# Table of Contents

Forward ................................................................................................................................................. 3
  * Steven H. VanderLeest*

Engineering Vocations for Women? ........................................................................................................... 4
  * Gayle E. Ermer*

Integrating Christian Faith with Academic Administration ........................................................................ 12
  * Otto J. Helweg*

Service-Learning Approaches to Intl. Humanitarian Design Projects: Assessment of Spiritual Impact ....... 19
  * Matthew G. Green, et. al.*

Faith-Based and Secular Experience on Rebuilding Engr.and CS Higher Education in Iraq ..................... 35
  * Benjamin S. Kelley, et. al.*

Electronic Portfolio for Assessment of a Christian Engineering Program .............................................. 48
  * Dominic M. Halsmer*

Responding to Academic Culture: From Research Focused to Teaching Focused Culture ...................... 55
  * Israel Dunmade*

Bias in Technology: From Creation or Fall? ............................................................................................... 61
  * Steven H. VanderLeest*

Christian Worldview and the Engineering Context .................................................................................... 70
  * Steven R. Eisenbarth and Kenneth W. Van Treuren*

Incorporating Christian Worldview into an Engr. Program and Its Assessment at Baylor University ...... 76
  * Kenneth W. Van Treuren and Steven R. Eisenbarth*

An Engineering Student Perspective on Ethics ........................................................................................... 85
  * William Jordan and Bill Elmore*

Observations upon Entering the Kettle ....................................................................................................... 99
  * Gary Spivey*

Faith in Christ and His Attributes — A Basis for Ethical Behavior .......................................................... 111
  * Ronald E. Terry, Steven E. Benzley, Val D. Hawks*
Forward

Greetings in the name of Christ! The fifth Christian Engineering Education Conference was an incredible gathering of committed Christian engineers who praised God with their minds and hearts through singing, conversation, presentations, panel discussions, and careful thinking about engineering education issues. Our conference was held on the campus of Westminster College and attended by over forty people from over two dozen institutions. We had 15 paper presentations, two panel discussions, and a worship time. Twelve of the papers appear in these conference proceedings.

I would like to thank the many people who helped make this conference a success. Our steering committee included Charles Adams, Adam Blankespoor, Dan Campbell, Gayle Ermer, Matthew Green, Paulo Ribeiro, Dave Shaw, Murat Tanyel, Jennifer VanAntwerp, and Wayne Wentzheimer. Special thanks go to Gayle – her fine work and dedication was absolutely essential and deeply appreciated. She helped immensely with the multitude of organizational details and also served as moderator for several of the conference sessions. A number of colleagues served as reviewers, including Charles Adams, Adam Blankespoor, Frank Duda, Israel Dunmade, Carl Erikson, Gayle Ermer, Paige Gibbs, Matthew Green, Dominic Halsmer, Otto Helweg, Bill Jordan, Ben Kelley, Paulo Ribeiro, Dave Shaw, Gary Spivey, Ron Terry, Jennifer VanAntwerp, Steve VanderLeest, Nolan VanGaalen, Ken VanTreuren, and Wayne Wentzheimer. Jeff Brown did a fantastic job meeting our needs as the conference director at Westminster. Finally, thanks go to Michelle Krul and Robin Zylstra for providing some clerical assistance.

Each paper author was asked to give their assent to the Apostle’s Creed and the Nicene Creed. This was a crucial point, particularly when colleagues from Brigham Young University submitted a paper. The steering committee carefully considered their submission and decided to accept it after a phone conversation confirmed their understanding of the creeds, particularly the concepts of the Trinity as well as the humanity and deity of Christ. The Church of Jesus Christ of Latter Day Saints (commonly known as Mormons) holds several texts sacred (such as the Book of Mormon) that traditional Christianity does not, so the steering committee asked the BYU authors to limit discussions of scripture to the Old and New Testaments of the Bible during the conference, as well as in their paper. They gave a lively presentation on ethics with a number of case studies. The associated paper is included in these proceedings.

It has become a tradition to hold a dinner meeting at ASEE in the years between the Christian Engineering Education Conferences. I am happy to report that our friends at George Fox University have begun planning to host an evening dinner gathering during ASEE in Portland, Oregon next year (June, 2005). We will post more details to the CEEC website (http://engr.calvin.edu/ces/ceec) as they become available.

The next CEEC is planned for June 21-23, 2006 (immediately following ASEE) in Chicago, Illinois. Please put this on your calendar and be thinking of how you can contribute – as a member of the steering committee, a reviewer, a paper author, on a discussion panel, a worship leader, or simply attending. Whether you can attend or not, we covet your prayers before and during the next conference.

Your Brother in Christ,

Steve VanderLeest
CEEC 2004 General Chair
Engineering Vocations for Women?

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Abstract
Despite small increases in the percentages of women students over the last twenty years, women are still significantly underrepresented in engineering. In other professions, for example, medicine and law, the number of female students has increased to the point where it nearly equals the number of males. In engineering, the percentage of female students entering the field has leveled off at something less than 20%. This paper will address the extent to which women are underrepresented in various engineering disciplines, both nationally and at Christian colleges. Three reasons why Christians should be concerned about this problem will be discussed. The first is the Christian concept of vocation, which views all Christians (male and female) as being called to serve our neighbors with the gifts God has given us. There is little evidence that women lack the gifts necessary to be good engineers. Biblical support can be provided for women having the freedom to use those gifts in a professional calling. The second reason includes fairness of opportunity for women to participate in a challenging and lucrative profession. The third reason is the requirement for enough engineers to keep our society functioning. Several reasons for the underrepresentation of females in engineering will be explored in order to identify the barriers that prevent young women from choosing engineering as a career and from completing an undergraduate engineering degree. These barriers appear very early in the educational experience of young girls and extend through college and into industry. The paper will present various ways to overcome these barriers in order to recruit and retain more female engineering students. These will include suggestions for individuals, for churches, and for educational institutions which will allow the gifts of creativity, analytical ability, and problem solving (among others) bestowed by God on both females and males to be better used for promotion of his kingdom here on earth.

Introduction
In 1986 I graduated from Calvin College as the only female out of 43 engineering students. Personally and professionally, I very much enjoyed my educational experience. I do not remember ever having to deal with discrimination based on being female. In fact, I may have received more encouragement from professors because I was female. Because I “stuck out” as a female, I may have been offered more opportunities, for example, being elected as a representative to and later president of the student engineering club. Since I was an independent learner, I was not hindered by my lack of access to male study groups. I also benefited from affirmative action when pursuing my doctoral degree at Michigan State University in the form of being awarded a ¼ time fellowship targeted for underrepresented minorities in engineering. Now, 18 years later, I am teaching at Calvin College and, fortunately, observe that there are more females in our program than when I was a student. Substantial progress has been made over the past 10 to 20 years at Calvin and elsewhere in involving more women and minority students in careers in science, mathematics, and engineering (not to mention other professions, like medicine and law).

However, I am still bothered by the fact that, although I see many female students in the lists of pre-medicine and pre-law graduates, there are still comparatively few in engineering. In the summer of 2002, I set out, with the help of some time provided by a Lilly Foundation Vocation Grant, to answer some questions about the involvement of women in engineering: To what extent are women underrepresented in engineering nationally and at Calvin? Why might we care, as Christians, that women are underrepresented in the fields of science and technology? Why are so few females interested in engineering? What barriers appear to be limiting their involvement with technology? And finally, what
might we do to encourage more women to enter engineering programs and complete their degrees? This paper will summarize the data I assembled to answer these questions and present some reactions.

Data

To what extent are women underrepresented in engineering? The national average for the proportion of females graduating in all engineering disciplines is currently 21% (year 2002). This number has been rising steadily but slowly over the past 10 years. While in medicine and law the numbers of females have increased sharply over that same time period (to 42% and 45%, respectively), engineering still lags well behind. In 2002, 15% of Calvin’s graduating class of engineers was female (our 10-year average is close to 10%). We are clearly behind the national average, which at least at first glance seems especially troubling, since our student body as a whole is disproportionately female (55%). The data from several other Christian colleges with engineering programs (members of the Coalition of Christian Colleges and Universities – CCCU) shows similar numbers to Calvin’s. Figure 1 displays the percentage of female engineering graduates (Bachelors level) between 1991 and 2002. The top series shows data for all engineering schools in the U.S. Another series shows data for Calvin, and the final series is for those graduating from the sampling of other Christian colleges with engineering. The very small numbers of females in these programs make it hard to draw statistically significant conclusions, but the trend for Calvin and the CCCU schools appears to be upward at rates slower than the national increase.

![Figure 1: Percentage of Female Graduates in Engineering (BS) from 1991 to 2002](image)

Actually, the scenario is more complicated than this data reveals. The number of women varies significantly between disciplines in engineering. The pie chart of Figure 2 shows the number of graduates in 2002 in the United States in various branches of engineering. The general engineering degree offered by Calvin and other similar programs is included in the “Other” category, with “Misc” including all named engineering types besides those already listed. It can be seen that electrical/computer engineering

Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/ceec

- 5 -
is the largest specialty by number of graduates, followed by mechanical and civil engineering. Smaller numbers of graduates choose industrial, chemical, or biomedical engineering, although these are the disciplines that females more often choose. The second pie chart (Figure 3) shows the distribution of students within disciplines when only females (14,055 of the total number of 67,301) are counted.

Figure 2: Percentage of U.S. Engineering Degrees (BS) in Different Disciplines in 2002

Figure 3: Percentage of U.S. Engineering Degrees in Different Disciplines (BS) for Females Only in 2002

Figure 4 shows the percentage of females in each of those disciplines. Since most of the Christian engineering programs focus on electrical/computer and mechanical engineering, it then makes more sense
that the numbers of females in our programs would be lower. In 2002, the proportion of female graduates nationally from only electrical/computer and mechanical engineering programs is 15%, which is closer to, although still somewhat higher than, that of the Christian colleges.

Another pattern noted at Calvin is that our retention of females is less than that for males. There is a consistent pattern of having higher percentages of females in the first year compared with those who graduate (~2% difference on average over the 1991 to 2001 time period). This is also true for the sample of CCCU institutions (~1.5% difference on average). Lower retention of female students has been noted at other institutions as well. In engineering, too few women enter the educational pipeline, and even if they do, they drop out at higher rates than males.

**A Christian View**

*Why might we be concerned about this as Christian engineering educators?* There are several reasons why we might consider encouraging more females to be engineers. Many others are already doing so. Over the past 20 years many organizations have been established that are dedicated to increasing the number of women in engineering. The American Society of Engineering Education (ASEE), for example, has the Women in Engineering division. Another example is the Women in Engineering Programs and Advocates Network (WEPAN). The Society of Women Engineers (SWE) has been concerned, since its inception in 1950, with promoting women in technical occupations. Congressional committees have even been set up within the last 10 years to address the issue. But as Christians, we are concerned with more than blindly following trends in the professions. Our mission is to train young people to pursue their callings to serve God and others through their professional work. There are several reasons why this mission may generate an interest in devoting resources to increasing the participation of women in engineering fields.
The most important reason I feel called to work toward gender equity in engineering is the concept of Christian vocation. We are all called by God, as Christians, to be disciples of Christ: to grow in holiness and spread the good news of the gospel. But, according to Lee Hardy, “we are also as Christians commanded, and therefore called, to love and serve our neighbors with the gifts that God has given to us. We are called, then, not only to be certain kinds of persons, but also to do certain kinds of things.” Every Christian is called to serve in developing the kingdom of God, in working toward “shalom” with his or her talents and interests. There are women who have significant gifts related to technology that would allow them to contribute, but current practices and attitudes have discouraged them from doing so. We have no reason to believe that God created women with lesser abilities related to engineering than men. Studies comparing spatial reasoning, for example, show only small differences in averages among males and females, while the individual differences are very large. This bears out the view that all humans are created in the image of God and have many of the same capabilities to serve him. The fact that development of technology is viewed as a primarily male domain is an example of the fallenness of the nature of gender roles in our culture. Sin invades the cultural understanding (or misunderstanding) of the meaning of gender differences. Both women and men have contributed to this problem. Unfortunately, Christians have often been guilty, more so than even secular institutions, of not acknowledging women’s gifts. This has taken the form of exclusion from certain occupations and by an overemphasis on women as caretakers rather than leaders. This interpretation of gender differences also has a detrimental effect on men, who may be directed to careers they are not suited for because those careers are not considered masculine (e.g., nursing, elementary education, or homemaking). I believe there are many women who have gifts for mathematical analysis, design, problem-solving, and creativity, among other capabilities that contribute to excellent engineering, whose gifts are not being used.

A second concern for Christians is justice. If we accept that women are capable of being good engineers, then the small numbers of women in engineering give us reason to believe that there may be impediments preventing women from selecting this field and achieving success in it. We might be concerned with identifying those barriers in order to eliminate them so that females as well as males have the opportunity to serve society by using their God-given talents. Engineering is a well-paid, highly respected, and challenging profession. Women should have access to it as well as men.

Finally, there is a concern that we are not preparing enough engineers. Most experts (although not all) feel that the available numbers of white males are insufficient to supply the ever increasing need for technical personnel. Therefore we need more women and minorities to make up the difference. Christians should be concerned about a shortage of engineers since they design so many of the things we rely on in everyday life. Lack of qualified engineers could lead to a weakened infrastructure, higher exposure to risk of disaster, or the manufacturing of poor quality products, none of which contribute to shalom. This also might lead an engineering educator to propose ways to attract more students, both men and women, into the field.

**Barriers**

*What are some of the barriers?* The fact that so few women participate in engineering indicates that there may be barriers inherent within our current system that need to be identified. Identifying the reasons for the underrepresentation of women in engineering is not an easy task. Obviously, encountering discrimination based on your gender would be a significant barrier to choosing any professional career. Fortunately, instances of overt discrimination are relatively rare. So, there must be other reasons why few females choose engineering and are more likely to drop out once they do.

The understanding of gender roles in our culture is a contributor to the lack of interest females express in engineering careers, as well as other professions. These barriers appear very early in the experiences of young girls and extend through college and into industry. Family expectations can lead females not to consider full-time careers of any sort in favor of nurturing family in the home. The problem of two-
income families and having someone home to take care of the children is significant. But, the honoring of family responsibilities needs to be shared by both genders, in order for women and men to be supported in their occupational callings.

Well before students reach college, they have often developed a stereotype of engineering work. With very little information about engineering available in the media or their educational experience (as opposed to medicine or law), students develop assumptions that are not complete. One example is thinking that engineers spend all of their time in front of computers or doing calculations, and therefore have very few people skills. Many young women do not see themselves as suited for this type of career and are unaware of the breadth of opportunities available for those with an engineering degree. An even more problematic assumption is that while medicine and law provide obvious opportunities for service to individuals and society, engineering is object-focused rather than people-focused and provides little opportunity for living out a Christian life of service.

Another barrier for women is lack of confidence, especially in basic mechanical abilities. Although females who choose engineering on average are better students than their male counterparts, it is very common for females to experience a decrease in their confidence over their college experience. Females are also likely to come into an engineering program with lower confidence, since they are less likely to have had hands-on opportunities to tune engines or wire circuits. Low confidence can be linked to experiences in engineering labs and classrooms where males tend to dominate. There is often temptation in lab and project settings for males to assume leadership and operate hands-on equipment while women assume more traditionally feminine tasks like report writing. While these may be comfortable roles for all involved initially, the accumulation of too many of these experiences can leave a female feeling inadequate.

A final barrier identified, especially in retention of female students in engineering programs, is the lack of social support networks for females. Many students, especially women, prefer to learn in groups. While male students will likely have room-mates and friends who share their major, female students will not. This leaves female students at a disadvantage in their everyday classroom work. It also leaves them feeling isolated and alone, which can leave them vulnerable to dropping out. A lack of role models may also cause women students to feel isolated.

**Recommendations**

*What can we do to overcome the barriers?* It is clear from many studies that efforts addressed toward increasing the number of female engineers need to start early. In elementary school already, girls fall behind males in their interest in math and science and their perceptions of their own abilities in those areas. In order to recruit more female engineering students, serious effort should be addressed to programs that increase female participation in math and the sciences and break down the stereotypes surrounding engineering and the subjects on which it relies. Also, females are less likely than males to know engineers personally or have participated in hands-on activities like home construction or automotive maintenance. Increasing exposure of students to engineering in their school has the potential to address this problem. Many of the local programs that have already been established, e.g., summer camps or take-your-daughter to work activities, could benefit from the help of engineering educators. We also might encourage development of policy initiatives that support the goal of increasing the number of female engineers. The state of Massachusetts recently introduced a requirement for pre-engineering content in primary school curricula. It will be interesting to see if this helps attract more females. We might consider joining an organization like SWE or WEPAN, both to foster our own growth in knowledge in this area and as volunteers to support their programming. At a personal level, we should make sure to involve our daughters in activities and programs that include many types of encounters with nature and culture. Boy Scouts and Girl Scouts of America have made great strides in this area, but often local church activities for children reinforce gender stereotypes. We might consider joining local school.
boards to push for equitable opportunities for all elementary students to participate in science and math activities in and out of the classroom.

My primary interest is in what can be done during the college years to increase retention of female engineering students. Smaller engineering programs like Calvin’s should be well-placed to attract more women students, since a liberal arts emphasis is often attractive to women. I have three primary recommendations for program elements that will help to retain women.

