to the lab to work on Matlab between 1 and 2 times with an average of 1.2 times per day. The overall average commuting for all students was 0.3 times per days.

Lab Evaluation

As shown in table 3, the overall lab evaluation was very good. Most of students (94%) evaluated the “lab hours” and “accessibility” as good, very good, or excellent.

Lab Impact on Students’ Academic Performance

When students asked if they believe current lab hours have any impact on their academic performance, 19 (38%) students believe it has positive impact, 23 (46%) believe it has no impact, 3 (6%) believe it has negative impact, and 5 (10%) did not select any. The following is the list of comments by each group of students:

Table 3: Overall Evaluation of Lab Hours and Accessibility

Evaluation	Frequency	Percent	Cumulative Percent
1) Excellent	11	22.0	22.0
2) Very Good	26	52.0	74.0
3) Good	7	14.0	88.0
4) Satisfactory	1	2.0	90.0
5) Poor	2	4.0	94.0
6) No Selection	3	6.0	100.0
Total	50	100.0	

Comments of students with positive impact choice

Most of the student commented that the lab hours were fine. Some students, however, would like to have extended hours or more access to the labs. More analyses are needed to identify students (part time or full time) of each category. The following is sample of students' comments grouped by the theme of the comments:

Accessibility- More Lab Hours

1. I would like lab to be open earlier in the morning and later at night. Twenty-four hours would be excellent.
2. Yes, because if a lab is not open, I'm wasting my time by waiting for one to open.

Accessibility- Lab Hours are Fine

3. The lab hours are more than enough to fit my need any time in my schedule needs.
4. There is always a lab open.

Comments of students with negative impact choice

Two students requested extended lab hours or more access to the labs. However, the third comment is actually a positive comment. Probably students choose the wrong box. The following is a list of all comments:

1. I have only once not been able to find a lab when I needed one. (*Full time students, working less than 20 hours a week, and commutes 2 miles*)
2. When I come into use a computer lab, the only one that is open is ET 315. Most of the time it is full so they should have the other labs at better times. (*Full time students, working full time, and commutes 35 miles*)
3. No, because during my current semester there is always an open lab for me to come to and do my homework. (*Full time students, working less than 20 hours a week, and commutes 6 miles*)

Comments of students with no impact choice

Either students have the software at home, or they believe the current lab hours are fine. Most days the lab is open in the middle of the day until 5 or 7.

Citrix Potential Impact on Students' Performance

When students asked if they believe remote access to the programs will have any impact on their academic performance, 40 (80%) students believe it has a positive impact, 4 (8%) believe it has no impact, 2 (4%) believe it has a negative impact, and 4 (8%) did not select *any*. *Please note student filled the survey after one week of running the server; therefore, some students already started using it when they filled the survey.*

Comments of students with positive impact choice

Summary: most of the student commented that they will give flexibility to access the software at any time, less commuting, saving time and money, and convenient. The following is sample of the comments:

Saving Time and/or Money

1. Save me \$ not having to drive.
2. It will be easier on the weekends when I don't want to travel for use of Matlab or AutoCAD.
3. Students will not have to take as much time to come to campus if they need to use the software.

Flexibility and Convenient- Access at any time

4. It will allow me to work more around my own schedule
5. I can get homework done faster because I can do it after I get home from my second-shift job.
6. Give more opportunities of convenience.

No Impact

7. I am not limited to the number of hours, and certain times, that any building is open.
8. I can do homework in the comfort of my own home.
9. I could access the software from any computer whenever I would like to work on my homework. I am not always at home when I work on homework.
10. I may find a program that I don't have access to off campus.

Already Used It

11. I have already used the Citrix server and I love it! I like how I can spend more time at home on my own computer. I'd be very disappointed if the Citrix server were taken away.
12. Since the remote access has been running I typically use it more than I ever did the on-campus software. It allows me to practice. My roommate said that he would have done better in AutoCAD if they would have been able to have the remote access.
13. I have already been using Matlab at home. My dial-up is too slow for CAD.

