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# **AC 2010-238: EDUCATIONAL OPERATIONS FOUR DAYS A WEEK**

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# Educational Operations Four Days a Week

## Abstract

Four day work weeks have been employed by industry, state agencies, and recently by higher education. The generally perceived benefit of the four day work week is reduced energy costs. These costs savings include more efficient building operations and less energy consumption driving to a facility. The generally perceived negative impact of four day operations, particularly of state agencies, is a decreased level of service.

How much energy would be saved and could the level of service be maintained in a higher educational environment by switching from five to four day weeks? This study occurs at a regional university within an Industrial and Engineering Technology department that has exclusive use of a building. The department contains seven degree programs ranging from TAC-ABET programs to non-accredited technical degree programs. During the study period all classes and laboratories were scheduled Monday through Thursday. Staff only worked Monday through Thursday. Faculty but not students could gain access to the building on Fridays.

The objective of this paper is to study the costs, benefits, and educational impacts of changing the five day academic and building availability week to four days a week. The paper will present the costs savings and the results of a survey of stakeholders collected during one academic quarter. The results of the energy costs are presented in tabular form and the results of the survey are presented in graphical form. The data and conclusions are expected to help decision makers make informed decisions when contemplating an alternative work schedule for higher education.

## Existing Work Schedule Practices

Four day work weeks are not a new practice, however very little has been written or studied about the affects of this practice<sup>1</sup>. Additionally until recently the concept of some type of alternative work schedule has not been widely accepted<sup>2</sup>. The objective of this study was to study the effects of changing the academic work week from five to four days.

Flexible or alternative work schedules can take the form of a compressed work week, flexible hours, or telecommuting. A compressed work week is generally working four, ten hour days, four days a week or nine hours a day with every other week only being four instead of five work days. The typical university works on a five day work week, although classes may only be scheduled four days a week, buildings and services are available five days a week. Flexible hours generally allow workers to come and go and work at variable times, with generally a core period of time everyone is expected to be at the office. This is generally how university faculty work, schedules are flexible but classes are generally fixed between certain hours, however classes are normally scheduled all five days of the week. Telecommuting allows workers to work certain days of the week from home. With online classes becoming more common, some traditional face to face university learning is being shifted to “telecommuting” type of working and learning.

The perceived benefits of a compressed work week are reduced costs from a reduction in energy usage. The reduction is generally from an institution being able to shut down or reduce a building's thermal and electrical systems one extra day a week. Energy reductions are also incurred by individuals that commute to work one less day a week. Other benefits cited in the literature are increased productivity, reduced absenteeism, improved employee morale, increased job satisfaction, improved work-life balance, decreased stress and reduced personal costs<sup>2&3</sup>. The perceived disadvantages of a compressed work week are a decreased level of service, difficulty of scheduling, longer work days, carpooling and child care challenges<sup>2&3</sup>.

Shifting to a compressed work schedule has recently become popular. For example, the state of Utah in 2008 established "Working Utah" where 17,000 state employees work a compressed four day work week and 1000 state buildings are closed on Fridays<sup>4</sup>. The reasons given for this work schedule was an anticipated energy savings in the buildings and less traffic. Recently it was found another actual savings was reduced overtime costs, workers are not inclined to put in an extra few hours after working a ten hour day<sup>5</sup>.

A few institutions of higher education have recently tried a compressed work schedule. For example Brevard Community College in Florida instituted a four day work week in 2007 during the summers and extended it the entire academic year in 2008. Brevard has found that it saved \$474,000 in energy costs, have 50% fewer sick hours and turnover is down by 44%<sup>6</sup>. Florida International University (FIU) started a four day work week for the summer session in 2008. FIU saved over \$250,000 by closing selected buildings on Fridays and a survey indicated most employees were satisfied with the program<sup>7</sup>. In the spring of 2009 SUNY Canton switched to four day work weeks and hoped to save \$250,000 a semester<sup>8</sup>. All of the above institutions also cited another reason behind moving to four day week was sustainability, the ability to reduce commuting and energy consumption by students and employees.

### **Central Washington University's Case Study**

This study was performed around the Industrial and Engineering Technology (IET) department at Central Washington University (CWU). CWU is a public, regional university located in Ellensburg, WA about 100 miles east of Seattle. The main residential campus has a student population of about 8,000 students and operates on the quarter system. The university has and continues to experience significant budget shortfalls stemming from state deficits.