First, it is important to stress the service aspects of engineering in whatever way possible. At Calvin, this has taken the form of using service learning projects in the introductory course to provide exposure to engineering design. The projects involve designing jigs or fixtures for people with various impairments to allow them to do more productive work. These projects refute engineering stereotypes by emphasizing teamwork and real world problem solving. Some studies have shown “the first undergraduate year as a significant time when women disproportionately abandon plans” to major in engineering or science.\(^{15}\) Attention should be given to arranging teams to avoid having a lone female, since in that situation it is more difficult for a female to fully participate. A service emphasis is important for motivating males as well as females to see engineering as a Christian vocation.

Second, in order to develop confidence in their mechanical abilities, female students need a non-threatening environment in which to practice hands-on activities. I am proposing the development of a “Tools 101” extra-curricular lab to which all first year female engineering students would be invited. This lab would involve teams working on technical problems using common hand and power tools. Some examples of possible activities include: changing a tire on a vehicle, soldering wires in an electrical circuit, installing a garbage disposal, and assembling a bicycle. In order to fund these activities, I plan to request a grant from the Engineering Information Foundation under their women in engineering grant program. If this program is successful, it might be extended to male students who could also benefit from these kinds of activities.

Third, a mentoring program would be helpful in order to provide a support network for women engineering students. One possible structure would be for two first year students to be paired with a junior level female student (since retention rates hover around 50% this should allow for an even match of mentors with mentees). Junior level mentors would be used rather than seniors to allow for more continuity and because senior students are often too busy to give a mentee adequate attention. The program would suggest that mentors meet with their students at least once per month and provide questions to facilitate dialog.

Some additional steps might also be taken by an engineering department, requiring more time and resources. More women professors could be hired as role models. This may be more easily said than done at small Christian colleges where the applicant pool is small, but organizations like WEPAN can help in identifying potential candidates. Engineering departments should be encouraged to continue tracking the proportion of women students entering and graduating from their programs. Monitoring does not address the problem, but it does raise awareness and provide feedback on any special initiatives taken. Departments might encourage the development of a student chapter of SWE. Even in the absence of a SWE chapter, other professional organization student sections can be encouraged to become involved with local schools in promoting engineering.

**Conclusions**

In order to encourage women to choose engineering as their vocation it is important to promote a broad definition of technology. Technology is (and should be understood as) a cultural activity – a creative process of designing the things that help us flourish, taken up in response to God’s cultural mandate and using the resources God has entrusted to us. Technology is often misperceived as including only objects and machinery with an emphasis only on analysis and efficiency. A definition of technology, and

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therefore engineering, that reflects the “people-centeredness” of it, and the opportunities it presents for serving God by providing for the needs of our fellow creatures, will be more attractive for all potential Christian engineers.

References


[2] The sampling included Cedarville University, Dordt College, John Brown University, LeTourneau University, and Messiah College.


[7] Van Leeuwen, Mary S. Gender and Grace: Love, Work and Parenting in a Changing World. Intervarsity Press: Downers Grove, IL 1990, p. 87. Additionally, the supposed advantage women have over men (on average) in verbal fluency has been shown to be very small (p. 59).

[8] Ibid., p. 117.


Integrating Christian Faith with Academic Administration

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Abstract

Not only in the “public square” but especially in secular colleges and universities, evangelical Christians have tended to surrender leadership to those promoting the prevailing cultural norms. The general rule is that the higher one ascends in any administration, the greater coverage and influence he or she may exert. Consequently, Christian faculty who have talents in administration and leadership should prayerfully consider an academic career in which they aspire to positions of chair, dean, vice president, and even president. This paper first defines some of the administrative posts available, evaluates why a Christian professor might seek them, and how one might go about climbing the administrative ladder. In doing this the paper suggests some of the opportunities that await Christian administrators, especially in secular institutions of higher education but also some of the pitfalls and challenges, with an emphasis of their effect on one’s Christian commitment.

Introduction: What do Administrators Do?

This paper is directed to engineering faculty in secular research universities. However, the discussion will also have relevance to engineering faculty in liberal arts colleges whether secular or Christian. Though most faculty are able to define the various administrative positions it may be useful to review them. There are, of course, many administrative positions in a university, such as Vice President of Student Affairs, Vice President of Business and Finance, Vice President of Research, all of which may have titles of dean or some permutation of similar wording. Again, we will concentrate on the administrative positions that would normally exist under the Vice President of Academic Affairs, sometimes called the “Provost.”

The Department Chair

While large departments may have assistant chairs or program directors, the department chair or head is a good starting place. First, some institutions use the title of “chair” to designate a department administrator that has a limited appointment of, say, three to five years, at which time the chair may be re-appointed. Also, it may be that the chair is elected by the faculty, though this is less frequent because upper administrators want a chair that is more likely to carry out their policies and make the “hard decisions.” The designation of “head” then, refers to an indefinite appointment, assumed to last until the department head steps down or is fired. Almost always the head is given the choice to resign instead of being fired.

The advantage to the upper administration of having department heads is that they are less beholden to faculty whereas a chair, knowing that he or she may return to the ranks of mere faculty will not want to create enemies by carrying out directives that will alienate colleagues. The advantage of having a chair is that one may be replaced as a matter of course when the appointed time is over without the embarrassing order to “resign or be fired.” The advantage from a faculty member is the opposite of the disadvantage seen by deans and above. That is, a chair may have a greater sensitivity to the faculty needs since he or she will return to the faculty ranks and has not been in the position so long that the needs of the faculty are forgotten.

Most administrators that have risen up through the administrative ranks agree that the department chair (we will use “chair” and “head” as synonyms for the rest of the paper) is the most demanding administrative position in the university. I define the position as “the worst of all worlds.” That is, the
chair is an administrator, teacher, and researcher. In other words, he or she is expected to fulfill the role of faculty (to a more limited degree) plus be an administrator plus continue to conduct research. What this often turns out to be is three full-time jobs.

The freedom a chair has to run the department depends on what kind of dean he or she is working for. Ideally, the dean is skilled enough in leadership to give authority along with responsibility. If the dean is a micromanager, the chair’s ability to actually lead is greatly reduced. Ideally, the dean delegates authority well and is, moreover, a mentor, helping the chair gain more administrative skills and grow in leadership abilities.

A typical job description for a chair is as follows:

1. Administer the Department of Mechanical Engineering and Applied Mechanics
   - Provide leadership to promote excellence in teaching, scholarly activity (research), and service among the faculty. Work toward a departmental annual average of $100,000 of extramural research/FTE and achieving above the university mean in average departmental teaching evaluations.
   - Create an environment conducive to faculty productivity and collegiality.
   - Create a caring environment for students to enable them to maximize their intellectual and emotional maturing.
   - Complete required administrative (paper) work in a satisfactory and timely manner.
   - Administer the department budget in accordance with the university regulations, promoting cost effectiveness, being careful to not overspend each biennium.
   - Provide a vision and implement the mission of the department and college, engaging in appropriate planning activities, both near and long term.

2. Assist in on-campus and off-campus promotion
   - Engage in community relations by interacting with community, state, and federal leaders in the region as appropriate.
   - Communicate the status of the department, encourage department-industry cooperation, and garner support for the department and college.
   - Engage in fund raising, cooperating with the Development foundation as appropriate.
   - Assist in recruiting students into the department.
   - Accomplish any other tasks as assigned by the Dean.

3. Maintain appropriate teaching and research
   - Suggested time allotments 20% teaching, 20% research, and 60% administration, service, etc. Use your research as a means of mentoring junior faculty, helping them to establish their own research programs.

The Dean

Becoming a dean is really a career change. Deans are usually considered pure administrators. However, some teach and some do research, but neither of these are normally in their job descriptions. Deans, of course, head up colleges and are the direct supervisors of the department chairs. In engineering colleges the departments usually have Civil, Electrical, and Mechanical engineering departments. Larger college will add departments such as Industrial, Agricultural, Chemical, Computer Science, Biomedical, etc., etc.
Kolodny gives a tongue-in-cheek description of the dean’s job.

“What constitutes an accomplished administrator [dean], however, is always in the eyes of the beholder. The faculty want a fighter who can protect their disciplinary interests, while central administration wants a team player who is sensitive to the needs of the campus as a whole. Faculty want a dean committed to collegial and shared decision-making. Central administration demands that the dean make tough independent decisions, even if that means countering faculty sentiment. Department heads want a dean who will provide all requested resources and then leave them alone to conduct department business as they see fit. Central administration wants a dean to ride herd on department heads, micromanaging them in the same manner that central administration is attempting to micromanage the dean. Donors are looking to back an articulate leader, but many of them also want to be consulted at every juncture or wooed with tickets to major athletic events. Undergraduates rightly complain that, except for ceremonial occasions like Honors Convocation or graduation, deans are invisible. Graduate students want the dean who is a distinguished scholar to teach their seminars and direct their Ph.D. dissertations. And everyone expects the dean to shape a vision for the college, especially when faculty, staff, and students are deeply divided over what that vision should encompass.”

While this sounds like an impossible job, I found it more enjoyable than being a chair. Again, however, much depends on the Provost (here I will use Provost to include Vice President of Academic Affairs, VPAA). Hopefully, the Provost is a delegator and not a micromanager.

A dean’s responsibilities deal more with off-campus constituencies than a chair. Fund raising may take up one-third of the dean’s time. The dean is always cultivating friends among the companies, governmental agencies, and other stakeholders. Deans are more often asked to speak to service organizations, be interviewed by the media, and attend countless meetings on and off campus. There are also many social responsibilities which entail entertaining at one’s home and attending functions of honor societies, graduations, student groups, etc.

The dean will distribute the college budget among the departments and programs. He or she will also be responsible that the programs are accredited by the Accreditation Board for Engineering and Technology (ABET) and other appropriate boards.

**Provost/Vice President for Academic Affairs**

The title of Provost is given to the VPAA when it is made clear that he or she is like the executive vice president. In other words, the other VP’s may report to him or her. The Provost is generally less visible to the public than the president or dean. The Provost is responsible for the academic standards and operation of the university. One of the challenges is that the communication between the Provost and the vice president for student affairs (VPSA) is frequently weak. The VPSA is charged with the welfare of the students and normally is in charge of the resident halls, the student organizations, student recruiting, and student discipline. For example, the well being of students is tied to their academic work. If the provost and VPSA are not in close contact, advisors of students may not find out about a student’s difficulty until it is too late to help. Another example is that the VPSA usually oversees student activities which need to be coordinated with the academic calendar.

Again, some university presidents give the Provost almost complete authority over the academics and others do not. The Provost is responsible for being sure all the academic programs receive the necessary accreditation as well as the whole university when regional accreditation boards come around.

The Provost will allocate the academic budget among the colleges and will usually have a dean of the graduate division, dean of libraries, director of the computer center (Information Technology Center, etc.) report to him or her. The life of a Provost, again, depends on the president. The Provost will often be
asked to sit in for the president at state meetings, such as the state board of higher education, if there is one.

*President/Chancellor*

The president or Chancellor (I will use president for both), is the top administrative official at the university. He or she will report to either a state board of higher education or a board of directors for a private institution. Some states have one board of higher education for all of the state colleges and universities. Some states have one for each and some group their institutions into two or three categories. For example, there may be a board for research universities, one for colleges that do not have research or graduate programs, and one for community or two-year colleges, like the one in California.

Again, some boards take a hands-on approach to governing and others were merely “rubber stamps” for what ever the president wants. Some states have a position called “chancellor” that is over all the state colleges and universities, so the president is somewhat in the same position as deans and chairs in that he or she may be micromanaged or given great leeway in running the university.

There seems to be two different leadership styles among university presidents. One is to concentrate on the university and the other is to concentrate on the stake holders external to the university. The latter then, usually gives the Provost the authority to make most of the internal decisions. It seems that president-day presidents are so caught up in fund raising and athletics, that there is little time for other concerns. In the past, there have been visible college presidents that have had a national impact in setting national policy and emphasis on higher education.²

Of course, the president has even greater responsibilities than deans to raise money and meet with the political leaders and other stake holders. Frequently, presidents are on corporate boards, regional or state organizations, etc. These positions provide additional income, some very lucrative. Presidents have to attend many civic functions as well as university programs. Presidents, more than deans, are quoted in the media and asked to give speeches to all kinds of organizations. It is the president who is normally asked to appear before the state legislative committees to report on the university and, hopefully, gain appropriate funding.

*Academic Leadership*

In all of these positions, leadership is the key element. Of the dozens and dozens of books on leadership, the two “must reads” are *The 21 Irrefutable Laws of Leadership* by Maxwell³ and *First Break All the Rules* by Buckingham and Coffman.⁴ Maxwell is a Christian and pastor. His 21 laws are sound and helpful. Buckingham and Coffman’s book is a result of years of gathering data and interviews. It contains many counter-intuitive rules a successful leader must follow.

Several examples from Maxwell’s book: Law 4, “THE LAW OF NAVIGATION, Anyone Can Steer the Ship, But It Takes a Leader to Chart the Course.” Law 17, “THE LAW OF PRIORITIES, Leaders Understand That Activity Is Not Necessarily Accomplishment.” Several items from Buckingham and Coffman: people can’t change their basic nature. You waste your time trying to make a “round peg” fit into a “square hole.” Another way to say this is, “Don’t waste time trying to put in what was left out. Try to draw out what was left in. That is hard enough.”

From the leadership classes at the U. S. Naval Academy, where I did my undergraduate studies, we were told that the three rules were: (1) Know your men, (2) Look after your men, and (3) Be a man. This was before the need to be gender inclusive. There is a lot of wisdom in these three rules which could fill a book.

**Why Should a Christian Become an Administrator?**

Hopefully, we now have a better picture of what administrators do in institutions of higher education.

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The question is should you seek to become one and, if so, to what level should you aspire? The bottom line is, of course, the Lord’s leading. For me, this did not happen until I had been a faculty member for about eight years. Rarely will God ask you to seek a position for which He has not given you talents and interest. While everyone may improve their leadership skills by reading and work, I believe that most leaders are born and not made.

One needs a personality and temperament that is recognizable by others as being leader-qualified. This personality need not be charismatic but it must be stable and mature. One needs considerable emotional maturity in order to be able to “keep your head when all about you are losing theirs and blaming it on you.” By the way, I consider Kipling’s poem, If, from which this quote was taken, to be one of the most profound recipes for living outside of the Bible.

I dislike the term, “full time Christian service” as it is used to define those in the professional ministry or mission work. I do not see this dichotomy in the Bible. I believe every serious Christian is in “full time Christian work.” The difference is that those of use with secular jobs need to make sure our time is regulated by the Lord and that we use our spiritual gifts to building up the Body of Christ as He directs. If this is so, I believe we are just as much serving God when we write a research proposal or teach a class in Vector Mechanics as we are witnessing to a person about Christ.

Having said this, we all want to maximize the talents God has given us for His glory. If a Christian professor has a talent for leadership and administration, he or she should cultivate it and seriously consider administrative positions. The normal route is to start as a chair, then dean, then provost, and finally president. One may be lead to stop at any one of these positions to finish a career.

Why would God want Christians in these places of authority? First, a Christian in a highly visible place has the opportunity to show the world a standard of excellence that brings glory to God. Second, the higher one ascends in administrative positions, the wider the area of influence in communicating the Gospel. For example, a Christian chair has a rapport with other chairs that a faculty member may not have. Third, as one ascends the administrative latter, one has more institutional power to protect other Christians; faculty, students, and Christian organizations on campus.

As a chair of a department, I found out that the university at which I was employed, was not allowing the Gideons to distribute Bible on campus. I went to the campus attorney and informed him that this was a violation of access and against the law. The policy was changed but as a chair, I had access and credibility that a normal faculty member would not have. As a dean in a secular university, I had a Christian faculty member who was giving credit to students for attending a Christian function. I was able to tell him that this was against the university policy and an unwise thing to do, thereby saving him from getting into serious trouble.

A Christian administrator can help Christian student organizations gain access to campus facilities when they might otherwise run into road blocks set up by people not sympathetic to their cause. A Provost can deflect complaints against Christian faculty, chairs, and deans because of their outspoken witness on campus. This assumes that the witness is appropriate and within university policy. Finally, a Christian administrator can use the prestige of the position to “show the flag.”

The downside to these administrative positions is that one is a highly visible target. A chair that is a known Christian will be under much more scrutiny than an ordinary faculty member. Another possible problem for a Christian who “tithes his or her time,” is that being an administrator may cut into the “Lord’s time.” However, the time demands do not necessarily have to be greater for an administrator than for a faculty member. It depends on a person’s discipline and organizational abilities. We all know that the University is a “black hole,” willing to gobble up every waking hour we have. Moreover, there will be times when the flexibility enjoyed by a faculty member will be less than an administrator because of office hours, classes, and conferences that require attendance.
I believe God gives us different mission fields at different times in our lives. When children are in high school, one has different time obligations then when they are toddlers or in college or out on their own. The “empty nest” affords more time to other tasks than when children are living at home. Consequently, higher administrative positions may be more fitting.

How does one become an administrator?

Once one has felt the Lord leading in the director of administration, what should one do? First, a professor has to have a solid research and teaching record. Few universities will appoint a person to the position of chair with a weak vita. It is possible to become an associate dean in a college and go, from there to becoming a dean either in the original college or in another, thereby circumventing a stint as chair.

A professor seeking to enter into administrative positions, should assess the possibilities in one’s own college and with consultations with the dean, determines if there is a possible opening. Even if there is, one may want to move to another institution. The places to look for openings are in The Chronicle of Higher Education, the various discipline journals, and, of course, the Web. For example, Prism, the journal for the American Society of Engineering Education, Civil Engineering, the journal for the American Society or Civil Engineers, etc. have advertisements for chairs, and other positions. The Chronicle, has openings up to president. There are also “head hunter” firms that specialize in academic recruiting. Finally, networking is always the most effective.