Comments of students with negative impact choice

There will only two comments listed under this category:

14. You will have less time spending on other classes.

15. I don't really think it makes much of a difference.

Comments of students with no impact choice

Summary: students either have software at home or not engineering students. The following is a list of their comments:

16. I rarely need to work off campus. Also, I am taking only one engineering class, so this is unlikely to impact me.
17. I have the software packages at home.
18. I have access

Lab recommendations to improve academic performance

When students asked about steps they recommend, pertaining to the labs that may improve their academic performance, they either recommended "do nothing," requested more lab hours, or more privacy in the lab. The following is the list of selected comments:

Labs Are Fine

1. At the time I would say finding time to get into here when I need to print stuff out. So I simply need to organize and plan better.
2. Designate a full-time open lab.
3. I do not understand what this question is asking. The only improvements would be to keep the Citrix option.

Accessibility- More Time

1. Maybe longer hours on weekend.
2. Have the labs open earlier in the mornings because I came to class early before to work on homework and none were open.
3. Have a lab open late at night for full-time workers.

Convenient issues

1. Easy access to food and drink. A little more privacy from the next person.
2. Have a separate lab for Matlab, one for AutoCAD and one for Multisim separate.
3. I think access to software off campus would be a huge benefit.

Other

1. Pass out free copies of AutoCAD.
2. Set times, be ready to work, work until you're done.
3. I believe the labs are not the problem, it's the doing the homework that sucks.

Final Survey

There were 48 (96%) engineering students participated in this survey: 36 (72%) freshmen, 8 (16%) sophomore, 2 (4%) junior, 2 (4%) senior, 1 (2%) student with no selection. There were 42 (84%) male, 7 (14%) female, and 1 (2%) with no selection. There were 43 (86%) full time students and 7 (14%) were part time students. Most of the students 35 (70%) were employed as follows: 8 (16%) students working full time, 15 (30%) working part time with 20 or more hours per week, and 12 (18%) were working part time with less than 20 hours per week.

In the final survey, there were 28 (56%) working and full time students. Out of the 28 students, there were 3 (6%) students employed full time, 14 (28%) students employed 20 hours or more and 11 (22%) students working less than 20 hours per week.

There were 40 (80%) students living off campus and 10 (20%) students living on campus. The range of distance commuted for students living off campus was between 1 and 40 miles and an overall average of 12.9 miles. Almost all students have a computer at home or have access to one off campus as follows:

- | | |
|--------------------|----------|
| 1) Dial up | 7 (14%). |
| 2) DSL | 14 (28%) |
| 3) Cable | 13 (26%) |
| 4) Satellite | 1 (2%) |
| 5) LAN (On Campus) | 10 (20%) |
| 6) Other (Fios) | 3 (6%) |
| 7) No Selection | 2 (4%) |

Only 27 (54%) students owned AutoCAD, 13 (26%) owned Matlab, and 11 (22%) owned both programs.

Lab Usage: AutoCAD

- 1) During weekdays: only 33 (68%) students used the lab from 1-6 hours per week with an average of 3.7 hours per day. The lab overall average usage of all students was 2.5 hours per day. There were 24 students commuted to the lab between 1 and 8 times to work on AutoCAD with an average of 3.1 times per week. The overall average commuting for all students was 1.5 times per day.
- 2) During weekends: only 19 (38%) students used the lab from 1-7 hours per week with an average of 2.5 hours per day. The lab overall average usage of all students was 1 hours per day. Only 13 students commuted to the lab to work on AutoCAD between 1 and 3 times with an average of 2 times per day. The overall average commuting for all students was 0.5 times per days.

Lab Usage: Matlab

- 1) During weekdays: only 30 (60%) students used the lab from 1-10 hours per week with an average of 5.3 hours per day. The lab overall average usage of all students was 3.2 hours per day. There were 21 students commuted to the lab between 1 and 6 times to work on Matlab with an average of 3.7 times per week. The overall average commuting for all students was 1.6 times per day.
- 2) During weekends: only 19 (38%) students used the lab from 1-6 hours per week with an average of 1.4 hours per day. The lab overall average usage of all students was 1 hours per day. Only 11 students commuted to the lab to work on Matlab either 1 or 2 times with an average of 1.2 times per day. The overall average commuting for all students was 0.3 times per days.

Lab Evaluation

As shown in table 4, the overall evaluation of the computer lab was very good. Most students (90%) evaluated the lab hours and accessibility as good, very good, or excellent.