The IET department offers Bachelor's of Science degrees in: Construction Management, Electronic and Mechanical Engineering Technology, Industrial Technology, Technology Education, Safety and Health Management and a Master's of Science in Industrial Technology. The department has about 20 faculty and staff and serves over 400 student majors. The department is located in the Hogue Technology building. This building is solely controlled by the IET department and contains laboratories, offices, and classrooms used exclusively by the IET department.

In academic year 2008/2009 the university experienced budget shortfalls and university wide budget exercises were performed to plan for reduced budgets. Funding for the following two academic years was reduced even further in July 2009.

As a means to reduce energy costs and foster sustainable living the department switched from a five to four day work week. The decision to make this switch was discussed and voted on during an all hands faculty meeting. Most faculty favored such a shift but a very vocal minority was vehemently opposed to offering reduced services for students. An excerpt for the department chairs letter explaining the shift reads “To reduce operating costs, energy expenditures, and provide sustainable leadership on campus the Hogue Technology Building will only be open for normal business Monday through Thursday spring quarter 2009. Classes have been modified to fit this schedule, staff will be in the building for extended hours M-Th and the computer lab will continue to be open M-Th until 11PM and Sunday from 3PM to 11PM. The department understands that there is a potential that this modified schedule may impact students ability to access certain laboratories. Faculty and staff encourage students to work within these modified parameters by modifying their behaviors and plan out intended laboratory work to avoid last minute crunches. As in industry constraints are a fact of life. “Staff worked four days a week and only faculty had access to the building on Fridays.

The spring schedule modification was a pilot project. Potentially, the modified schedule would cover the entire academic year. The IET department worked with facilities management to track accurate cost savings and developed quantitative metrics to ensure the department cost savings was worth the potential reduction in service to students, internal and external constituencies. Additionally a survey of faculty, staff and students was conducted in the spring of 2009 to gauge the qualitative affects of this change. Classes for the fall of 2009 were scheduled four days a week, however due to vocal minority opinion, the department chair changed the building operation hours back to five days a week for the fall of 2009. Thus the study performed only contains one quarter of data.

The switch from five to four day work weeks was expected to achieve the following benefits:

- Reduced operating costs for electricity and heat
- Reduced personal costs for commuting one day less a week
- Increased efficiency of faculty by having a day without classes to schedule meetings, prepare for classes and perform research
- Leadership role model for sustainability on campus
- Provide an optimal time to conduct field trips “Field Trip Friday”

The switch from five to four day work weeks could potentially produce the following negative impacts:

- Decreased level of service for students
  - Less available time for using the computer lab that contained specific software used in classes but not available to the students at home, i.e. AUTOCAD, Solid Works, Timberline estimating, etc
  - Less time available to students completing senior and class projects in machine and layout laboratories
- Apparent decrease in service to visitors and other departments on campus

## Method of Cost Data Collection and Survey

While other universities, corporations and government agencies have instituted a compressed work week and provided evidence of the savings, there is not much information about how many buildings or what type of buildings were closed. There is nothing about the methodology of how the savings were determined.

In this comparison, utility data was obtained from the Facilities Management Department (FMD) to determine if money was being saved. Data was obtained for March, April, and May of 2008 and 2009. Electronic metering exists on all the transformers on campus. The electrical consumption data is read directly from the meter in the form of kWh and stored in a computer database. There are two transformers that feed power to the Hogue Technology Building. Data was obtained from these two transformers for the prescribed time period.

FMD also measures the amount of steam condensate that is pumped back to the central heating plant from all the steam heated buildings on campus. This information can then be converted to therms (1 therm = 100,000 BTU's). The amount of condensate that is pumped out of a building is directly proportional to how much steam the building uses. The computer system records the meter reading once an hour. Equation 1 demonstrates how gallons of condensate are converted to therms.

$$\frac{(X \text{ gallons of condensate})(1040 \text{ Btu/lb})(8.33 \text{ lb/gal})}{100000 \text{ Btu/therm}} = \text{therms} \quad (1)$$

In order to compare therm consumption from one year to the next, the data has to be normalized by heating degree day (HDD). CWU uses 65° as the HDD temperature. Normalizing accounts for the difference in temperature from one year to the next so that you can make a more accurate comparison and is shown in equation 2.

$$\left( \frac{\text{Total Therms}}{\text{Total HDD}} \right) (\text{Average HDD past 6 years}) = \text{normalized therms} \quad (2)$$

Note: Total therms/HDD were one month time periods and average HDD is the same month averaged for the past 6 years.