Frankly, I have found the position of dean giving me more time to engage in overtly Christian activities. My support for the Christian Faculty and Staff Fellowship on campus is significant. The pressure is of a much different sort than that of a faculty member and I find it fits my talents and temperament better. While overseas, I advised a provost and president of a university, so I have an understanding of these positions. I have applied for president positions, but the Lord has not seen fit to open anything beyond being a dean, so I will finish my academic career as one.

Finally, there several periodicals for academic administrators along with several books that are given in the reading list.

Reading List

“Academic Leader: The News Letter for Academic Deans and Department Chairs,” Magna Publications, Inc., 2718 Dryden Drive, Madison, WI 53704, Ph. 800-433-0499, email: custserv@magnapubs.com

“Administrator: Practical Wisdom for Higher Education Executives,” Magna Publications, Inc., 2718 Dryden Drive, Madison, WI 53704, Ph. 800-433-0499, email: custserv@magnapubs.com


References


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Service-Learning Approaches to International Humanitarian Design Projects: Assessment of Spiritual Impact

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The University of Texas, Austin

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Messiah College, Grantham, PA

Nolan Van Gaalen
Dordt College, Sioux Center, IA

Abstract

Christians are called to be both globally aware1 (Mt. 28:19-20) and sensitive to humanitarian needs (Mt. 25:38-40). This calling leads to an awareness of abundant opportunities to give aid, often in ways which may be linked to the name of Jesus Christ2 (Mt. 5:16, Gal. 6:10). Engineering faculty at Christian institutions have a unique stewardship opportunity to channel the enthusiasm of students who are eager to apply their newly acquired engineering tools. This paper discusses a special case of service-learning projects3 that involve applying engineering skills to address problems of the poor in developing nations. These projects are referred to here as “international humanitarian” (IH) projects. Four such projects are documented and discussed in-depth in a parallel ASEE paper4, including the design of (1) a women’s hospital in Nigeria by senior engineering students at Calvin College, (2) a crop irrigation system in support of a Honduran community development organization by Dordt College students, (3) a modular and scalable solar power system providing economical power to remote areas by electrical engineering seniors at Grove City College, and (4) a water purification system in Guatemala by Messiah College students. These four projects are summarized in the appendix for reference.

This paper builds on the foundation of the parallel ASEE paper, which discusses general pedagogical aspects of the projects. Here we focus our attention on aspects of special interest to Christian engineering educators. We discuss the objectives that motivate IH projects as well as steps to enhance achievement of these objectives. We conclude by highlighting implications for future IH student projects, with student academic and spiritual growth and high-impact deliverables fulfilling specific needs.

Introduction

Engineering educators are increasingly recognizing the value of exposing students to need-based engineering problems and pedagogies3,5,6,7. Another area of growing interest is the globalization of engineering education8,9,10,11. These important topics may be concurrently addressed with a service-learning approach by involving students in international humanitarian (IH) design projects1,2,12. This approach addresses key ABET criteria by integrating both globalization and social needs into the engineering curriculum. Additionally, social needs are a clear priority of engineering as a profession (“…I dedicate my professional knowledge and skill to the advancement and betterment of human welfare …”13) and of major world religions (as indicated by their international outreach). It is not surprising, therefore, that engineering departments at faith-based institutions place a high value on such projects. A parallel ASEE paper4 presents the methods and conclusions of design projects from four faith-based
institutions that exemplify the successful integration of both globalization and humanitarian interests into the curriculum. The paper concludes with insights thought to be generally applicable for successfully designing, selecting, and executing IH design projects. Table 1 presents a summary of these insights in the form of actionable guidelines.

Table 1: IH Project Implementation Guidelines

| Team Formation                      | • Students should be self-motivated to tackle an IH project.  
|                                    | • Self-selected teams may be appropriate, if united by their motivation.  
|                                    | • IH projects may call for teams with interdisciplinary skills.  
| Project Selection                   | • Partner with individuals knowledgeable about the problem context.  
|                                    | • Ideally, partner with individuals already involved with the problem.  
|                                    | • Carefully scope projects for feasibility in consideration of the obstacles involved.  
| Funding                            | • Prepare for higher costs than traditional domestic projects.  
|                                    | • Consider philanthropic churches, community groups, and individuals.  
|                                    | • Students and their communities may be willing to help fund an IH project.  
| Obstacles Identified                | • Plan in advance for international travel which is often critical and difficult.  
|                                    | • Partner with knowledgeable individuals for help with travel logistics.  
|                                    | • Insure students have an adequate awareness of special design constraints. Travel, contact with individuals, and supplemental lectures and research can help.  
| Deliverables                       | • Encourage or require delivery of a working design or actionable recommendations to provide motivation, satisfaction, and community rapport.  
|                                    | • Avoid assuming that high-technology is required. Creative adaptation and synthesis of low to medium technologies may be appropriate.  
| Mentoring & Teaching               | • Seek mentors with problem-related expertise, particularly if faculty lack it.  

This paper builds on the foundation of the parallel ASEE paper, which discusses general pedagogical aspects of the projects. Here we focus our attention on aspects of special interest to Christian engineering educators. We discuss the objectives that motivate IH projects as well as steps to enhance achievement of these objectives.

Christian Motivation for IH Design Projects

Motivation for investing the resources required by IH projects includes: high-impact deliverables which significantly enhance quality of life, notable academic growth of students, and spiritual growth particularly in the area of linking faith and vocation. These outcomes may be difficult or impossible to obtain to the same degree through classic industry-sponsored design projects. Here we discuss these motivating factors with an emphasis on those most significant from a Christian perspective.

High-Impact Deliverables. A key objective of IH projects is to produce deliverables “for the benefit of humankind” (from the ABET definition of engineering.) Secular companies recognize the importance of producing products for the betterment of humanity. General Electric's motto is "We bring good things to life," and NASA represents themselves as "benefiting mankind." Just as not every individual development in the space program has direct and immediate spin-offs for the benefit of mankind, an IH project may represent an intermediate step in the process of achieving greater quality of life. However, it
is a goal of IH projects to at least attempt deliverables which provide an immediate, direct benefit. In the case of the Grove City College solar project, for example, the immediate benefit is inexpensive solar power available for computers, medical equipment, and other high-value uses. It is hoped that the benefactor will realize that there are foreigners who offer meaningful help to improve the quality of their life. It is expected that the benefactors will capitalize on the technology, learn from it, and build the capability to address similar problems using more of their own resources, thus initiating the sustainability of the project.

In order for deliverables to achieve the desired high impact on quality of life, several common pitfalls should be avoided. The design must be rugged and durable enough to have a high potential of surviving local conditions. Additionally, it is important that any required maintenance and parts will be available, preferably in-country. A final consideration is whether the benefactor can realistically afford to implement the project deliverables. If these and other potential barriers to success are overcome, there is realistic potential of the project having a high impact.

**Student Growth: Academic.** On the surface, the nature of IH projects may appear dramatically dissimilar to what students will encounter in industry. This apparent difference has lead some to question whether such projects adequately prepare students for the industry positions which many will pursue. However, closer inspection reveals many fundamental similarities IH projects have with industry responsibilities, as well as some key advantages. Both the engineering depth and cultural breadth of these projects are examined here, which combine to provide a solid basis for launching a career in either industry or non-profit pursuits.

IH projects engage students in a classic and widespread problem solving sequence: problem definition, identification of alternative solutions, selection of an appropriate option within constraints, formulation of an action plan, gathering key data for the design, preparing the design, executing the design, evaluating the engineering effort and making necessary corrections, testing and evaluating project deliverables, identification of lessons learned, and making recommendations. Numerous professionals including scientists, engineers, economists, and business leaders all rely on similar high level skills of problem identification and problem solving for their daily work. Leaders in these fields recognize the critical importance of the ability to identify important problems, generate solutions, evaluate constrained decision options, and execute the solution. The Grove City College solar panel project, for example, not only follows such a sequence, but is also typical of work an electrical technology graduate would be expected to complete in industry.

IH projects engage students in learning the interrelationship of science, technology, and society. Engineers need a working understanding of this context because solutions to most problems transcend technical considerations to include cultural, political, and other non-technical factors. IH projects provide a unique platform for learning the application of engineering within a foreign societal context. Just as students learning a foreign language may clearly understand grammar for the first time when removed from the comfort of their native tongue, so engineering students designing for a foreign culture may understand “design for society” and “design for culture” principles most clearly when removed from the comfort of their native socio-technological context. And just as the student of Latin may become a masterful English writer, so the students designing IH projects may become exceptionally socially conscious and culturally appropriate designers who are equipped for a variety of markets.

Because of the cultural breadth of IH projects, an additional benefit is that they may help satisfy a cross-cultural general education requirement. If students are able to spend at least some time in another culture, appropriate preparation and documented post-project reflection may count for cross-cultural credit.
Other academic benefits from participation in IH projects include:

- Allowing students to view the nature of the world today through participant interaction with multiple foreign cultures and institutions.
- Sharpening an appreciation for Christian/Western culture and institutions by instructive comparison and contrast with other countries.
- Encouraging critical self-assessment of Western culture, such as the comparatively high consumption of resources and prioritization of material pursuits at the expense of relationships.
- Experiencing cultural and societal immersion and actively contributing to improving conditions in the host country, when appropriate.
- Motivating students to study and apply their gained knowledge through the commitment to the client and providing a context for theory.

**Student Growth: Faith and Calling.** IH projects can provide learning grounds for students to link vocation with spirituality, thus impacting their lifelong careers. Such projects show that technology can be used to improve the lives of others, an important link for the Christian gifted with engineering training. Additionally, the projects develop a sense of the need to help others through exposure to human need on a global scale, rather than focusing on economic drivers of more prosperous economies (which may be dominated by “want” rather than need.) Throughout, the projects reinforce the spiritual values of caring and compassion. For faith-based institutions, these outcomes are often in direct fulfillment with the mission of the college or university. Messiah College’s mission, for example, is “to educate men and women toward maturity of intellect, character and Christian faith in preparation for lives of service, leadership and reconciliation in church and society.”

The individual commitment to benevolence fostered by IH projects promotes good mental health. This outcome is well understood by psychologists and is discussed at great length in reference14. IH projects can instill in students a commitment to good works, enhancing the student’s mental health and leading to great technological benefits to society through their resulting efforts. Personal involvement during their education gives students a sense of the worth of applying technology to address significant societal needs. After graduation, engineering students who have participated in IH projects are in a unique position to contribute in a meaningful way to bettering the lives of less fortunate individuals in developing countries. Such contributions are of immeasurable value in the present world with widespread turmoil and crisis.

Some students in Christian engineering programs wish to prepare themselves for future work as engineers in various places in the world where modest application of appropriate technology can greatly improve the human condition. These students see this as a calling, given their interests and gifts. To quote Frederick Buechner, “The place God calls you to is the place where your deep gladness and the world's deep hunger meet15.” In this spirit, some students find great delight in applying their engineering abilities, and see application to technologies among the poor as the greatest need matching their passion. IH projects give students the opportunity to use uniquely endowed God-given talents and skills to help benefit humankind, leading to the satisfaction of a job well done by meeting an urgent of need.

Mentoring relationships with faculty during such projects are also important to help shape the character and life choices of participants. For IH projects implemented outside of the curriculum, an unusual benefit is that peer interaction and mentoring happens between students in all years of study.

Other students may not have goals to practice engineering full-time in developing countries, but they desire to take on an IH project in order to serve an immediate need and learn more about the design process in doing so. Their picture of future service as professionals may be to work in an "ordinary" engineering position in their home country, and then to give a portion of their time in the future to provide design assistance on various short-term projects via the intermediary of aid or relief agencies such as Christian Engineering Education Conference 2004

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Engineering Ministries International. Students may see this as a constructive way to tithe both their time as well as their financial assets in service to the kingdom of God.

**Implementation: Team Formation and Cross-cultural Preparation**

*Team formation.* It is notable that in all four of the exemplary projects summarized in the appendix, teams were composed primarily of self-selected students who chose the project because of their interest. The commitment of the students to meeting important societal needs appears to sustain project momentum, and this common goal helps build team cohesiveness. Team members should ideally have a positive attitude, be eager to listen, slow to speak and have a servant’s heart. Translation is often needed in non-English speaking countries, which multi-lingual team members may be able to help with.

*Cross-cultural preparation.* Faculty should prepare students for the cross-cultural situations they will encounter. This should include basic customs of the country to be visited such as: food, clothing, communication norms, authority structure, perceptions of time and punctuality, and so on. Students should also become familiar with the region’s geography, history, and if possible basic language training. Exploration of these issues could be included as a necessary part of an IH project's background research, and be documented as such in project reports. A text such as reference\textsuperscript{16} could be used to guide cross-cultural preparation.

One approach to facilitate cross cultural preparation is to arrange for an “expert” on the culture of interest to critique the student’s cultural preconceptions. This expert does not have to be from the country of interest. In one example at Grove City College, a Nigerian born engineer who had practiced engineering in the United States for 20 years was able to provide meaningful cultural preparation for students considering a project for an African country. Even though the country of interest was not Nigeria, the Nigerian born engineer understood the “African way” and was able to convey this notion to the American students relative to their “American way.”

The engineering department at Calvin has been struggling to fit a new general education requirement for Cross-Cultural Engagement (CCE) into the engineering program. This requirement is part of a recent major overhaul of the college-wide core curriculum\textsuperscript{17}. CCE provides orientation to another culture, engagement with members of that culture, and reflection on the learning experience. Calvin has a CCE coordinator and a committee that oversees the wide variety of courses that meet the CCE requirement (which can be stand-alone, or added to an existing course.) This college requirement nicely addresses the need for cross-cultural preparation that is important for students considering an IH project. Many engineering students are able to fit this new requirement into their already tight schedules through a January interim course, an interesting feature of Calvin's calendar.

**Implementation: Project Selection**

Project selection is a critical challenge for successfully executing IH projects (reference 2 discusses IH project selection in-depth). Strategic project selection helps students consider what causes are worthy of their work and can engender lifelong commitments by students to service, leadership, and reconciliation. A variety of factors must be considered, and here we focus on stewardship of financial resources and cultural impact in the receiving society. In the four projects referenced in this paper, the faculty were actively involved in project selection and specification. It is helpful to be in communication with the benefactor and discuss the merits of pursuing particular projects. It is recommended to partner with mission groups, churches, and para-church organizations to help screen potential projects. Such groups can provide invaluable support through encouragement, on-site contact personnel, logistics help, fundraising support, and with prayer. A visit by the faculty member to the developing country prior to selection of the particular project is of immeasurable value in specification of project needs and constraints. It will promote acceptance of the finished project as long as the cost-benefit aspects are
favorable to the benefactor. In the case of the Grove City solar power project, faculty visits to Uganda identified the critical need for remote electric power in Uganda and associated design constraints. Discussions were conducted with professional colleagues at the Uganda Christian University on how to address this need.

**Stewardship.** Of special interest to Christian faculty is determining what factors would justify (or disqualify) a given IH project as good stewardship. Selection of IH projects will always include a consideration of the costs of the venture and a decision to spend time and effort to raise the needed funds. IH projects may require significant extra effort and expense on the part of everyone involved. It is undesirable to burden students to raise all of the travel funds and construction expenses that are usually needed. In addition to at least partial support through the agency partner, there may be funding available from parents, or perhaps from fellow church members and from other sources of support who can give a donation for this cause through the college’s advancement office. Any preliminary trips to gather key data for the success of the project should be factored into the budget. Ideally, exploratory travel should be planned with the minimal personnel involved and in the most reasonably economical manner. It is best to fully utilize Internet, mail, and telephone conversations to get as much key information as possible in order to conserve project funds. The Grove City College project is an example in which the students were able to complete the project without traveling to the target location.

**Cultural impact.** Project selection will also involve early analysis (and debate) of issues surrounding the impact of possible solutions on the receiving community and culture. This analysis may be hard to complete in such an early stage of the design process. As with any design project, the IH project teams should consider generating and evaluating their design alternatives in the light of a rainbow of norms for “responsible technology” in determining an obediently optimal solution that meets the need. These simultaneously applicable norms include trust, caring, justice, stewardship, etc., along with cultural appropriateness. (For a discussion of design norms, see Responsible Technology, pp. 68-76 and pp. 170–177.) In discussing what it means for a design to be culturally appropriate, the authors of RT suggest that proper balances need to be kept between at least five sets of opposites. These are “continuity and discontinuity, differentiation and integration, centralization and decentralization, uniformity and pluriformity, and large scale and small scale.” Where a particular design solution ought to be situated on each of these five continua also depends on the particular culture and its history. This is applicable to our IH projects as well. RT goes on to say that “the culturally appropriate tool or product is one that both alleviates human burdens and preserves what is wholesome and good in a particular culture. In this way it strikes a balance between continuity and discontinuity.” The authors later also recognize that “determining what is and what is not appropriate in a given situation is not easy. It demands a communal discernment of what is right in a given culture, of what comports with the will of God for that people. …this discernment should be guided by the simultaneous following of the other normative principles, the great command to love, and a basic respect for and understanding of the God-created and God-willed diversity found within creation [including] humankind.” (RT, 171) For an in-depth example of how one institution encourages design teams to incorporate these normative principles, refer to references. 