Citrix Users

In general, the response to the Citrix sever was very good. There were 25 students used the server during the trial period. This means that 50% of students filled the survey and 42% of all students in all sections used the server. There were 28 (56%) students indicated that they will use or continue to use the server in the future, 5 (10%) students will not use it in the future, and 17 (34%) students were undecided. Out of 25 students who used Citrix, 9 (36%) indicated that they will use Citrix in the future and the rest 16 (64%) did not make any choice.

Citrix AutoCAD Usages

During weekdays, 15 (60%) students accessed the server to work on AutoCAD from 1-5 hours with an average of 2.3 hours per day, 6 (24%) students did not use the server at all, and 4 (16%) students did not fill any hours. During the weekends, 14 (56%) students used AutoCAD from 1-5 hours with an average of 2.4 hours per day, 7 (28%) students did not use the server at all, and 4 (16%) did not fill any time.

Table 4: Overall Evaluation of Lab Hours and Accessibility-
Final Survey

Evaluation	Frequency	Percent	Cumulative Percent
1) Excellent	12	24%	24.0
2) Very Good	22	44%	68.0
3) Good	9	18%	86.0
4) Satisfactory	3	6%	92.0
5) Poor	2	4%	96.0
6) No Selection	2	4%	100.0
Total	50	100%	

Citrix Matlab Usages

During weekdays, 15 (60%) students accessed the server to use Matlab from 1-10 hours with an average of 3.0 hours per day, 6 (24%) students did not use the server at all, and 4 (16%) students did not select fill any time. During the weekends, 14 (56%) students used AutoCAD from 1-3 hours with an average of 1.9 hours per day, 7 (28%) students did not use the server at all, and 4 (16%) did not fill any time.

Citrix Technical Evaluation

Table 5 shows the results of Citrix users' evaluation. The table shows that 96% of the users evaluated the instructions as good or better; 92% considered the server connection time was good or better; 88% believe that the sever response time was as good or better. The overall quality of the server was good or better by 96% of the students. Only one student evaluated the server overall quality as poor because he was not able to install the server client on his machine as mentioned in his comment.

Table 5: Citrix Technical Evaluation

Criteria	Excellent		Very Good		Good		Satisfactory		Poor	
	No.	%	No.	%	No.	%	No.	%	No.	%
1) Instructions to download the server	10	40%	9	36%	4	16%	1	4%	1	4%
2) Server Connection Time	7	28%	10	40%	6	24%	2	8%	0	0%
3) Server Response Time	6	24%	10	40%	6	24%	2	8%	1	4%
4) Server Overall Quality	10	40%	10	40%	4	16%	0	0%	1	4%

Citrix Problems

As shown in Table 6, 68% percentages of students did not face any trouble using the serve, 20% indicated that they had some trouble, 12% did not make any selection.

Table 6: Citrix Evaluation

Criteria	Frequency	Percent
1) Yes, I faced some troubles using the server	5	20%
2) No, I did not faced any troubles using the server	17	68%
3) No Selection	3	12%
Total	25	100%

The following is the list of comments and recommendations by students who faced troubles in using the Citrix server or did not make a selection but wrote a comment. In summary, most students faced minor troubles like slow server, losing AutoCAD settings, and troubles in setting up the server.

1. It worked on my desktop, but would not work on my laptop. Also, every so often it would get very slow. I recommend adding visual basic studio. I can save my files to my computer and the Citrix server.
2. When I would use AutoCAD at home, when I would come back into lab, I would have to restart it.
3. I wish that it would recognize a flash drive when the program already opened.
4. Could not access very effectively with IP address. Software was too slow to use. Recommend faster software and I would use all the time.
5. The install directions sucked. It took forever to get it working. Recommendations to make it easier to install initially.
6. I tried to set it up quickly but it was not successful. I have not tried since.

It is worth mentioning that all 4 out of 5 students who had trouble with the server either agree or strongly for strongly recommend the server to the ETS.

The following is the list of all comments and recommendation by students who did not face any trouble using the server. In summary, students would like to have more programs, to keep the server, and work on making the server respond faster.