A survey, via the web, was conducted that asked the same questions of the students and the faculty (the faculty survey also include two staff members). Twelve of the 20 faculty and 69 students responded to the survey. Two additional questions were asked of the faculty. One was if having class four days a week made them more productive and the second was if having classes four days a week made them more productive in terms of preparation, research, and service. The survey questions and results are included in the findings section.

## Findings

### Cost Savings

The Hogue Technology building has a univent heating system. This means that there is a heat exchanger and fan in each room (much like a Motel 6). The building automation system controls the fans and provides the schedule as to when the fans are on or off. The temperature for each univent is a locally controlled by a pneumatic thermostat for that individual univent. If the room needs to be heated, the heating valve is opened and outside air is blown across the heat exchanger. When the thermostat is not calling for heat, the heating valve is closed and there is an economizer damper inside the univent that draws air from the room. The building automation system has two modes: occupied and unoccupied. During occupied mode, the fans are operating and maintaining the temperature set point. In unoccupied mode, the fans only come on at a much lower temperature set point and shut off prior to reaching occupied mode temperature set point<sup>9</sup>.

Monday through Thursday the building was in occupied mode from 04:00 AM to 5:00 PM. On Friday and Saturday the building was in unoccupied mode. On Sunday the building went into occupied mode from 12:00 PM to 5:00 PM (One computer lab was open)<sup>10</sup>.

As shown in Table 1, the total kWh saved was \$530 for the period of March, April and May.

Table 1 *kWh Consumed at Hogue Technology Building*

Month	Year 2008	Year 2009	Difference	Dollar
March	21391.16	20879.13	512.03	\$20
April	23197.75	19172.63	4025.12	\$161
May	25258.13	16526.88	8731.25	<u>\$349</u>
			Total	<b>\$530</b>

*Note.* kWh calculated at annual average of \$0.04/kWh.

The increased savings in May versus March could be attributed to more daylight hours (lights off for longer periods). Also the authors observed a greater sense of environmental awareness among the faculty and staff during the test period, for example people seemed to be turning off lights more often in classrooms and offices when they were not needed.

The results of reduced steam usage are shown in Table 2 and demonstrate a savings of \$812 in the cost of therms.

Table 2 *Therms Consumed at Hogue Technology Building*

Month	Year 2008	Year 2009	Difference	Dollar
March	2760.17	2363.87	396.30	\$373
April	1758.11	1660.96	97.15	\$91
May	1584.73	1214.41	370.32	\$348
			<b>Total</b>	<b>\$812</b>

*Note.* Therms calculated at annual average of \$0.94/therm. Therms normalized by HDD.

Summing the kWh and therm amounts yields a total savings of \$1342. Assuming the quarterly saving is about \$1300 per quarter (excluding summer) the estimated annual cost saving is about \$3900. Summer is not included in this assumption since the building is not air conditioned. The saving of a few thousand dollars may not seem like much, but when compared to the department's annual Goods and Services (GS) budget of about \$24,000, the magnitude of \$3900 is approximately 16% of the GS budget. This is just a demonstration of the potential energy savings. When you think about a university's annual energy budget, , and the savings across several buildings and with high heating and cooling loads, these reductions could be substantial.

### Survey Results

Faculty were asked if having classes four days a made them more productive in terms of class preparation, research and service. Figure 1 shows that the faculty felt that having Friday to prepare for class, conduct research or service was positive or in terms of the question it improved their quality of life. Also in Figure 1 the students feel having class only four days a week improved their quality of life.