The Dordt College engineering and agriculture faculty and students who were involved with the Tolpan irrigation project at various stages wrestled with the issues of cultural appropriateness and land stewardship. Serious thought was given to not continuing the project because of the possible negative impacts. It was not entirely clear that it was appropriate or stewardly, even if it were possible, to install diversion dams and settling tanks on two small mountain creeks and lay 7000 feet of PVC pipe to irrigate native corn and bean crops on several rather steep mountainside meadows. The potential for undue influence on a local developing community was enormous, even if the team’s interaction with it was quite short lived. Yet this native community, while living on its own “anthropological reservation” had been in contact with the neighboring Ladino community, and an American Wycliffe Bible translator had lived with the people for decades. A Honduran Christian pastor ministered in that village and they had been

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served with medical assistance from the Luke Society clinic in the region. When it was determined that the village elders and their pastor, as well as the local Luke Society medical staff, all desired some assistance with the village’s chronic food security needs, and when it was found that the village has expressly chosen communally owned land rather than land controlled by just one or two individuals, it was decided to go ahead with the effort. The faculty and the team eventually became convinced that to do nothing would be a breach of the relationship with the local people in their real needs and a denial of support for the ongoing work of the Christian community. In other words, this project was seen as supporting the development of a holistic Christian ministry among the Tolpan people.

The Grove City solar power project also referenced design norms for cultural appropriateness. The use of solar power technology was already well accepted in the target country, and met the criteria for "responsible technology." The process of using mobile equipment such as a portable sound system was already considered an acceptable solution to the problem of limited resources. Prior to commencement of the design and development effort, the expected impacts of the project were determined mutually by both the benefactor and the faculty advisor.

Implementing IH Design Projects

The previous discussion provides both motivation and knowledge for the implementation of IH design projects. Table 1 presents a summary of actionable guidelines for team formation, project selection, funding, overcoming common obstacles, setting the scope of the project deliverables, and implications for project mentoring. These guidelines from Table 1, along with the data analysis presented in the parallel ASEE paper and the discussion above of motivation and cross-cultural issues, all combine to provide a framework for implementing IH projects.

Christian faculty are encouraged to prayerfully consider tackling IH projects even though they may seem insurmountable. The value of such projects goes far beyond the final deliverable, and extends to the rich student learning with potential life-long impact. Even projects without a completed working prototype may be very successful from this perspective. Table 2 suggests possible sources of IH design project problems. Faculty who wish to implement domestic service-oriented design projects are referred to references 3 and 12.

Table 2: Potential Sources of IH Design Projects

<table>
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<tr>
<th>Christian Affiliation</th>
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<tbody>
<tr>
<td>• Personal contact with individuals and organizations working in developing countries</td>
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<tr>
<td>• Engineering Ministries International <a href="http://www.emiusa.org">www.emiusa.org</a></td>
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<tr>
<td>• The Basic Utility Vehicle design initiative <a href="http://www.drivebuv.org">www.drivebuv.org</a></td>
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<tr>
<td>• HCJB World Radio Engineering Center <a href="http://www.hcj.org/tech/">www.hcj.org/tech/</a></td>
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<tr>
<th>General Project Sources</th>
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<tr>
<td>• Development by Design <a href="http://www.thinkcycle.org/tc-topics/">www.thinkcycle.org/tc-topics/</a></td>
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<td>• Design that Matters <a href="http://www.designthatmatters.org/">http://www.designthatmatters.org/</a></td>
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Conclusions

The team of Calvin students provided valuable deliverables including assessments of environmental conditions, engineering analysis, and recommendations for implementation. The students emphasized the value of a large project as a way to put their technical learning into perspective, as well as linking faith and vocation. The construction of the Grove City portable solar system met both the team’s objectives as well as practical needs of the benefactor. Additionally, all components used are available in the

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- 25 -
developing country, and the prototype represents a good model from which the benefactor can collect ideas for constructing similar units. Messiah College has received positive feedback from clients, mission agencies, and other stakeholders; along with requests for further help on other projects. Additionally, the written and oral reports of participants have been overwhelmingly positive. Students often engage in a life-changing reflection on the experience, especially in terms of an increased desire to help the needy both at home and abroad. The Dordt faculty and team decided that the irrigation project was important support for the ongoing work of the Christian community in holistic ministry among the Tolpan people. With a wisely selected project and team, leading students in the pursuit of an IH design project can result in high-impact deliverables accompanied with tremendous student growth, both academically and spiritually. It is hoped that engineering faculty will prayerfully consider initiating similar efforts at their home institutions.

Appendix 1: Exemplary International Humanitarian Design Projects

The following four IH projects are documented and discussed in-depth in a parallel ASEE paper, and are summarized here for reference.

Institution I: Design of a Women’s Hospital in Nigeria (Calvin College)

The engineering curriculum at Calvin College includes a senior design project that extends over two semesters and frequently includes teams that select an international humanitarian project such as a water supply system for a village in Ecuador, low cost modular housing using local materials for Haiti, or a solar-powered, battery-backed incubator for premature infants born in developing countries. Teams are provided with $500 to use towards supplies, prototype parts, and so forth. Many teams have been successful in obtaining additional funding from local industry, state or federal grants, or sometimes through humanitarian aid agencies when the project is mission-related. A group of four faculty team-teach the course, giving lectures on concepts important in completing successful engineering projects (such as team dynamics, conflict resolution, communication, project scheduling) and serving as the team advisor for several of the teams. A few major milestones are required of each team (such as a problem statement, task specifications, project schedule, feasibility study, oral presentations, and so forth), while other deliverables are specific to each team.

During the 2002-2003 academic year, a senior design team worked with Engineering Ministries International (EMI) and the Worldwide Fund for Mothers Injured in Childbirth (WFMIC) to develop a women’s hospital in Jos, Nigeria. The focus of this center would be to treat vesicovaginal fistula (VVF). (VVF afflicts around 2 of 1000 women after childbirth in developing countries. It sometimes occurs after prolonged labor, causing a small hole between the bladder and vagina.) Victims of VVF are often social outcasts because of the resulting urinary incontinence and associated infections. The goal of the project was to design a culturally appropriate, cost-effective hospital complex (including the hospital, patient hostels, and staff housing) capable of serving the needs of 1,000 to 1,200 women suffering from VVF per year. The hospital was designed to have a communal setting that would be open and inviting to the women coming for surgery.
One of the team members contacted EMI three months before the class began in May, 2002 to discuss cooperation on a project. EMI had already made a preliminary investigation of the proposed location and worked with a local contact on preliminary specifications. The Calvin team then joined the effort in September, agreeing to produce structural, water, and wastewater design plans. Project deliverables were a project manual (detailed design specifications including a complete set of design drawings), a cost estimate, and design notebooks (providing design calculations). The team visited the site in October, 2002 for one week. The cost of the trip was covered by fund-raising the team carried out over the previous summer. During the trip, the team surveyed the site, tested soil samples, met with local contacts involved with the project, and interacted with local residents.

The student design team split up the project into various functional areas, with one team member responsible for each. They reviewed each other’s work periodically. The design included basic engineering assessments of environmental conditions (soil, weather, elevations, water quality, etc.), engineering analysis (e.g., live and dead load computation, shear calculations, expected water demand, water pressure), and design decisions and implementation (e.g., material selection, truss design). The advisor for the student team was a licensed professional engineer with extensive civil engineering industrial experience. The team also received advice and guidance from an EMI project manager. The students emphasized the value of a large project as a way to put their technical learning into perspective. Here are some quotes from the team’s final design report, emphasizing their reaction to a faith-based project in their engineering studies:

“From the drawing of the plans, to doing the calculations to writing the specifications, to writing the report ... we kept our focus on the overall purpose of our project. Our purpose was to help others... We persevered because we remembered what we saw in Nigeria and what we saw in the eyes of those women and girls...given the opportunity to make someone else’s life better we took the opportunity with open arms.”

“From the details of designing a water storage tank to the structural design of a truss we can use our talents as Christians to serve the people of God’s kingdom whether it be abroad or at home.”
Institution II: Design of a Crop Irrigation System in Honduras (Dordt)

Dordt College is a fifty-year old Christian liberal arts college in the reformed tradition. This general engineering major, first implemented in the early 1980's, offers mechanical and electrical emphases to an engineering student body of about 90 students. About 20 seniors complete the program each year. The two-course senior design sequence begins with a fall class where design project management and teamwork principles, engineering economics, statistics, aesthetics, ethics, etc. are discussed, and where project teams and proposals are formulated.

Dordt College’s involvement with the irrigation system project began in the spring of 2000, when a member of the department was contacted by members of a Luke Society volunteer brigade that had traveled to Honduras to build a clinic. These members also desired to answer the needs for greater food security and for improved health of the 300 indigenous Tolpan people in the village of San Juan near this clinic in the Montana de la Flora region of Honduras. As a class design assignment, the faculty member asked his junior level fluid mechanics students to study the problem and its constraints, and to create an initial plan that might be used as background if the project was to proceed. Over the following summer, major funding for the project became available through the Luke Society, and a team of seniors became involved in the Fall of 2000.

Under the direction of Dr. Bryn Jones, an MD and Luke Society volunteer who represented the “client” and arranged for logistical support, and the mentorship of a faculty member, the four students each took primary responsibility for one of the following aspects: Water Diversion, Holding Tank and Filtration, Transportation and Distribution (pipe layout), and Application. In January 2001, they traveled to survey the site with a Dordt College agronomy professor and a volunteer licensed civil engineer, as well as several other Luke Society personnel. They spent 10 days in Honduras, collecting topographical data, developing an initial irrigation system layout, and installing a small diversion dam (with bypasses) on each of the two streams chosen as water sources.

Realizing some of the challenges that would await them, the student team returned to the U.S. to design and to plan for the installation of the irrigation mainline and laterals into some 25 acres of mountainside fields involving an 80-foot elevation drop from top to bottom. As design decisions were made about the needed system components, the in-country Luke Society personnel purchased the 6,000 feet of PVC pipe and directed the villagers' work to clear brush and dig the necessary trenches for the mainline and laterals. In March 2001, Dr. Jones led a 10-day Luke Society volunteer brigade of 40 persons, including the team and its faculty mentor, to Honduras to install the system. Travel and lodging expenses for this trip were raised by the students and volunteers through requests to friends, family and home church communities.

On March 20, 2001, after five days of intense effort, the dams and filtration boxes and valves were operated and checked, and the irrigation mainlines were flushed. One of the hand-moveable, pressure-regulated sprinkler lines was assembled in one of the fields for testing. The irrigation system operated as planned. In a small demonstration plot, a drip-irrigation system for a vegetable garden was also installed at the top of one of the hillside fields.

Beyond the engineering experience and the international travel, the team learned other important lessons. Seven members of the National Police and the Honduran army escorted the volunteer group while it was in this area, which had recently been threatened by a group of “banditos.” Another more important lesson for the Dordt students involved is that the people they assisted and worked with are not poor due to any lack of industriousness. Though there was a language barrier for many of those involved, there was a great deal of communication of positive intent and respect as people from vastly different cultural backgrounds worked and relaxed together during the installation phase of the project. A shared Sunday worship service in three languages (Tolpan, Spanish, and English) was an occasion for praising God together and sharing other gifts with each other. As a department, we learned that this project could not have been carried out without the focused planning and diligent logistical support of the Luke Society.

Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/ceec

- 28 -
leadership both in the US and in Honduras. Since projects of this magnitude would only be possible every few years at best, future international humanitarian projects should be smaller in scope and involve fewer people in travel if we wish to do them on a regular basis.

Figure 2: Dordt Students Installing a Crop Irrigation System in Honduras

Institution III: Design of a Solar Power System for Remote Areas (Grove City)

Grove City College Background. Grove City College (GCC) is a four-year, independent college located in Grove City, PA with an enrollment of 2,200. Although the school is primarily a liberal arts college, it has ABET accredited electrical and mechanical engineering programs. The college has recognized the importance of providing its students an opportunity to study in developing countries or to participate in aiding their development. Faculty members also have been supported through faculty development funds to (1) travel to developing countries to investigate potential engineering projects, (2) attend conferences such as the Christian Engineering Educators Conference (CEEC) in order to share like experiences, and (3) participate in the development of a possible new cooperative study center in Uganda, East Africa.

Senior Design. The electrical engineering students are required to take a three-hour course entitled “Introduction to Design” during the first semester of their senior year. They are taught the design process as well as soft science subjects such as ethics, professionalism, and communication skills. About half way through the course, they form groups of 3-5 students. At this time, the groups propose their design projects that they will develop during the remainder of the semester and during the second semester prior to graduation. They are required to complete lab work on their projects during the last third of a three-hour lab the first semester, and complete the project during a two-credit lab course the second semester. The college normally funds $300-$2000 for each senior project. The projects are student driven with
faculty input in the form of recommendations and assistance with problem solving.

Problem Statement. The use of solar power to supply electricity in Africa is wide spread. There exists a need to develop a scalable, modular solar power system that is easy to use, portable, and reliable. Products that partially meet this need currently exist on the market. However, there is no one system that is scalable and portable and has a reliable monitoring system built-in. In general, companies do not provide integrated systems that are easily reconfigured and include the solar cell, charge controller, battery, battery monitor, and inverter. Thus, consumers with little or no technical knowledge face a real challenge in solving this problem. The Scalable Portable Solar Power System project sought to provide a portable power system that eliminates this difficulty of setup and integration in current systems, while supplying reliable battery monitoring capabilities.

Project Selection. The need for a portable scalable solar power system originally was identified by a faculty member who had worked on missions related projects in Africa. He observed first hand the large number of solar power systems being installed in Uganda. The faculty member observed the difficulties in using the solar systems and depending on them for critical electrical power.

The general project idea was presented to all the upcoming seniors at the end of their junior year. The group of four students that tackled the problem included two students who had chosen the “classical” concentration and two students who had chosen the computer engineering concentration.

Design Approach. The students first identified the sub-components necessary to meet the objectives for the solar power system. They determined that they needed a solar panel, inverter, battery, charge controller, and system state monitor. The two “classical” students concentrated on the “power” aspects of the project and worked on the solar panel and battery specifications. The two computer engineering students concentrated on the system state monitor and the charge controller. The battery, inverter and solar panel were bought from commercial vendors according to the design team’s specifications. The charge controller was modified from a circuit that they found in the literature. They made a printed circuit board of their final design. They researched the literature and found two promising theoretical approaches for the system state monitor. They settled on one of them and implemented its algorithm using an embedded controller. Part of this process required the students to develop a data acquisition system to measure operating parameters and to develop a database. The system sub-components were integrated, and the complete system was mounted on a dolly structure for portability. The total cost for the project was $1,700. The major purchases were $500 for the solar panel and $200 for the batteries.

The teaching staff checked the sizing to specifications of the major components, checked the modified design of the charge controller, and guided the students in their search for a feasible system state monitor.

Project Results. The project required an understanding and application of circuit analysis and design, data gathering and analysis, embedded system programming, and system integration, construction and
verification. The team designed, analyzed and implemented on a PCB a charge controller. The battery monitoring algorithm involved mathematical analysis techniques. The technique to monitor the state of the battery involves two measurements of the electrical condition of the battery. One is the open-circuit (or unloaded) voltage across the battery terminals and a coulometric measurement which tracks the current discharged from the battery. This technique was implemented using a Motorola 68HC11 to execute the required switching of the loads, the analog to digital conversions, the managing of the databases and the execution of the algorithms. The HC11 was also used to control the user display. The team had to determine reasonable specifications for the solar panel array and the inverter. Finally, they located manufacturers of scalable individual components, purchased the components, and installed them on a dolly structure.

In addition to the normal engineering required in a senior level project, the design team also had to consider the issues of ruggedness, adaptability to developing countries and sustainability. Although the students did not have the opportunity to travel to a developing country, the faculty member who had visited Africa gave them advice throughout the project.

Conclusions and Lessons Learned. The project was completed on time according to the design specifications at a reasonable cost of $1,700. This result was quite an accomplishment in itself. The students did not have the assistance of an electrical/electronic technician since the electrical department was just recently given approval to hire one. They would have profited from the help of a technician in the installation, testing and integration aspects. This project was the first time that some of the students had the chance to work with currents over 1 mA. It was also difficult to evaluate and integrate the large area solar panel (25.4 lbs., 4.3 feet long, 2.2 feet wide, and 1.6 inches thick). The students also had to rely on the help of the mechanical engineering technician for the construction of the dolly system. (The mechanical technician had the responsibility to assist the mechanical engineering students who were also trying completing their projects.)

The students additionally had to consider the ramifications of the fact that the system would potentially be used in a critical life-threatening situation in a hostile environment. Although the monitoring algorithm worked adequately, the students eventually concluded that more work needed to be done as well as more proof of performance testing should be completed before the system was shipped to a third world country and put into operation.

This solar power project is not an external studies program. However, it is anticipated that similar projects in the future will be conducted under the umbrella of the "external studies" program at GCC. It is anticipated that engineering students will travel and study for a semester in a developing country and while there complete an IH project.

Institution IV: Design of a Water Purification System in Guatemala (Messiah)

Messiah College’s mission is “to educate men and women toward maturity in intellect, character, and Christian faith in preparation for lives of service, leadership, and reconciliation”. Messiah has a student body of 3,000 students, 160 of which are enrolled in the engineering program taught by eight faculty. Messiah employs summer work experiences and internships to provide valuable real world experience for their students in all disciplines. In addition, for many years the Engineering Department has been utilizing extra-curricular projects, both locally and globally, to help educate engineering students. Several local urban projects in Harrisburg, PA have included community gardens, building straw-walled sheds, and roof-top gardening techniques.