1. Recommend faster response when connected.
2. Just keep it
3. I really liked the CITRIC server it was very handy.
4. I had to come to class everyday anyway so it made no difference.
5. It was a bit slow at the some instances but overall worked well.
6. Stop windows from freezing all the time.
7. Add more programs (programming and others).
8. Pre-set some templates and settings for AutoCAD.
9. Add the settings to AutoCAD so we do not have to do it ourselves (layers, templates, etc.

Citrix and Academic Performance Evaluation

Table 7 summarizes the evaluation of saving time and improving academic performance after using Citrix. The following is the summary of the key points from the table:

- 1) Time: 72% of students agreed or strongly agreed that the server has reduced their commuting time to campus. Only 1 (4%) student strongly disagreed because he was not able to use the server. In addition, 80% of students agreed or strongly agreed that the server has provided them with more time to study at home. Only 2 (8%) students disagreed or strongly disagreed with this point. In conclusion, the most students agreed that Citrix has reduced their commuting time and provided them with more time to study at home.
- 2) Grades-Exam & Homework: 80% of students agreed or strongly agreed that the server has improved their grades in the homework. Only 2 (8%) students disagreed or strongly disagreed with this point. In addition, 68% of students agreed or strongly agreed that Citrix has improved their exam grades. Only 2 (8%) students disagreed or strongly disagreed with this point. In conclusion, the most students agreed that Citrix has improved their grades in both homework and exams in general and in the homework grades in particular.
- 3) Grades-Courses: 80% of students agreed or strongly agreed that the server has improved their grades in the Citrix related courses. However, only 1 (4%) student disagreed or strongly disagreed with this point. In addition, 68% of students agreed or strongly agreed that Citrix has improved their grades in other courses. However, 16% of students disagreed or strongly disagreed with this point. In conclusion, most students agreed that Citrix has improved their grades in all courses in general and Citrix related courses in particular.
- 4) Citrix Server- Evaluation and Recommendations: 80% of students agreed or strongly agreed that their overall experience with the server was excellent. However, only 1 (4%) student disagreed or strongly disagreed with this point. In addition, 84% of students agreed or strongly agreed to recommend strongly adopting Citrix server by the College of Engineering, Technology, and Computer Science permanently. However, 8% of students disagreed or strongly disagreed with this point. In conclusion, most students agreed that their experience with Citrix was excellent and recommend strongly that the college adopts the server permanently.

Table 7: Citrix Academic Evaluation

Citrix Benefits	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
	No.	%	No.	%	No.	%	No.	%	No.	%
1) Reduce commuting time	15	60%	3	12%	6	24%	0	0%	1	4%
2) Provide more study time at home	13	52%	7	28%	3	12%	1	4%	1	4%
3) Improve homework grade	10	40%	10	40%	3	12%	1	4%	1	4%
4) Improve exam grades	6	24%	11	44%	6	24%	1	4%	1	4%
5) Improving Citrix related course grades	9	36%	11	44%	4	16%	0	0%	1	4%
6) Improving other courses grades	11	44%	6	24%	4	16%	3	12%	1	4%
7) Students' overall experience with the server was excellent	10	40%	10	40%	4	16%	0	0%	1	4%
8) Overall, students strongly recommend using Citrix server	14	56%	7	28%	2	8%	1	4%	1	4%

Conclusions and Recommendations

The pilot study was successful with 85% participation of students attending ENGR 120 and ENGR 12. The overall evaluation of the labs was very good or excellent in the initial and the final surveys by most of the students. However, some students would like to have extended hours or more access to the labs.

There were 25 (42%) Citrix users in both classes of which 22 students were employed and most of them (18) were working 20 or more hours per week. In conclusion, most students agreed that Citrix server:

- Reduced their commuting time and provided them with more time to study at home;
- Improved their grades in both homework and exams in general and in the homework grades in particular;
- Improved their grades in all courses in general and Citrix related courses in particular; and,
- Their experience with Citrix was excellent and strongly recommends the college to adopt the server permanently.

This study was conducted in limited number of courses and during the spring semester where the number of students in both classes are much less than the fall semester. This study preliminary conclusion recommends that the College of Engineering, Technology, and Computer Science at IPFW adopts the Citrix server for at least one year and run the surveys again for better evaluation.

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