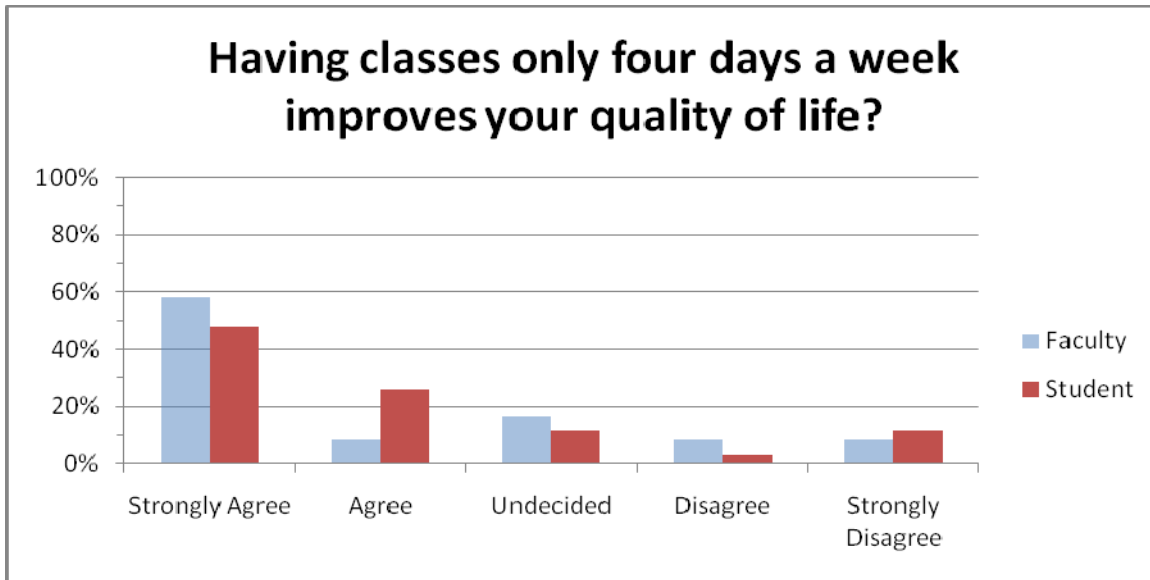


Figure 1. Faculty and student responses to whether having class four days a week improves their quality of life

Figure 2 clearly shows both faculty and students like having classes only four days a week, provided the building was open on the day there were not any classes.

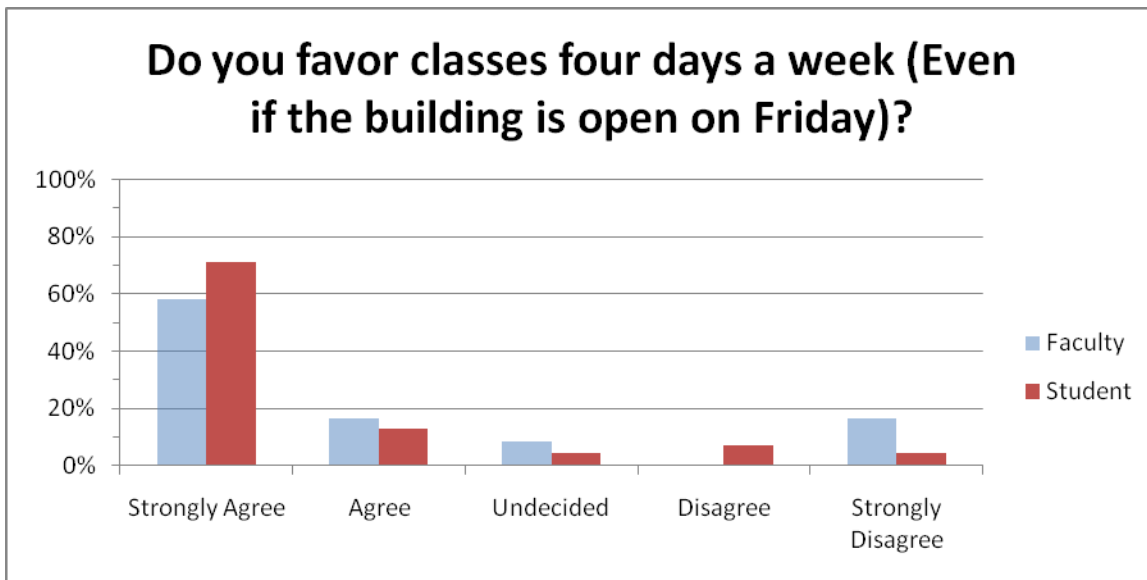


Figure 2. Whether faculty and students favor classes four days a week

Figure 3 shows most students do not favor classes five days a week, however, a few were not sure as indicated in approximately 40% of respondents indicating they were undecided or disagree with having classes on Fridays.