Many of the Engineering Department’s global extra-curricular projects have been facilitated through Dokimoi Ergatai24 (Greek for “Approved Workers”), basically a student run organization, which collaborates with faculty, staff, and the local community to initiate, nurture, and oversee the development of appropriate technologies for implementation in needy areas abroad. Some of the projects have
included:

- Photovoltaic(solar) electric power systems for a medical dispensary in Burkina Faso and a hospital in Zambia
- Solar-powered drinking water pumps supplied to a school for persons with physical disabilities
- Human powered pumps to irrigate a micro-enterprise farm run by persons with disabilities
- Hand-powered tricycles which provide mobility and freedom to polio victims

Other projects with global interest have been sponsored by the Collaboratory for Experiential Learning program, a “hands-on” learning laboratory. Some of these projects include work on water purification and on landmine detection, removal, and detonation.

Water for the World\textsuperscript{25} is an interdisciplinary extra-curricular project started in January 2002, inspired by one man’s concern to provide pure drinking water to the world. A simple two-fold mission was developed:

- Create an awareness in people that there is a need for clean drinking water (education)
- Create devices to provide clean drinking water to people groups at an affordable cost and who can be easily trained to maintain the devices (sustainable purification)

Presently there are 14 students, first year to senior year, from four of the five schools within Messiah College who are now committed to take part in this on-going project. Four teams have been established. An engineering team has built a small, three filter, ultra-violet light prototype purification system which can be powered by AC or DC electricity. A natural sciences team tests and documents the purity of the

\textbf{Figure 4: Prototype of a Three Filter Ultra-violet Water Purification System}

Christian Engineering Education Conference 2004
http:// engr.calvin.edu/ces/ceec

- 32 -
water being filtered. A business team has developed a marketing strategy for the device which was developed. A communications-education team has developed (and maintains) a website for the project and has developed a brochure in both an English and Spanish edition and educational materials. Faculty advisors from each department/school were solicited and have been involved with the teams.

The teams meet bi-weekly together in a large meeting and as needed during the week to fulfill the objectives of each team. The man who inspired the project and an alumni advisor who is an environmental chemist come to most of the meetings, giving valuable input to the teams.

In addition the mechanics and chemistry of water purification techniques, teams have also learned team dynamics including: time management, project management, communications skills, division of labor, conflict resolution and the use of logbooks.

In August 2003, a scouting team of students and advisors visited a Kekchi Educational Center in San Juan Chamaleco, Guatemala to investigate water needs of the school, find local suppliers of water purification materials and equipment, and field-test the prototype system mentioned above. All three objectives were met. Based on the scouting team’s recommendation, the center has installed a system which saves the school $1,600-$1,700 per year in purchasing bottled water and firewood to boil water. Another system is being planned for a seminary in Guatemala City.

Through this and other similar extra-curricular projects, engineering students have begun to fulfill the mission of Messiah College, “to educate men and women toward maturity in intellect, character, and Christian faith in preparation for lives of service, leadership, and reconciliation.”

References


Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/ceec


Faith-Based and Secular Experience on Rebuilding Engineering and Computer Science Higher Education in Kurdistan of Iraq

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Abstract
In December 2003, twenty* Baylor University faculty members conducted a two-day on-site workshop for four different groups of Kurdish faculty (Colleges of Engineering, Medicine, Arts, and Law) from several Iraqi universities. The workshop was hosted by the University of Dohuk in Dohuk, Iraq.

Four Baylor engineering and computer science (ECS) faculty members worked as a team to develop and prepare the engineering/computer science workshop. Because of limited and sporadic information about Iraqi engineering and computer science education, the team’s preparation was intent on flexibility. Suitcases full of books, syllabi, and educational materials taxed participants’ endurance. The reception by the Iraqi faculty, staff and students was warm and eager.

The scope of exchanges and learning were often unexpected and illuminating, especially when the discourse involved students as well as faculty. Both the presenters and workshop participants welcomed the opportunity to learn from each other. Iraqi faculty learned about the curricular components, teaching elements, and assessment processes used by U.S. universities. Through frequent questions and exchanges the Baylor faculty learned of the unique challenges Iraqi engineering and computer science faculty face because of limited resources and the structure of their secondary education system.

While this demonstration of outreach had definite Christian vocational origins, its outcomes were aimed at professional content. To help underpin the faculty’s commitment to this experience as vocational calling, daily scripture and reference readings were prepared for the trip. Although Kurdistan of Iraq is overwhelming Islamic, their government is intentionally secular and their ideas relating to faith tolerant. Impromptu occasions to share faith experiences were rich for the deliverer and recipient.

Current opportunities for broad-scale follow-on efforts as a result of this project are limited. Funding for a program allowing Iraqi undergraduates to spend five weeks at Baylor to gain a deeper understanding of U.S. society, culture, values and institutions was reduced. Stranded Iraqi Ph.D. students have been offered the opportunity to continue at their studies at Baylor. Funding for an electrical engineering faculty member from the University of Mosul scheduled to spend six months at Baylor involved in the study and research of field programmable gate arrays did not materialize. Current difficulties and dangers faced by Americans in Iraq makes it difficult to execute on-site projects.

Introduction
As news was breaking of Saddam Hussein’s capture by the 1st Brigade of the 4th Infantry Division, based at Ft. Hood, Texas, on December 14, 2003, a group of twenty* Baylor University faculty members were assembling and making their final preparations to travel to the Kurdistan region of Iraq to present workshops to Iraqi faculty colleagues from six universities. These Baylor faculty members represented a number of different academic disciplines and all were volunteers. The genesis of this effort dated back to 1996 when Baylor University President Robert B. Sloan and University of Dohuk president Asmat M. Khalid signed a letter of cooperation between these two institutions. At that time, however, political instability and travel restrictions in Iraq prevented meaningful cooperative initiatives from moving forward. Then in the summer of 2003, after the initiation of the war in Iraq, three Baylor faculty members traveled through Turkey to Northern Iraq and reestablished relations with President Asmat and the University of Dohuk. This meeting led to a commitment from Baylor University to send a delegation to Kurdistan of Iraq to present workshops to Iraqi faculty colleagues. This trip provided faculty members with an opportunity to travel to Iraq and present workshops to Iraqi faculty colleagues from six universities. The workshops were designed to exchange ideas and foster collaborations between Baylor and Iraqi universities.

While this demonstration of outreach had definite Christian vocational origins, its outcomes were aimed at professional content. To help underpin the faculty’s commitment to this experience as vocational calling, daily scripture and reference readings were prepared for the trip. Although Kurdistan of Iraq is overwhelming Islamic, their government is intentionally secular and their ideas relating to faith tolerant. Impromptu occasions to share faith experiences were rich for the deliverer and recipient.

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the University of Dohuk to present a workshop to faculty members at there and five other northern Iraqi universities. Dohuk University prepared and distributed flyers, as shown in Figure 1, for the workshop.

**Background**

There are twenty universities and 43 technical institutes in Iraq. In the first years after Saddam came to power in Iraq, he was credited with creating one of the strongest educational systems in the Middle East. The reputation of Iraqi scientists, engineers and mathematicians has historically been strong within the Arab World.\(^1\), \(^2\) In 1982 Iraq won a UNESCO award for eradicating illiteracy. Especially noteworthy here is that literacy rates among women were among the highest of all Islamic nations. Currently 45% of students in primary schools are girls.\(^3\) Beginning in 1973, Saddam and Baath Party officials ordered all textbooks to be written so that lessons were intertwined with Baath Party ideology. But by the decade after the 1991 Gulf War, UNICEF estimated that school spending had fallen by 90%. During this period school buildings deteriorated and teachers’ salaries fell to $6 per month. By 2002, USAID estimated school enrollment had dropped by 53%.\(^4\)

During the past two decades most Iraqi universities have suffered greatly under the Saddam regime. Academic libraries have few books published after the early 1980s and most journal subscriptions ended around then.\(^5\) As a result of the Gulf War and UN Sanctions, laboratories, if operational at all, use outdated equipment and instrumentation and expired chemicals. Some instrumentation has been looted.\(^2\) Entire sections of science students may have to huddle around one piece of laboratory equipment. Computer Science courses were often taught without the benefit of a computer.\(^1\)

In 1988 Saddam ordered the construction of seven new universities even as existing universities suffered. As more new buildings came on line there were fewer resources devoted to the existing ones. Kirkuk University was the last to open, in January 2003, three months before Operation Iraqi Freedom began.\(^6\) The University of Two Rivers (formally Saddam University) was the only Iraqi institution of higher education not affected by Baathist party favoritism. The best professors were selected for appointment and students were admitted strictly on merit. With the new policy to treat all Iraqi universities the same, according to Fa’yek al-Azzawi, the university’s vice president and professor of electrical engineering, the University of Two Rivers will be set back if it is forced to become “like the others.”\(^7\)

Brain drain from Iraqi universities begin occurring shortly after the 1963 Baath Party coup d’état. A second wave of faculty departures occurred in the early seventies after Hussein forced his way into power. The Iran-Iraq war of the 1980s was the greatest period of academic departure as university priorities shifted from centers of education and research to promotion of Saddam’s preferences and Bath Party ideologies. The professorial leakage continued during the 1990s as Saddam prohibited foreign travel and issuing diplomas allowing graduates to seek jobs abroad. Estimates are that 30% of Iraq’s professors, including many who were the most successful, fled to other universities all over the world.\(^1\) Some of the replacements were unqualified as they had been educated in the meager settings of Iraqi universities, and often called “homemade Ph.D.s.” Others were Saddam’s relatives and Baath Party loyalists. An estimated 2,000 university professors fled Iraq between 1995 and 2000. Salaries for faculty members refusing to endorse the Baath Party continued to decrease (to as low as $50 per month) while salaries for select professors and administrators who supported the Baath Party increased. The majority of professors had to find second jobs as tutors or outside of the university, and often sold their personal

*Christian Engineering Education Conference 2004*

*http://engr.calvin.edu/ces/ceec*
Further corruption infiltrated the university classrooms as some professors blackmailed students, who in turn bribed professors. There were some instances where students placed a gun on their desk and cheated as they took a test, and defiantly intimidated the instructor to stop them.

Compared to the majority of the Iraqi universities, the three Kurdish controlled universities prospered during the last decade of the Saddam regime. Dr. Diane King, a Kurdish-studies scholar at the American University of Beirut and who was the first foreigner to teach at the University of Dohuk, commented on the plight of the Kurdish universities as, “There are two stories to tell: Everyone is aware of how far they have to go, but if you look at how far they’ve come, that’s amazing too.” The Kurdish universities are now apprehensive because of plans by the Iraqi Minister of Higher Education and Scientific Research to reintegrate Kurdish universities with the rest of the Iraqi Higher education system. Part of this calls for increasing enrollments to accommodate Arab students from other regions of Iraq. Some Kurdish administrators worry that this will lessen the region’s autonomy, including teaching more courses in Arabic vs. Kurdish. The three Kurdish universities are often seen as symbols of Kurdish nationalism and pride, stemming in large part from teaching in their own language.

During the second half of 2003 there is evidence that the brain drain of the previous two decades began to reverse. Scores of former Iraqi faculty members have returned from other countries. Many others have inquired about returning or to offer donations, scholarships, equipment and partnerships. Among the countries where professors most often fled include Yemen, Jordan, Libya, England, the Netherlands and the United States. Many of those who have returned appreciate the new freedom of their homeland but find it difficult to accept the sparsely equipped facilities and continued low faculty pay. Some returning faculty are not welcomed back with open arms because of resentment that their departure caused hardships on those left behind or because they were perceived as leaving for better pay.

Since the fall of Saddam several universities have expressed the intent to become more Western. At the forefront this includes interest in changing the current lecture-only style to one that encourages problem solving, discussion, interaction, and critical thinking. There are also university-specific initiatives driven by optimistic anticipation of Iraq’s future. Salahaddin University is planning an American-style liberal arts university adjacent to its existing campus. The Sulaimani province has committed the funding and land to initiate a private university focused on business administration and economics. Dohuk University is in the process of designing a College of Democratic Studies that will offer coursework solely in English.

Some of this change has been precipitated through assistance provided by U.S. partners either funded by USAID or institutions forming individual partnerships. Such assistance has included lending expertise such as the development of a computer lab shown in Figure 2. The State University of New York at Stony Brook, the University of Hawaii, DePaul University, Jackson State University, and the University of Oklahoma have all secured significant USAID funding to help lead consortia of U.S.-Iraqi university partnerships. Other universities have held book drives or invited Fulbright scholars. Baylor’s delegation of twenty-two individuals is the largest single academic contingent to visit Iraq to date.

Besides the U.S. lead coalition military support in Iraq, USAID is also involved with the Coalition Provisional Authority and the United Nations in carrying out infrastructure rebuilding programs in education, health care, food, security, transportation, community development, local governance, and transition initiatives. Expenditures have exceeded $2.6 billion. Education accomplishments include:

Figure 2: A new university computer lab. (USAID photo, Weekly Update #30)
• Rehabilitating 2,358 schools
• Training 31,772 second school teachers
• Distributing 1.5 million secondary school kits, 159,005 student desks, 26,437 teacher desks, 61,500 chalkboards, 808,000 primary student kits, 81,735 primary teacher kits
• Conducting accelerated learning program for 600 student
• Training 860 secondary school Master Trainers
• Printing 8,759,260 text books
• Reviewing 48 math and science textbooks

Other examples of infrastructure improvements include rebuilding electricity production that exceeds pre-war levels. Irreparable sections of key bridges have been demolished and new bridges constructed. An International Satellite Gateway and twelve new telephone switches have been integrated with Iraqi Telephone and Postal Company’s fourteen switches. Millions of children have been vaccinated.3

Under the Saddam regime, all textbooks contained political and/or religious propaganda, including science and math books.10 An exercise on verb tense in sentences included “We do our best to serve our country and our people. As our beloved leader, President Saddam Hussein says, ‘Serving the Iraqi people is a duty.’”3 The most blatant were history and civics books. For example, a history book may claim that the Iran-Iraq war was an instance of the warlike nature of Persians and their hostility toward Arabs.9

All 563 Iraqi textbooks have now been edited and revised by a team of Iraqi educators. Because civics books were so laden with propaganda as to be considered not salvageable, civics was removed from the curriculum for 2003-04. Time pressures and political sensitivity led to the temporary exclusion of controversial topics such as the Gulf War and reference to Israelis, Americans, and Kurds.10

Although there are noteworthy efforts to help rebuild Iraq’s higher-education system, much more is needed. According to John Agresto, the senior American official in charge, “After the looting and the fires, we’ve done really very, very little.” Only $8-millioun out of an estimated $500-million needed has been provided. While the U.S. has been restoring key civil sectors mentioned above, education, culture, and sports were all things where international support was expected. According to Mr. Agresto, “The truth is, the international community has not come through.”13 Some have suggested this lack of funding and coordinated support has resulted in fragmented and less than desirable efforts Baylor has experienced in its efforts to initiate broader and more significant aid activities.

Issues of Faith

Faud Hussein, a college professor returning to Iraq from the Netherlands, oversees the editing and publication of textbooks for the Ministry of Education. He and his team are resisting pressure from religious groups who desire to infiltrate the school system. Some groups feel that the roles of schools are to train students in Islamic law and not to do so is an attempt by Americans to break Iraqi identity. Dr. Hussein is recommending “concepts of tolerance” against content that is anti-Semitic or anti-West that could sow the seeds for future intolerance.4

As was the case under Saddam, religion is taught in Iraqi schools as a subject. Christians are excused from taking Islamic classes and if there are enough Christians they take a class in Christianity. The old Saddam Islam textbooks presented a Sunni interpretation on ritual ablutions and the early Caliphate, and Shiite students were forced to learn this interpretation.10

Beginning with the Fall 2003 semester, for the first time in nearly fifty years, Iraqi faculty voted in free elections to choose presidents and deans. Baath party members were banned from key academic posts.
The credentials of the elected administrators were scrutinized by U.S. officials to ensure they comply with written stands to keep Baathists, or those who had been involved in human rights violations or associated with illegal-weapons research, out of positions of power. Ten to twenty percent of the faculty and administration were at least midlevel Baath Party officials and have been dismissed, though a loosening of this restriction was announced in April 2004. Iraqi-American tension developed with the perception that Iraqis were left out of the higher education rebuilding decision-making process. Farouk Darweesh, Deputy Director of Education and professor of Mechanical Engineering, stated “The policy makers meet with the ambassador group,… and there is not a single Iraqi there.”

Although Iraqi universities are now free from Saddam’s political influence, some are facing pressure to portray favored religious views in textbooks, and are faced with balancing competing religious sectors. There have been campus clashes between professors and students as Sunni and Shiite student groups roam campus like “morality police” telling women students to cover their heads and pressuring professors to segregate classes by gender. A female computer science student reported that a male student used a megaphone to chant “You girls gotta stop wearing short skirts or you’re going to hell.” Some of the religious tensions are heightened by the appointment of the Minister of Higher Education (a former professor and petroleum engineer) who some consider a religious fanatic who has appointed members of his own religious group to high-ranking university positions. The end result claimed by some university presidents is that “religious factions are hijacking the university” and threatening to diminish recent gains in academic freedom. The U.S.-led coalition indicates they are aware of these situations but that policies involving religion on campus is considered an internal matter.

Baylor’s efforts reported here had no “officially-sanctioned” religious mission. If it had, the faculty team would not have been permitted by government authorities to proceed. However, there is little doubt that every individual member of the Baylor workshop team considered this experience one of Christian service to a distant group of colleagues. There were many opportunities among the team members for Christian witness (preaching to the choir) as well as numerous opportunities for team members to serve or share as a Christian to Iraqi citizens. The steering committee of Baylor Horizons (a grant from the Lily Foundation and entitled, The Theological Explorations of Vocation for a Life of Service) and the office of Universities Ministries equipped each team member with a series of daily scripture and text readings relating to vocations. This was quite thoughtful and useful, though with the team’s hectic schedule it was always a challenge to remain current. The content of these readings is shown in Table I. Several copies for this document were confiscated by government officials as they searched individual belongings when the team crossed

<table>
<thead>
<tr>
<th>Date</th>
<th>Scripture</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday 15-Dec-03</td>
<td>Exodus 3:1-12</td>
<td>Chapter 2 of Career and Calling; Ginny Ward Holderness with Forrest C. Palmer, Jr.</td>
</tr>
<tr>
<td>Tuesday 16-Dec-03</td>
<td>Matthew 25:14-30</td>
<td>Chapter 3 of Your Work Matters to God; Doug Sherman &amp; William Hendricks</td>
</tr>
<tr>
<td>Wednesday 17-Dec-03</td>
<td>Romans 12:1-8</td>
<td>Teaching as Profession and Vocation; Mark R. Schwehn</td>
</tr>
<tr>
<td>Thursday 18-Dec-03</td>
<td>Colossians 1:15-20</td>
<td>Chapters 1 &amp; 4 of The Call: Finding and Fulfilling the Central Purpose of Your Life; Os Guinness</td>
</tr>
<tr>
<td>Friday 19-Dec-03</td>
<td>John 10:1-5</td>
<td>Chapters 5, 6, &amp; 9 of The Call: Finding and Fulfilling the Central Purpose of Your Life; Os Guinness</td>
</tr>
<tr>
<td>Saturday 20-Dec-03</td>
<td>Matthew 25:31-46</td>
<td>Chapter 3 of Rich Christians in an Age of Hunger; Ron Sider</td>
</tr>
<tr>
<td>Sunday 21-Dec-03</td>
<td>1 Corinth. 12:1-13</td>
<td>Chapter 7 of Education for Life: Reflections on Christian Teaching &amp; Learning; Nicholas P. Wolterstorff</td>
</tr>
<tr>
<td>Monday 22-Dec-03</td>
<td></td>
<td>The Journey Begins; Todd Lake</td>
</tr>
</tbody>
</table>

Christian Engineering Education Conference 2004
http:// engr.calvin.edu/ces/ceec

- 39 -
the border checkpoint headed back into Turkey from Iraq.

After the conclusion of the trip, one of the participants, Dr. Rene D. Massengale, Assistant Professor of Biology, wrote a communication to the other team members. This communication highlighted some of Dr. Massengale’s thoughts reflecting on some of the spiritually significant encounters she experienced. For example, early in this communication she wrote, “It is truly amazing how God’s hand was so evident upon our delegation during each moment of the trip.” She further comments of her feelings that it was God’s “stamp of approval” of our efforts once the team learned of Saddam’s capture on the morning of departure. Dr. Massengale described of how she learned of God’s special presence in the individual lives of her colleagues and the special prayer times spent with other team members.17

Dr. Mark Long, Baylor associate professor and Director of Middle East Studies, was one of the faculty members who made the previous exploratory visit to Iraq and one of the team leaders in the workshop effort. In a later essay published in the local newspaper he eloquently captured the sense and experience of Christian vocational calling this team experienced. Dr. Long wrote:18

**Reading Locke on the Tigris**

**Discussion with Kurds helped me find the real Baylor**

Only with difficulty can I render the scene, that of the 30 or so Kurdish professors talking at once, excitedly, passionately.

The clatter, as it were, of three languages simultaneously filled the university classroom, the lights occasionally blinking out because of unstable power grids in the northern Iraqi city.

Yet the trilingual conversations (in Kurdish, Arabic and English) continued unabated. U.S. forces had just captured Saddam, and I found this group of law and political science professors particularly engaged during the workshop on John Locke’s ideas and the American founding. This was their own 1776, a day of liberation. Inevitably, powerfully, the talk among my Kurdish interlocutors then turned to 1787 – and a constitution that might “secure the blessings of liberty to themselves and their posterity.”

“Exhilarating” is too weak a work for what I experienced as an American teacher among Iraqi friends in Kurdistan. And the other 21 of my colleagues whom Baylor sent last December would all say the same.

Such is the joy of teaching: taking up great texts and powerful ideas, and inviting others into the extraordinary venture of pursuing sharpened minds and strengthened hearts, deepened souls and bolder vision.

In fact, I went to Iraq with a pretty clear understanding of higher education as my personal vocation, a call to give my life away, to God’s glory, in the classroom.

Semester by semester, I tell my students, “I am yours for this semester. My life is yours and we study together as students in American history (or Mideast politics or ancient civilizations).”

But I came back from Iraq with a sense – and I had not expected this – of Baylor’s corporate vocation. I thought:

“As Baylor has sent me into the classroom, there to give my life away in faithful service, so here in Iraq – Baylor is giving itself away. All of us – administrators, staff, students, faculty – have determined to share ourselves as Christian educators in a war-torn country to help give them back their future. We aren’t here to find new donors or raise the endowment or recruit new student athletes. We are here as Baylor University, called to faithful Christian higher education, to give our lives away.”

No other university in the United States has so fully invested itself in rebuilding Iraqi higher education, whether measured as funds spent or educators sent. And that has been possible only because
Baylor has articulated such a bold vision for Christian higher education and because it enjoys the intellectual and moral leadership it does.

That vision – set forth in 2012 – and that leadership sent my colleagues and me to Iraq – and to the sort of experience I had with new Kurdish friends as we spoke of Locke and Jefferson and Madison and the hope for human dignity.

Perhaps I’ll never adequately render the scene from that day in the Iraqi classroom. But this I can affirm: I went to a remote and mountainous region half a world away, to a war-torn country, and there discovered Baylor University.¹⁸

Travel and Workshop

There was considerable apprehensive by all members of the Baylor team not too naive to appreciate it, to travel to a distant part of the world that was officially considered a war zone. Perspectives among the Baylor participants did not center on whether they supported this war effort, or the United States Presidential leadership (a Texan), or any other particular political view. For the Baylor team members this was a vehicle to combine professional and Christian service to a neighbor, albeit distant one, in need of help.

The Baylor administration struggled mightily with the risk assessment of this effort. Though not formally funded by the university, Baylor institutional funding from numerous divisions was used. Other support came from the Baylor Horizons program funded by the Lily Foundation. Remaining expenses were paid from the personal resources of the participants. Many of the workshop supplies were paid out of normal Baylor departmental accounts. Gifts for the hosts were predominately purchased separately by individuals. All of the textbooks were donated by individual faculty members or the textbook publishers themselves, including Prentice Hall and Scott/Jones Publishers.

Security preparations and precautions for the trip were thorough. Project leader and Baylor’s Director for International Education, Dr. William A. Mitchell, was previously a U.S. Military Commander in Turkey. He used his Turkish contacts (and language skills) to help us safely arrive at the Turkey-Iraq border. From there, Dr. Asmat and his internal authority provided for the team’s safe keeping. Although the team encountered travel challenges and delays, there was never a moment when the members felt threatened or in danger.

The route to Dohuk began in Waco where team members carpooled to Dallas/Ft. Worth International Airport for an early morning flight to J. F. Kennedy Airport in New York City. It was during the early morning preparation and the drive to Dallas where team members all intently tuned to NPR and listened to the BBC broadcast of early breaking news of Saddam’s capture. The first televised coverage wasn’t seen until after the participants arrived at the airport. This very gratifying and significant event in itself allowed the travel portion of this effort to begin with an extra special sense of purpose, history, and permission.

From JFK the team traveled to Istanbul, Turkey, a city rich with Christian history and artifacts, though

Christian Engineering Education Conference 2004
http://enr.calvin.edu/ces/ceec

- 41 -
there was little time for tourism. This stop in Istanbul was less than a month after the terrorists’ attacks of November 21, 2003, on the British Consulate and the headquarters of London-based bank HSBC. These attacks on Western entities killed twenty-seven people and injured more than 450. Because of the heightened concerns for safety and security of Westerners in Istanbul, the hotel where the team stayed was selected because it was off the Western beaten path. A nearby internet café allowed team members early communication with anxious spouses and other family members back in Texas. On the bus drive to the hotel the host warned the team to avoid invitations from locals to enter club restaurants after dark. Unfortunately, the one individual on the team who elected to use frequent flyer miles and arrived the day before did not have this warning and was conned out of around $250.

From Istanbul plans called for a flight to Ankara, then Diyarbakir, before a chartered bus ride to the Turkey-Iraqi border. Unfortunately, snow in Diyarbakir cancelled that leg of the flight and another flight was not available until the next afternoon, potentially causing a two-day delay. The only resulting alternative was to charter a bus for an all night, fourteen-hour bus ride from Ankara to Diyarbakir, which was done. This was probably the portion of the trip, traveling at midnight through the snowy mountains and politically unstable regions of eastern Turkey, where the Baylor faculty bonded as a team. But as a result of travel delays, the hosts had to wait an entire day for us at the border and the workshop was shortened from three to two days. The message on the first sign visible upon arrival in Iraq, as shown in Figure 3, read, “Welcome to Kurdistan of Iraq.”

There are notable exceptions between the situation that exists in Kurdish northern Iraq and the rest of the country. Most notably is the relative prosperity. Miles of petroleum-transporting trucks wait in line at the Turkish border leading into Iraq, as shown in Figure 4, and all of them pay a tax that funds much of the Iraqi Kurdistan infrastructure. Over a decade of protection under the no-fly zone has lent political and economic stability. While one’s imagination of Kurds may raise visions of nomads roaming snowy mountainous regions, that figment is largely historical. Exceptions may include taking refuge after Saddam’s attempted Kurdish genocide and poison-gas massacre that killed 5,000 in Halabja on March 16, 1988. Kurds have overcome tribal skirmishes to develop a working free-enterprise and democratic system.

Kurdish universities are a new and important element of the region’s progression. Dohuk University occupies several pre-existing building located around the city. Dohuk’s College of Engineering is housed in a building that was previously an elementary school. It is heated by semi-portable kerosene heaters in an attempt to cut through the damp and cold, and causing the rooms to reek with that characteristic odor.

The workshop was attended by students and faculty from Dohuk and at least five other
nearby universities, which were not all Kurdish. Besides the engineering-computer science workshop, other Baylor faculty presented workshops in the arts/humanities (Figure 5), medicine, and politics/law. Throughout the two-day ECS workshop approximately one hundred faculty and students attended. As in many regions of the world, much of the educated Iraqi Kurdish population has reasonable command of spoken English. Thus, there was no need for formal translation. When the Dohuk Engineering Dean, Dr. Ali F. Hassan, was asked about how much of the workshop presentation the participants could understand, he responded, about 80%.

The outline schedule prepared in anticipation of this workshop is shown in Table II below. While the ECS team roughly followed this schedule for the first morning, the lively, cordial discussions and exchanges prevented us from staying on schedule or even anticipating the directions the conversations would take.

<table>
<thead>
<tr>
<th>TABLE II: Workshop Outline Schedule</th>
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<tbody>
<tr>
<td>Responsive and Targeted Engineering &amp; Computer Science Education for the Kurdistan Region22</td>
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<tr>
<td>Day 1</td>
</tr>
<tr>
<td>Morning Wednesday 17-Dec-03</td>
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<tr>
<td>9:00-10:30 (1:30) Opening Ceremony</td>
</tr>
<tr>
<td>11:00-11:15 Break</td>
</tr>
<tr>
<td>10:30-13:00 (1:30) Introduction &amp; Elements of U.S. Higher Ed (bsk)</td>
</tr>
<tr>
<td>13:00-14:30 Lunch</td>
</tr>
<tr>
<td>Afternoon</td>
</tr>
<tr>
<td>14:30-16:30 (2:00) Programs Overview- Computer Science (ccf &amp; dbs)</td>
</tr>
<tr>
<td>16:30-16:45 Break</td>
</tr>
<tr>
<td>16:45-18:30 (1:45) Programs Overview- Engr (jbt) &amp; Kurdish Comparisons (bsk)</td>
</tr>
</tbody>
</table>

Travel via the Turkish border and other limitations prevented the program schedule from containing overt references to Christian topics. Within the context of the program, Baylor’s intentional integration of Christian vocation within a larger secular framework was contrasted with the Iraqi system of Islamic studies by college students.

Within the secondary schools of Iraq students are targeted around age fifteen as to whether and the type of collegiate education they will be allowed to pursue. So students with engineering and computer science potential complete a curriculum in high school aimed at preparing them for these studies. By the time Iraqi students complete high school they have also completed their liberal arts and basic general education requirements. Some hypothesize that this lack of continued or advanced liberal arts study stifles long-term creativity. But this system also has the advantage of leaving more time in college to pursue a depth and breadth of technical topics. It was interesting to learn during workshop discussions that some Iraqi faculty came to the conclusion that the engineering or computer science curriculum offered by their university was superior to the model U.S. curriculum presented in the workshop. This was because of the
relatively larger time spent on technical topics and the greater number of topics covered.

When it came to presentations and discussions on teaching and learning the debate was quite lively. Iraqi faculty members shared that they face many of the same challenges as U.S. faculty with regard to student motivation and learning. However, some of the underlying causes are quite different. For many courses there aren’t enough textbooks for each student to receive a copy. Thus, the book for the course is shared by two or more students and sometimes it can’t be taken from campus. {Observing the severity of these conditions helped the Baylor faculty better appreciate their less daunting teaching challenges.} Further, many Iraqi faculty have become disenfranchised by low pay, inadequate facilities, and what they perceive as apathy by the students. The pedagogical style of faculty is often one lacking stimulation, graded assignments, or opportunities for interaction with students outside of class time. This finding was confirmed by the dean but somewhat in contrast with the enthusiasm faculty demonstrated by the opportunity to participate in the workshop. It was this topic, improving pedagogical delivery, which was considered as perhaps having the best potential for positive follow-on collaboration.

Faculty and students in Western universities take access to information, library and other resources for granted. There is no public mail service or access in Dohuk. Dohuk University’s engineering library in totality consists of only a few scores of linear feet of books and journals. Many of them are outdated. The Baylor team brought with them two large suitcases full of books and accompanying course syllabi. Although attempts were made to bring three books on each topic so they could be share among the Iraqi universities, there often were requests for more copies.

Limited internet access is available in Iraq². Many businesses and most middle class families in Iraq own a computer. Many computers were looted from government, university, and business offices in the aftermath of the war. Because of daily power outages and fluctuations it is difficult to plan on reliability. Internet access also suffers from sporadic outages and costs $200 per month for a 128k connection, which is out of reach for most Iraqis. Internet cafés are the choice for on-line access but too is slow, unreliable, and often crowded.²³ Dohuk University has internet access but predominately only in the medical school for now. There is hope it will soon spread to the other academic units. Information access, including electronic library resources, is another area ripe for collaboration.

Regardless of the limitations and barriers facing Kurdish engineering and computer science higher education, there are notable success stories. For example, university administrators are selective about which fields of engineering they offer. There are no biomedical engineering design programs in Iraq because there is no medical device industry in Iraq. But there are irrigation engineering programs that are responsive to the needs of the country. Likewise, most computer science programs do not excessively emphasize computer programming because there is virtually no software industry in Iraq. But there are ample opportunities for network design, building and maintenance and Iraq is considered to have a well-educated computer science community.²³,¹

The timing for follow-up efforts in Iraq is opportune based on need. But the current political and logistical uncertainties prevent new grassroots responses. Little new funding is available from traditional sources. New and different levels of violence against Americans have increased. During 2004 there have been numerous reports of kidnappings and murders including those of Christian missionaries and government aid workers, and the bombing of Christian churches²⁴ (Figure 6). Though most of these reports are from Iraq proper, some of the violence has infiltrated the Kurdish region. The most recent incidents of Iraqi prisoner abuse, beheading of an American contractor, and murder of

Figure 6: Iraqi Christian church bombing in August 2004 (H Mizban, AP)²⁵
the head government official make on-site activities tenuous.

Though initial follow-on efforts appeared promising, sustained funding challenges and regional instability continue to thwart opportunities. Funds were de-appropriated for the program Baylor was pursuing to host a group of Middle Eastern students, including undergraduate students from Iraq. These students would have spent five weeks at Baylor this summer gaining a deeper understanding of U.S. society, culture, values and institutions. A September 2004 higher education workshop in Afghanistan, with an emphasis on women’s education and requested via Laura Bush and Karen Hughes, was deferred. Baylor’s Risk Assessment Committee, in light of U.S. State Department travel warnings for and concerns over liability, recommended this effort be postponed.26

After the team’s return from Iraq, an electrical engineering faculty member from the University of Mosul made contact concerning opportunities to study and conduct research for six months at Baylor beginning in August 2004. This individual did not attend the workshop although some of his Mosul colleagues did. He is also the brother of a faculty member at Dohuk University and his contact was made via that connection. His area of study and research was to be field programmable gate arrays. The prospect for this cooperative initially looked promising and considerable effort was invested in working out the details. However, the vehicle he was using to secure authority to study at Baylor was not able to overcome strict bureaucratic requirements.