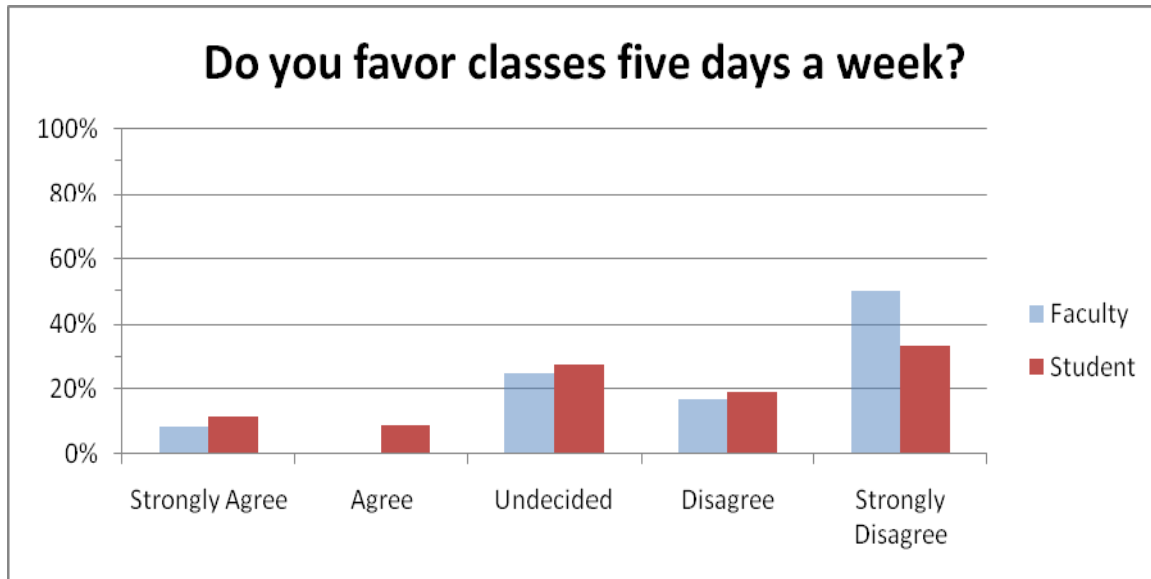


Figure 3. Whether faculty and students prefer classes five days a week

Although most students and faculty favored classes four days a week, Figure 4 shows a higher percentage of respondents are sure they do not want the building closed on Fridays. However, the tendency for most respondents is that having the building closed one day a week does not matter that much as indicated by the similar scores from strongly agree to disagree. Again faculty had access to the building on Fridays, students did not.

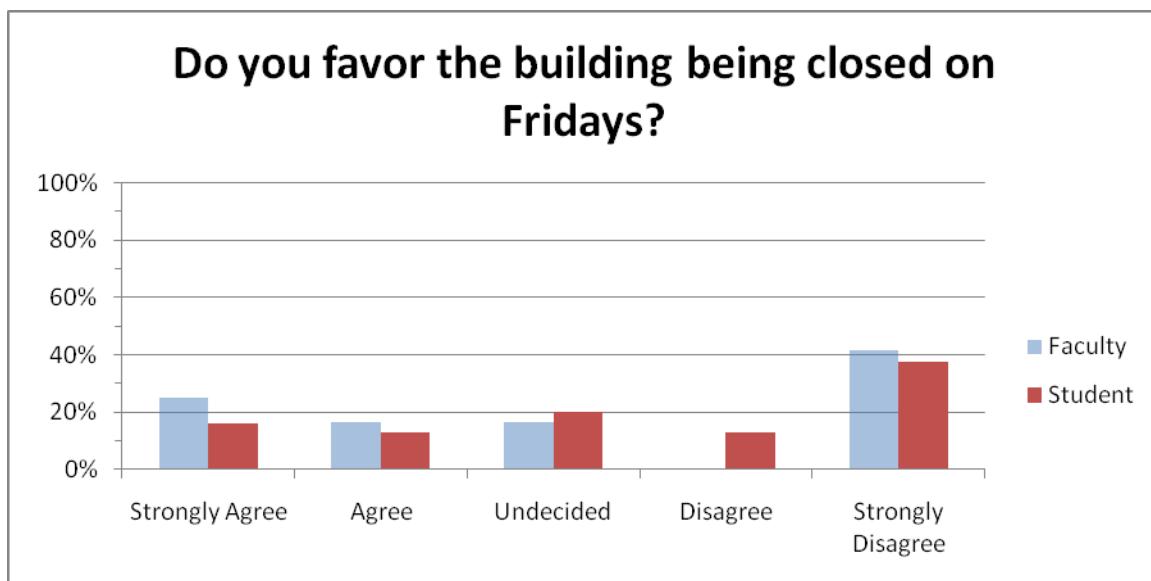


Figure 4. Whether faculty and students favor the building being closed on Fridays

Figure 5 shows how the respondents felt about the building being closed on Fridays and this effect on student learning. The replies are mixed, no clear indication from either faculty or students feel education is negatively impacted.