Definition and enforcement of U.S. government economic and trade sanctions likewise has increased the difficulty of cooperative ventures between Iraqi and U.S. academic communities. Moreover, U.S. government legislative or executive sanctions on permissible and legal activities continue to change. Under such conditions, actions such as providing editorial comments to a scholarly work authored by a scholar from a sanctioned country could be in violation. Violations of such sanctions can create criminal and civil liabilities, including imprisonment.27

Baylor’s School of Engineering and Computer Science is currently hosting a visiting professor/researcher from Papua New Guinea working in the area of Appropriate Technology for developing countries. Hopes are that this effort, and other intentional opportunities (such as hosting a Mosul colleague), will lead to more vocational service opportunities. A new student group, Engineers on Mission, is being organized, and the school hosted an Appropriate Technology symposium in May 2004.28

Although there is a shared corporate identity within the school of the desire to affect the external world through Christian service, many of Baylor’s efforts in this direction are the result of individuals pursuing projects and activities based on personal interests or opportunities. A number of opportunities arise from Baylor-facilitated programs and efforts while others are generated individually. Baylor’s School of Engineering and Computer Science’s Tenure and Promotion guidelines have an explicit expectation of Christian activity and service but that requirement doesn’t appear to be the driving force. Rather, it appears the motivation is that individual faculty members desire to actively live out their Christian faith and therefore seek opportunities to do so. Identifying faculty candidates with this type of attitude is an important component in the search and recruitment process.

Conclusion

Twenty faculty members from Baylor University organized an on-site workshop to assist Iraqi faculty who for the last fifteen years and beyond have been isolated and operated with sparse resources under the Saddam Regime. Included within this was a team of four faculty members from Baylor’s School of Engineering and Computer Science. The reception by the Iraqis was gratifying and exchanges among the Baylor workshop leaders, Kurdish faculty participants, and even students was revealing. Although this effort’s purpose was to lend academic and professional assistance, its motivation had definite Christian overtones. This was a meaningful and rewarding experience for all of the Baylor volunteer participants. Two areas considered rich for collaborative efforts, teaching methodologies and library/information

Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/cecc

- 45 -
resources, were identified. Proceeding now with broad based follow-on efforts is difficult because of issues relating to costs, political instability, and safety. Still, several projects are moving forward. Efforts such as these are among the varied opportunities many of Baylor’s School of Engineering and Computer Science faculty, staff and students seek to live out their Christian faith and service.

References

*Christian Engineering Education Conference 2004*

http://engr.calvin.edu/ces/ceec

- 46 -
The entire Baylor contingent consisted of eighteen Baylor University faculty members, two representatives from the Consortium for Global Education, and two Baylor University graduate students.

Other References

Electronic Portfolio for Assessment of a Christian Engineering Program

Dominic M. Halsmer
Oral Roberts University, Tulsa, Oklahoma

Abstract

In an effort to continuously improve the quality of education in the general engineering program at Oral Roberts University, a new tool known as Electronic Portfolio or e-Portfolio has been implemented as the primary data-gathering instrument for assessment. Students periodically submit exhibits to the portfolio as evidence that educational objectives are being met. Not only does this provide good information for program improvement, but it also allows the students to see more clearly how their lives are being transformed. This is highly motivating for both students and faculty, and it also helps to streamline the ongoing assessment process. Oral Roberts University is a Christ-centered institution. As such, educational objectives include the ability to practice biblical principles of stewardship. Special exhibits are proposed to assess the attainment of these educational objectives.

Students take a more active role in helping to assess their education by electronically submitting evaluations, coursework, test scores, and survey results at the entry, intermediate, and capstone levels. These exhibits are carefully selected to demonstrate satisfaction of the program educational objectives, which are derived from departmental and university mission statements, ABET evaluation criteria, and input from other constituents. A professional level may also be added to facilitate the gathering of information from alumni, employers, and graduate school advisors. Data is then aggregated, disaggregated, and evaluated to assist in making program improvements. The e-Portfolio effectively serves as an individualized web site for each student. Multiple e-Portfolios may be developed by each student for different purposes. A growth portfolio highlights improvements in student’s knowledge and abilities. A portfolio developed for a prospective employer or graduate school highlights the student’s best work. Faculty may also customize e-Portfolios to meet their individual needs. University-wide implementation issues are discussed including the necessary training for students to use the software effectively, and advisor responsibilities.

Academic Vision and Mission

Oral Roberts University’s academic vision is to transform students by the power of the Holy Spirit into whole, competent servant-leaders through liberal arts and professional education that is fully Christian. Within a Spirit-filled, healing community, administration, faculty, and staff love and serve students by helping them grow in knowledge, skills, wisdom, character, and spirit. Part of this vision is realized through the pursuit of excellence in the ORU Engineering, Physics, and Physical Science Department, which offers a Bachelor of Science in Engineering Degree with concentrations in mechanical engineering, electrical engineering, and computer engineering. Bachelor of Science Degrees in Biomedical Engineering, Engineering Physics, and Science Education are also offered through the department. There are approximately 75 students currently pursuing these undergraduate majors, with the vast majority selecting the Bachelor of Science in Engineering Degree, which is ABET accredited. All students in these majors will begin the development of personal electronic portfolios this semester (spring of 2004).

The mission of the department is to provide students with the knowledge, skills, and experiences that will prepare them to enter directly into professional practice as Christian engineers, or into advanced studies in engineering, or other professional areas. This training equips students in the application of science and mathematics for the improvement of the physical world, and enables graduates to enter the engineering...
and scientific communities, and contribute to the healing of the human condition. The department supports the overall university mission by the development of analytical thinking and problem solving in science and engineering, and promotes understanding and reconciliation between the fields of science and theology. A team of engineering students and faculty members have developed a rough draft of a conceptual framework for the department as illustrated in Figure 1.

**Measuring a Transformed Life**

The Bible admonishes us with the following words from Paul’s Letter to the Romans, “Do not conform any longer to the pattern of this world, but be transformed by the renewing of your mind. Then you will be able to test and approve what God’s will is – His good, pleasing and perfect will.” In 2003, the ORU School of Education began implementing a tool called Electronic Portfolio (or e-Portfolio) to assist them in the transformation of their students, and in the demonstration of this transformation to their constituencies, including their accreditation agency. With the help of the ORU School of Education, and a company called Chalk and Wire, the ORU Engineering, Physics, and Physical Science Department has begun implementation of a tool of this same form. In fact, every academic department of the entire university is planning to implement this tool within the next year.

E-Portfolio is a secure, web-based electronic portfolio that allows for the collection of student artifacts, or exhibits; the assessment of those artifacts, and the analysis of the resulting data for program and university improvement. Exhibits are chosen to demonstrate the satisfaction of program outcomes in the lives of the students. The conceptual framework for the department, along with ABET criteria for general engineering programs and input from other constituents, guide in the development of the departmental mission and program outcomes. The following is a summary of the program outcomes for the Engineering Major.

1. Graduates are able to apply knowledge of mathematics, science, and engineering.
2. Graduates are able to design and conduct experiments, as well as analyze and interpret data.
3. Graduates are able to design a system, component, or process to meet desired needs.
4. Graduates are able to function on multi-disciplinary teams.
5. Graduates are able to identify, formulate, and solve engineering problems.
6. Graduates understand professional and ethical responsibility.
7. Graduates are able to communicate effectively.
8. Graduates have a broad education necessary to understand the impact of engineering solutions in a global and societal context.
9. Graduates recognize the need for, and are able to engage in life-long learning.
10. Graduates have knowledge of contemporary issues.
11. Graduates are able to use the techniques, skills, and modern tools necessary for engineering practice.
12. Graduates are able to apply Christian principles of stewardship.

Students submit exhibits to a personal “website” via the internet along with demographic information which allows for aggregation and disaggregation of data for program improvement. Faculty members develop rubrics for evaluation of exhibits and assessment of student work. Since students have access to their e-Portfolio accounts for a minimum of eight years, it is planned to gather additional data from graduates on an ongoing basis. Portfolio exhibits include supporting documents, evaluations and recommendations, evidence of competencies, written samples, projects, evidence of creativity and performance, and evidence of extracurricular activities. Hardcopy items may be entered by using a
scanner. Specific choices for engineering exhibits are shown in Table 1. Table 2 presents an assessment rubric that was developed to assess an exam from the course: EGR 221 Mechanics I: Statics. The rubric is broken down into several categories which define the various knowledge and skills to be possessed by the students. Levels of achievement are then specified for each category. Students receive this rubric prior to the exam so they know what is expected of them. Faculty then use the rubric after the exam to score how well the students did in each category, thus giving a quantitative measure of overall student learning in each category.
Unlocking the Mysteries of the Universe!  
Harnessing the Power of Creation!

Students of the Creator, Stewards of Creation  
Genesis 1:27-28

Figure 1. Conceptual Framework for Oral Roberts University  
Engineering, Physics, and Physical Science Department

Christian Engineering Education Conference 2004  
http://engr.calvin.edu/ces/ceec

- 51 -
Implementation and Expectations

A new course was created to introduce students to this new initiative. A non-credit seminar course, “E-Portfolio: Journey to a Transformed Life” will be required for all students. The course is designed to impart ORU’s vision and mission and the rationale behind e-Portfolio. Students are introduced to university-wide and program specific “Learning Outcomes” and gain an understanding of our mission of developing a “whole person to go into every person’s world.” This pass-fail course is presented in two parts and has a total of 5.5 contact hours. During the first part, the Vice President for Academic Affairs casts the vision, presents the rationale, and outlines the purpose of the course. In the second part, students engage in a technology lab for two 2-hour class sessions to learn how to construct their e-Portfolio online through Chalk and Wire, the service provider. Students are supervised and trained by department faculty representatives who serve as departmental assessment coordinators, and are assisted by student technology trainers. Each student has been allocated 60 Megabytes of space in which to store their exhibits. There is some concern that this may not be enough space, considering the three required video clips. However, as technology continues to advance, the cost of storage space should continue to drop, and this is not thought to be a significant problem for the future. Students are currently being trained on e-Portfolio, and they seem to appreciate the instrument.

Table 1. Proposed E-Portfolio Exhibits

<table>
<thead>
<tr>
<th>Engineering, Physics, and Physical Science Department</th>
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<tbody>
<tr>
<td><strong>Entry Level</strong></td>
</tr>
<tr>
<td>1. E-Portfolio Agreement Form</td>
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<tr>
<td>2. Essay on Stewardship/Ethics</td>
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<tr>
<td>5. Self-evaluation of Presentation</td>
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<tr>
<td>8. ORU GPA (Transcript)</td>
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<tr>
<td>9. Initial Resume</td>
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<td>10. Sophomore Interview</td>
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<tr>
<td>Category</td>
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<tr>
<td>Information</td>
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Table 2. Assessment Rubric for EGR 221 – Mechanics I: Statics Examination

Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/cecc

- 53 -
Rubrics similar to that presented in Table 2 have been developed for the other student artifacts, including those which address Christian stewardship. One of the main artifacts which addresses this outcome is the disposition evaluation. This faculty evaluation provides the opportunity for faculty to give feedback to students regarding ethical behavior and Christian character, as expressed during their academic careers. The Engineering, Physics, and Physical Science Department volunteered to adopt e-Portfolio in the spring of 2004 as a beta-test for the rest of the university, which is to start in the fall of 2004. Our enthusiasm to get started as early as possible was motivated to some extent by an upcoming ABET site visit. The Chalk and Wire software was selected because the ORU School of Education had already chosen this instrument. Their choice was based on ease-of-use, customer support, and affordability.

Implementation of e-Portfolio will help to streamline the assessment process in engineering, since students assist in submitting exhibits. This has the added benefit of giving the students a closer view of how their lives are being transformed. It is expected that this will motivate them to higher levels of performance and further accomplishments. Faculty also will benefit by enjoying a more automated method of collecting and assessing student work. An additional benefit of e-Portfolio is the students’ ability to easily share their work with friends and family simply by identifying the web address of their portfolio. This allows new students to stay closer connected to those “back home” by sharing their new knowledge and accomplishments. Hopefully, this will lead to better retention rates.

References

Responding to Academic Culture: 
From Research Focused to Teaching Focused Culture

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Abstract

Moving from one institution to another, particularly from a university to a college and vice versa in different geographical locations and cultures, as an academician may be painful and challenging. This could be due to differences in philosophies, policies, and practices. What are the potential problems? What are the surviving strategies? How can it affect faith, relationships and academic reputation? How can mistakes be avoided? What can be done to make such changes pleasant and fulfilling?

In this paper, the transitional experience of moving from one institution to another institution with different culture shared. The paper highlights a number of difficulties experienced, strategies adopted and lessons learned. In totality, the experience shows that absolute reliance on Christ for direction at all times is the main ingredient for success of a Christian and for overcoming whatever problem one encounter. Furthermore, the paper advocates being an example of believers by following in the steps of the master teacher (Jesus) and trusting Him for His promises, because faithful is He that has promised for He will perform it.

Introduction

Changing a job is common to various categories of human labour. Labour turnover varies from sector to sector and from region to region. Academic labour turnover is higher in developing countries like Nigeria than in the advanced countries like Canada. Why do people change their jobs? People change their jobs for various reasons. According to Gerencher, financial concerns and job dissatisfaction are the common reasons for changing a job [1]. Career advancement, personal growth and the need to reunite with the family are some of the other possible reasons for moving [2]. Generally, making such decision may be difficult and exhausting. However, what should a Christian do before taking such a step and how should it be approached? As believers we are to commit our ways to His hand because He knows/holds our future. Our will should be subject to His will. Why should we not just take the step? The reason is because it is not all things that glitter are gold. The Bible put this in another way in Proverbs 16:25 by saying that “There is a way that seems right unto a man, but the end thereof is the way of death”. Furthermore we are directed to “Trust in the LORD with all our heart; not to depend on our own understanding. We are to seek his will in all that we do, and he will direct our paths” (Proverbs 3:5-6; Isaiah 52:12 NLT).

Moreover, the author believes that one should count the costs (Luke 14:28) before taking such a crucial decision that may heavily impact his/her family relationship, his/her commitment in his/her local church and his/her relationship with friends. Pre-tenure years may be very challenging as the instructor develops new courses and new research portfolio, as he/she seeks for research funding and as he/she develops new collegial relationship. These activities will require a lot of effort and time to the extent that if care is not taken he/she may have less time to devote to family relationship and church activities. He/she will also have to be more prudent with the use of his/her time so that professional activities might not adversely affect his/her family relationship and his/her devotion to God. Therefore, after seeking the face of the Lord in prayer and receiving a conviction/leading to go ahead, a number of issues should be considered and adequately planned for in order to ensure a smooth transition and attainment of good success in the new environment.
Differences in culture have been identified as an important factor to consider when contemplating changing jobs or moving from one geographical (residential) location to another. According to Ohio University’s office of Faculty and Teaching Assistants’ Development, culture is “the systems of knowledge shared by a group of people, including a group’s values, beliefs, attitudes, notions of appropriate behavior, statuses, role expectations, and worldview”. “An understanding of culture can help an international academician to develop important skills to enhance his ability to teach in North American classrooms” [3]. It is therefore necessary for a teacher moving from a religious institution to a secular one or from one geographical location to a different one to identify and understand those cultural issues that can affect his success in the new teaching environment.

This paper was based on the author’s experience at Mount Royal College, Calgary in Canada and the experience shared by a friend at University of Manitoba, Winnipeg in Canada. It is also based on a number of reports reviewed on international instructors’ experiences in North America. These experiences of the author and other international professors were compared to previous experiences of the author and that of his other friends at the Federal University of Technology, Akure; Enugu State University of Technology, Abakaliki Campus, and at the Federal College of Fisheries and Marine Technology, Lagos in Nigeria. The comparisons were also based on oral communications with the author’s friends from Universities in Ethiopia, Kenya, Ghana and Uganda.

Among the various cultural issues associated with the academic environments, an international faculty member needs to understand and adapt to the following:

**Differences in the place and structure of education in the two cultures**

In Nigeria, post-secondary education is considered essential to getting good jobs and having university education is necessary to reaching the peak of one’s career. Post-secondary institutions in Nigeria can be grouped into three categories, namely: Universities, Polytechnics/Colleges of Technology, and Colleges of Education/Schools of Nursing. Until recently, all these institutions are owned and funded by the federal and state governments. The majority of the institutions do not require tuition from students. In addition to 12 years of primary and secondary education, admission into these institutions is based on the students’ performances in two nationally/regionally organized examinations, namely: the secondary school certificate examination administered by the West African Examination Council and the university (and polytechnics) matriculation examinations administered by the Joint Admissions and Matriculation Board [4, 5, 6]. In comparison, there is some similarity in the importance attached to post secondary education in North America and in Nigeria. However, there is neither standard pre-college curricula nor centrally organized entrance examinations to post secondary institutions in North America [2]. Thus there is the tendency for variation in the knowledge base of students in the classroom. Therefore, the international instructor should not assume that all the students have had equal background knowledge of certain course. He/she needs to develop a means of finding such information. Otherwise, he/she may find himself/herself speaking above the level of some class members.