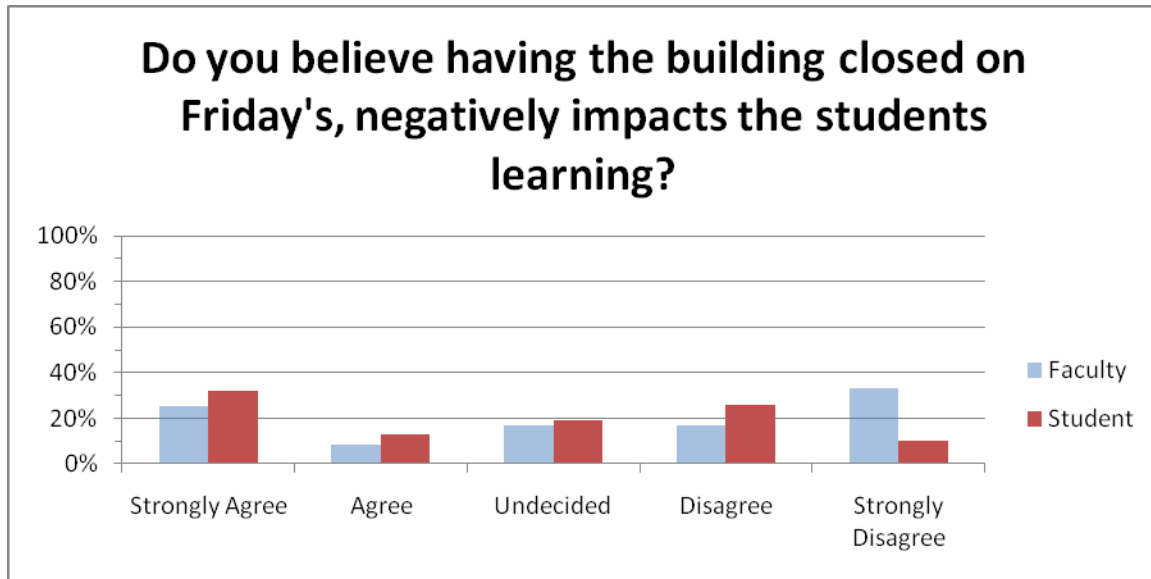


Figure 5. Whether the faculty and students believe having the building closed on Friday's negatively impacted the students learning

Figure 6 shows how many students and faculty continue to come to town on Fridays even without having any classes on Fridays. The survey was trying to determine if personal transportation cost would be lower and consumption of gasoline would go down. Students still came to town but faculty responses were mixed, indicating they still came to town maybe not as often as five days a week.

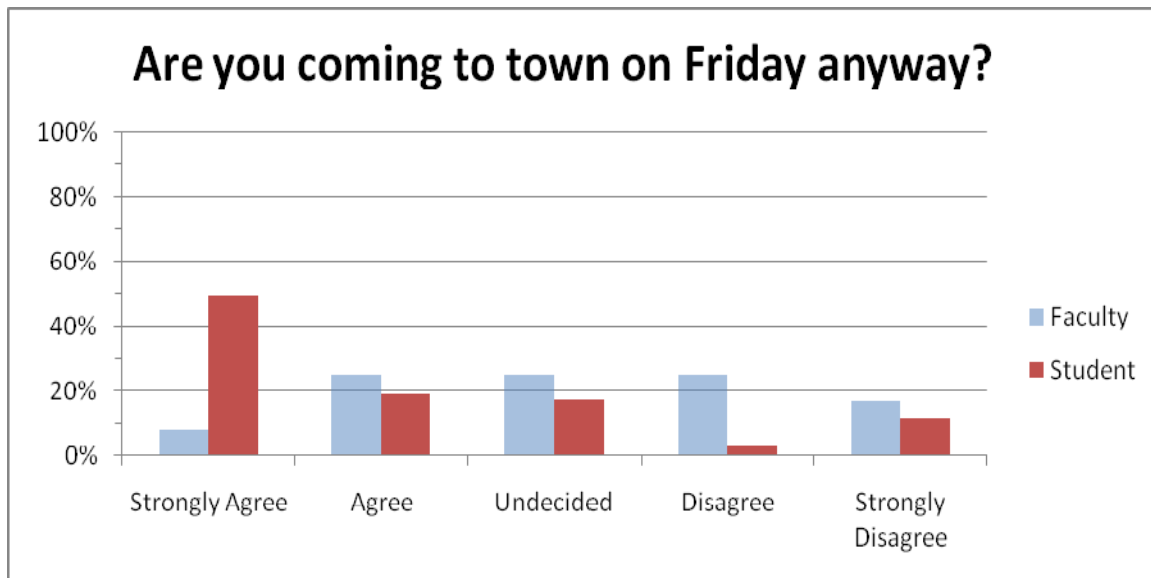


Figure 6. Whether faculty and students are coming to town on Friday Anyway

Figure 7 indicates that both faculty and students live close to the University. Combine results of Figure 6 and 7, most students continued coming to town and given the relative short distance to town, personal cost and fossil fuel consumption reduction was minimal.

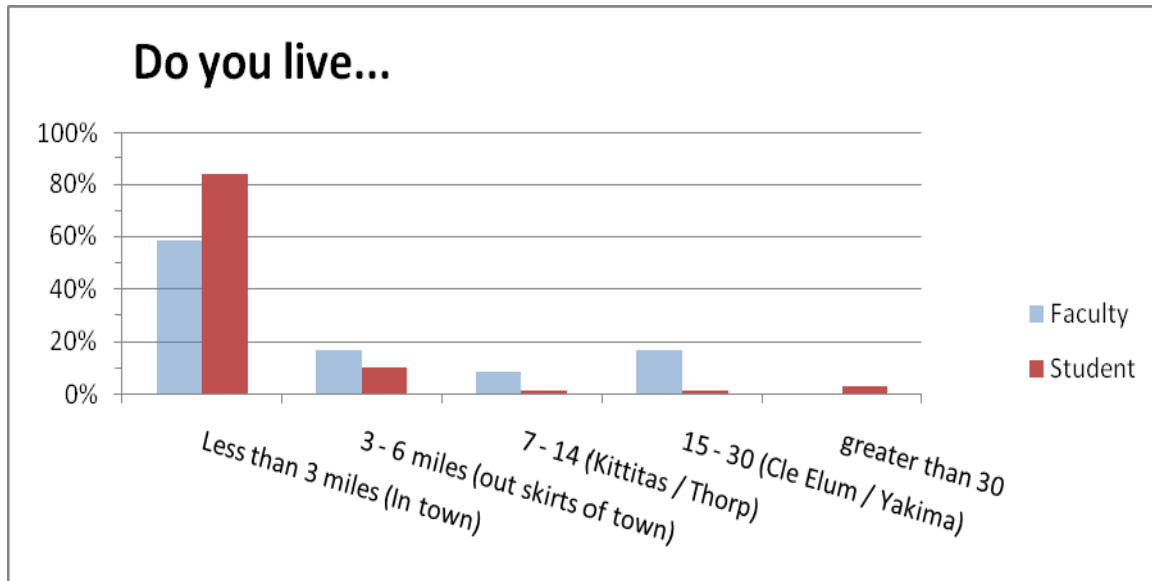


Figure 7. Faculty and student population in relation to the Hogue Technology Building

Figure 8 shows that most students and faculty normally do not drive to school every day.

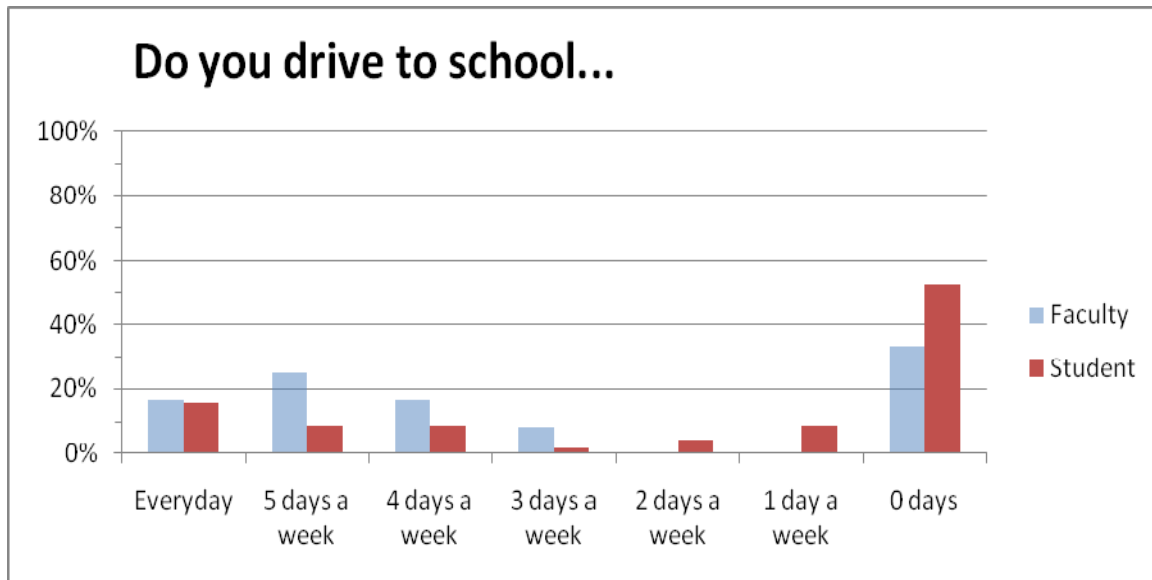


Figure 8. Faculty and students that drive to school.

Figure 9 shows most faculty drive to work and student either walk or drive. Since most students walk or ride a bicycle to school the reduction in transportation costs and fossil fuel consumption was minimal.

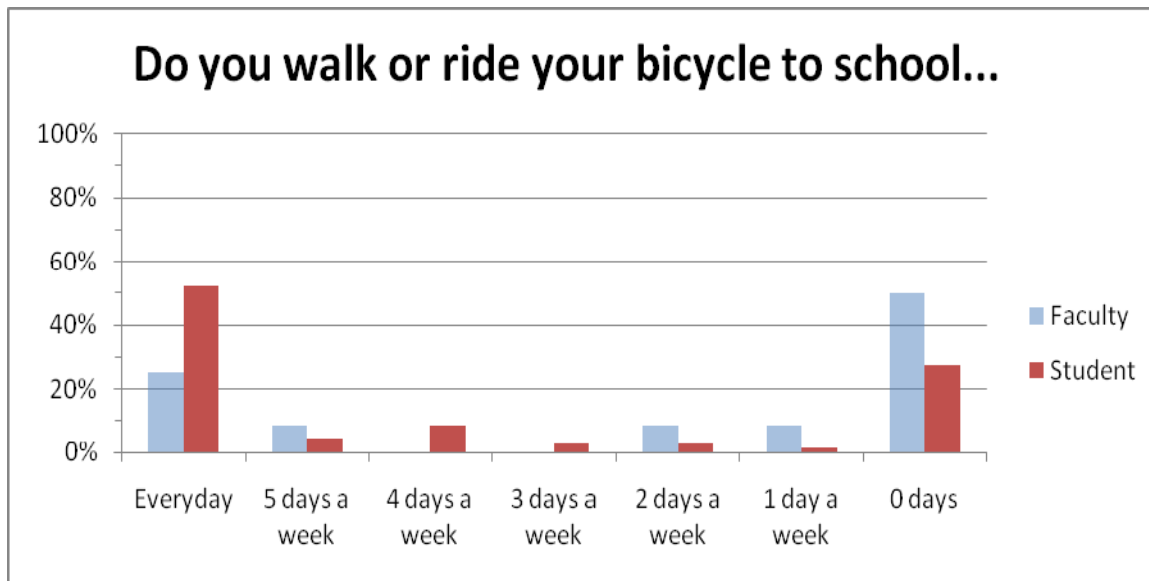


Figure 9. Faculty and students that walk or ride their bicycles to school

The survey participants were also invited to provide additional feedback comments. There was no real consensus among the faculty comments. Their comments tended to include a pro and con to having the building closed on Fridays. The students were split on liking or disliking the fact that the building was locked on Fridays.

### Conclusions

A technical degree oriented academic department changed from a five to four day work week. The authors presented documented cost savings and the results of a survey of both students and faculty. Unfortunately the pilot project was only conducted for one academic quarter. A better analysis would have covered an entire academic year. Even for the short period of time that the energy consumption was monitored, real savings in energy costs were realized. The magnitude of the cost savings, although small for a single building, could be significant for a campus. The univent HVAC system in the Hogue Technology building does not draw in a lot of outside air. This is significant when it is cold, or hot, outside because you do not have to consume as much energy to change the temperature of the air. Additionally this building is not cooled with air conditioning. Many of the other buildings on campus would see a much larger energy savings because their systems bring in more outside air and provide both heat and air conditioning. This energy savings would translate into real monetary savings.

One aspect of the study that everyone seemed to agree on was having classes only four days a week. As to whether the building should be closed on Fridays, the responses were mixed. Often the comments were both for and against the idea of having the building closed on Fridays. Students like the classes four days a week and being green, but wanted access to the labs on the

fifth day. The biggest complaint was not having access to software that only resided in one lab in the Hogue Technology building. Responses were also mixed on whether the building closure negatively affected student learning. Again the primary complaint was access to lab software that was not installed at any of the other campus computer labs.

This study demonstrated that there was no significant reduction in personal transportation cost and fossil fuel consumption. This was due to the short commuting distances in the rural college town setting of the University.

### **Future Work**

Unfortunately this work did not adequately address the impacts to student learning by changing from a five to four day weeks. A complete analysis that measures outcomes of the same classes offered five or four days a week would provide data to form an analysis on the impact to student learning.

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