Furthermore, post secondary education in North America has broader classifications into two and four year colleges, universities, vocational and technical schools, institutes of technology, and professional schools [2]. Their ownership is evenly shared between the private and the public. Unlike most African Universities, the funding of North American institutions is from students’ tuition, foundations and research/service contracts with only some or no financial support from government. This feature places greater demand on post-secondary institutions’ administrators on the need to balance their budgets. Such action may require trimming down the labour force. Consequently, there is no sense of “job security” as is the case in most of the African higher institutions where majority of the academic and support staff are employed on full time permanent basis. The period of probation, which is similar to pre-tenure in North America, is three years. After this period, the staff can be rest assured of working there till retirement. Exceptions to this is only if he/she commits grievous offence, is unproductive or resigns his/her
Moreover, the structure of Nigerian education system is essentially British even though it has undergone restructuring in recent years. Unlike most of the American higher institutions, there are a lot of similarities in the organization, policies and practices of the Nigerian post secondary institutions because the government, through its responsible agencies, moderates their activities. All universities are answerable to the National Universities Commission (NUC) while polytechnics and colleges of technology are answerable to the National Board for Technical Education (NBTE). Each university in the country has two major decision making bodies, namely: the governing council and the senate. The senate makes major academic decisions while the governing council makes major administrative decisions. The senate is made up of all heads of departments and full professors while most of the governing council members are appointed by NUC and some representation from various groups in the university community [4, 5, 6, 7, 8]. A number of academic decisions are also made at the school and departmental levels with distinct academic management responsibilities given to the faculty boards, deans and heads of department (HODs). The ultimate decision making body at the school level is the faculty board. It makes recommendation to the senate for final approval of the decisions reached at the school level. The membership of includes all academic staff from the rank of Assistant Lecturers to full professors. It meets on monthly basis to review the activities of the school on issues under its jurisdiction and those referred to it by the dean and committee of HODs. In comparison, there are a number of similarities in the structure of academic institutions in North America and Nigeria. In some colleges, the academic council makes major academic decisions while the board of governors makes major administrative decisions. The membership of the academic council is mainly constituted by election and representation from all units/interest groups in the college. The members of the board of governors are nominated by the responsible agencies and also have some representation from interest groups in the college. Colleges are also organized into faculties, departments and programs with advisory boards made up of various internal interest groups and external representations. It seems that academicians of all categories are given greater participation in academic decisions at the universities than in community colleges.

The administration of university curriculum in Nigeria is based on a course system similar to the American system. Students’ workload varies from university to university and from discipline to discipline. At undergraduate level, the average workload per semester is between 21 to 24 credits for engineering students but it may be less at the senior levels to enable them retake courses that they were yet to pass [9]. In addition, all courses taken by engineering students must be passed before he/she can graduate. Exemptions to this condition are uncommon. In general, there seems to be greater flexibility in students’ workload and courses taken in North America than in Nigerian Universities. Furthermore, students’ workload is less. This is understandable because, unlike in Africa where most students are studying on full-time basis [9], majority of students in North America are at one time or the other taking part-time jobs during the semester. This has the tendency to affect their concentration and dedication to studies. An international faculty that is new to this teaching environment must take note of this when planning the course and giving assignments to students. This he/she can do by streamlining the number of assignments, or by giving longer due date.

**Variation in values, beliefs, statuses and role expectations**

In the two cultures, students’ grades seem to be the main motivating factors for studies. It is because financial aid organisations, employers and others use students’ grade in judging their intellectual capability.

In Nigeria, various grading systems are used. While some universities use percentage scores others use letters A, B, C, D, E and four or five grade points system or its hybrids [5, 6]. However, majority of the higher institutions in North America use letters A to E and four points grade system [2].
Overall, it seems that the expectations of student’s performance in many North America Universities and colleges are relatively lower than in African Universities for the award of comparable grade. An instructor must find out the students’ grading practice in his/her new environment and adapt to it.

Furthermore, North American college students value relating the course materials to its practical application in support of their career goals [2] and their locality. This is understandable because college education, especially the applied degree programmes are industry oriented while universities’ first degree programmes are not only directed towards employment but also in preparation for further (graduate) studies. Thus, unlike in African Universities where professors’ responsibilities to students are essentially limited to lecturing and research supervision, greater effort is required on the part of instructors in creating humorous/conducive atmosphere that enhances students learning and in clarifying his/her expectations from students [2, 9, 10]. Therefore an international professor needs to recognize that he/she is accountable for students’ performance and there are limits to what he/she can expect from the students in his/her new teaching environment than in the previous workplace.

Moreover, while the productivity of African university professors are essentially based on his proficiency in publishing research papers in referred journals, the value of an instructor at the college depends on the perception of the students and peers through their evaluations of his/her teaching. Annual evaluation of academics in many Nigerian Universities is similar to what is done in North American post secondary institutions but there are differences in the process. The basis of evaluation also seems to be the same but the importance attached to each factor is different. While the evaluation at the university only involves filling out some forms which are subsequently assessed by the head of department, the evaluation at the college involves the preparation of a dossier which is a collection of students’ evaluation, peers’ evaluation and other reports. These are subsequently reviewed by tenured members of the department under the supervision of the chair. There are no student evaluations in Nigerian Universities. Therefore, international instructors need to understand these major differences and develop strategies that will enable him/her adapt quickly to the new measures of his/her productivity so that he/she can meet the expectations.

Knowledge of differences in attitudes and notions of appropriate behaviour

In most African universities, students regard a professor as an unquestionable authority in his/her area of specialization and his relationship with them is essentially formal. Although North American students also show respect to their instructors, the relationship is informal such that they go by first name in most of the North American post secondary institutions [2]. Both sides of the “coin” have pros and cons. The unquestionable status accorded professors by African students make some instructors unresponsive to students’ learning needs, aspirations and concerns. The informal relationship has the prospect of enhancing students’ learning [11]. On the other hand, the informal relationship has the tendency of making some uncultured students rude and overbearing to the new faculty, particularly if they perceive that he/she is vulnerable.

Furthermore, while it is not uncommon to find students coming to the classroom with snacks in North America, it is rare in many African universities. In addition, there are differences in dress code. Unlike in Africa, where instructors’ dress to the office and classrooms are between formal and semi-formal, it is not uncommon to find some North American professors in casual dresses like t-shirts when in the classroom [2].

Moreover, North American students are generally more vocal. They also play active role in determining the adequacy of their curriculum and in evaluating course delivery. This is unlike in Nigerian universities where engineering curriculum is developed by professors without any consultation with students, but in...
line with the requirements of the regulating professional body and the national universities commission. It is necessary to understand these differences so that the international faculty would not become disgruntled. The knowledge of the differences is also essential so that he/she may have a positive attitude and make a concerted effort at developing a cordial relationship with his/her students as well as with his/her peers [11].

It is believed that suddenly facing all these differences in academic culture may be shocking and destabilizing for the unprepared. It may also tell on one’s faith, because if care is not taken there is the tendency to take on the “arm of flesh” and thereby loosing one’s consecration to God. However, as Christians we know that we are faced daily with challenges. Whatever challenge that arises should be seen as an opportunity to learn some lessons. With our trust in the Lord Jesus Christ for divine wisdom and guidance in handling the issues, we can be rest assured that we will overcome (Proverbs 16: 20; 3:13; 4:5,7; 2:6; 24:3). Care also has to be taken because in an attempt to meet all these challenges one may become totally encumbered with the problems and thereby devoting less time to personal quiet time, family relationship and church activities. It is essential to remember that the “arm of flesh” will fail us and that in all this we are more than conqueror because of Him that love us. In time like this, we will need to be prayerful and build up ourselves on our most holy faith because faithful is He that promised for He will perform it (Phil 4:6; Jude 20; Heb 10:23).

The author also believes that the Christian worldview of the new instructor may initially make students and peers to be sceptical of him/her. This may be particularly true in a secular institution, especially if he/she cannot find colleagues that share the similar consecration to God. However as time goes on, as he/she continue to allow Christ to be seen in him/her and as he/she is diligent in his/her works, he/she will be seen as a role model by students and peers alike. This should be helpful to him/her in overcoming the huddles of the early years of his/her carrier in the new institution. He/she will also find out that many of his/her peers are supportive and that most of the students are appreciative.

Conclusion

This paper highlighted the fact that changing one’s job or moving from one geographical location to another may be necessary. It advocated the need to commit such intent to God in prayer and making adequate preparation before actually taking the step. It also pointed out that academicians changing his/her job or moving from one geographical location to another may find adapting to his/her new teaching environment very challenging. However, knowledge of values, attitudes and notions of appropriate behaviour in his new college can help him/her adjust quickly. It can also enable him develop class activities that will both support the learning goals and elicit student interest and participation. Finally, one should not depend on the knowledge or understanding of the situation only, but should trust God who has promised to go before us and be with us (Deut. 31:8; Isa. 45:2; 52:12). One should depend on His wisdom and guidance because that is the only sure guarantee for success and victory.

References


Bias in Technology: From Creation or Fall?

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Abstract

Technology is not ethically neutral. It is biased towards certain uses, persuades the user towards particular actions, and has built-in values in its structure. This bias has been recognized by a number of philosophers and historians of technology, though called by many names, such as “valence” or “value-laden”. Christians can find an underlying foundation for this bias in the story of creation and the fall. Rather than a complete acceptance of technology as is, or complete opposition, this paper presents an argument for a middle ground – a cautious acceptance of technology as part of God’s good creation but corrupted by the pervasive influence of the fall. But all bias is not necessarily due to sin. Some trade-offs are simply part of the created order. This discussion leads to a critical evaluation of technological products, seeing bias as a multifaceted effect with sociological, cultural, scientific, economic, and theological strands. After establishing a case for the non-neutrality of technology, the practical implications for engineering design methodology and engineering education are explored.

Introduction

Technology is not neutral. It has an intrinsic bias that is built into it from the original inception of a particular problem (i.e., identification of a need), built into it throughout the entire design process, built into it all the way through implementation, use, and disposal of a product. Bias is a propensity towards certain behaviors, a predisposition towards some uses over other uses. Technology is obviously biased towards at least one use – the use intended by the designer. The technological product is designed to perform its intended function. However, other biases may be at work. Even though the designer did not consciously build in other functions, the technological product often can be used in ways the designer did not intend. Consider the lawn mower that is used to trim hedges, the car that is used to pull skateboarders, the shoe that is used to hammer in a nail, or the aircraft that is used as a weapon. Humans are ingenious tool makers but also imaginative tool users (sometimes devilishly so). Even when the maker did not envision a particular use, the user might boldly conceive of one. In a sense the user becomes designer when a new use is found for an existing tool. The user has identified a need for which the existing tool provides a solution. The possible uses of a tool are not limitless however. The structure of the tool lends itself to some uses better than others. Because the hammer pounds nails better than the shoe, we will use the hammer, given the choice. The set of likely uses, or even the wider set of viable uses provides a map of the bias that is built into the technological product. That is, bias is the usefulness or utility of a tool as a function that varies with the target use. Technology as tool is meant broadly here, so that, for example, systems, processes, and software are also tools.

The structure of the technology includes physical aspects (such as the mass of the hammer handle) but may also include aesthetic or ergonomic aspects (such as the layout of a computer graphical interface as a metaphor of a desktop). A technological product, especially a tool, is often considered well designed when form follows function, when the structure intuitively suggests the use. Any particular structure can lead to multiple possible functions, and a product made of multiple structures will have a multitude of possible functions – some intended by the designer, some not. Werner Rammer recognized one facet of this bias in that “social concepts and practices are consciously and non-consciously incorporated in the machine and inscribed in the programs.”¹ Lambert Van Poolen has in the past characterized technology design at its most basic level as the specification of size, shape, and material. However, in a recent article, he adds “function” to these three as the attributes that “mirror personal and corporate values.”² I believe this addition to be essential, as the former three, which are structural in nature, are constrained and directed by this latter attribute, which is intentional (volitional) in nature.

Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/ceec

- 61 -
Carl Mitcham desribes how an early philosopher of technology, Ernest Kapp thought of technology as an extension of human organs – the cup as an extension of the cupped hand, the hammer as an extension of the arm, the telescope as an extension of the eye, or even language as an extension of the mind. More recently however, others have recognized that technology not only extends human capabilities in some respects, but also limits them in others. This extension and limitation is an outgrowth of the bias built into the technology. Don Ihde called this effect amplification and reduction (such as a microscope that magnifies one area while simultaneously reducing your field of vision). Marshall McLuhan, thinking especially about communication technology (the media), called it extensions and amputations. Egbert Schuurman considers particularly the reduction: “When the computer dominates education, student users may adapt themselves uncritically to the computer’s reduced worldview. Whatever does not make it to the computer screen is then simply not considered by the student. Computer programs contain only information that has to do with measurements, sizes, and statistics.” Similarly, Pacey sees the technology itself as a distraction that limits our view: “One problem seems to be that the use of such equipment [visual processing, computers, etc.] is sometimes associated with a narrowing of the focus of what one looks at. The equipment itself is part of the fascination, so one tends to look only at what it reveals.”

In discussing technological things as hermeneutical text, Van Poolen says: “Here is an emphasis on understanding and interpretation through the performance of a text. That text might be a novel, poem, drama script, or musical composition. This could be extended to the performance of an engineering drawing for a technological product. What results from playing these texts is the machine. The performance takes place in the manufacturing place and in our culture where the artifact is put to use.” Arnold Pacey makes a similar point in his book, Meaning in Technology, laying out an extended comparison of music and technology as interpretation and meaning. It would be interesting to explore further the “performance” of technology by the user, not just the manufacturer, which Van Poolen leaves open as a possibility, but does not pursue. This leads us to identify two extremes that should be avoided when discussing (and teaching about) the bias of technology: a focus on design to the exclusion of use and a focus on use to the exclusion of design.

The first extreme considers only the design (and not the use) of technology as the “performance”. Performance implies there is an audience that is passively interpreting the performance, but many technologies require that the audience more interactive, that they are also the performer, as user. This performance is based not on the engineering drawings but on the machine itself as text. It is true that in some sense the function is built into the technology prior to the use. However, the form implies the function (though not perfectly), so that people tend to use the technology in the ways the designer intended. That is, communication occurs through the technology that persuades and influences the use. The idea of the machine as a hermeneutical text is key – interpretation of the machine is an unavoidable act intrinsic in the use, and the use is unavoidably tied to the inherent structure of the text: the size, shape, structure, and function of the machine.

The second extreme occurs when we consider only the use (and not the design) of technology as the “performance”. While a few philosophers deny the bias of technology completely, buying into the thinking behind the phrase “guns don’t kill people – people kill people,” Rammert (following some of John Dewey’s thought) is a bit more subtle: “Technology has no existence and function outside of its use. It is what I would like to call the use-relations that create both the handled object as a tool and the manipulating gesture as technical practice.” But this does not sufficiently recognize the role of the technology in the use. A technology biases the user towards those actions for which it is particularly well-suited, and dissuades the user from actions for which it is poorly suited. For example, guns and knives don’t kill people by themselves, but people without guns and knives are less likely to kill than those with them.

Technology as performance is a helpful idea, but perhaps “communication” is more apt. Art is performed and interpreted, and its function is purely its form. Art is meant to provoke a response. It is not used for
any further purpose – it is an end in itself. Not so technology. It is not meant to be hung on a wall and simply observed. Technology communicates an intended function, but the user may interpret that communication in ways different than the designer intended. Function does not always follow form precisely. The use is communicated through a cultural and social environment that influences our interpretation. Technology is not an end in itself: it solves a problem or fulfills some social need.

Engineers often complain about the lack of sophistication and technical know-how in users – their inability to understand technology, their tendency to abuse technological products, their quick fix mentality, and their litigious attitudes. But perhaps engineers have too easily taken the mantle of expert and not respected users as fellow image-bearers of the creator. Perhaps we need to see technology as a communication between the designer and the user, and the user is seen as a fellow designer who may find innovative new ways to use the technology. This line of thinking encourages transparent, collaborative, interactive technologies such as open source software, do-it-yourself kits, erector sets, and community web sites such as gasbuddy.com or the Wikipedia.

Teaching about Bias in Technology

It is widely (though not universally) accepted in the literature that technology is non-neutral, i.e., it is partial, or biased, to certain uses. Many scholars have argued effectively against the neutrality of technology. Allchin claims “it is disingenuous nowadays to claim [that technology is neutral]…the very artifacts bias who can and cannot use them.” Ibo van de Poel enumerates three reasons that the instrumental view (technology as a “means” alone, and thus neutral) is unsatisfactory: 1) formulation of goals and choice of technological means are not independent, 2) choice of means for a given end is not neutral, 3) technologies realize more than their intended goal. Borgmann also considers the “means” viewpoint and claims “…it is an equivocation to speak indifferently of tools in a modern and in a pretechnological setting. A means in a traditional culture is never mere but always and inextricably woven into a context of ends.” Don Ihde makes the case that “this non-neutral, transformative power of humans enhanced by technologies is an essential feature of the human-technology relations.”

Mel Kranzberg has asserted that “technology is neither good nor bad; nor is it neutral” His point is that the same technology can be good for some users in some contexts and bad for other users in the same or other contexts. He uses the example of a chemical pesticide that is banned in one context because it is found to be a carcinogen, but nevertheless is used widely in another context because it controls malaria-carrying mosquitoes. Kranzberg’s claim, in essence, is that a particular technology cannot be judged good or bad in a universal or global sense. The value judgments we make about a technological product are context dependent: “...technical developments frequently have environmental, social, and human consequences that go far beyond the immediate purposes of the technical devices and practices themselves, and the same technology can have quite different results when introduced into different contexts or under different circumstances.” Like Kranzberg, I claim that technology is not neutral, but rather than disavowing any overall judgment regarding its goodness, I observe that technological products have a variety of good and bad effects on all stakeholders. These effects are related not only to the functions the technology is designed to perform but also to the unintended consequences of the technology.

Unfortunately, this understanding of the non-neutrality of technology is not widespread amongst engineering students. Students are often inclined to believe the neutrality premise, and this belief can have perilous societal consequences. If the product is neutral, then logically, the designer has no ethical responsibility for how the product is used or abused. Under this view, the engineers, manufacturers, and distributors need not worry about the social impact of their products. If the product is neutral, then no user can rightly complain about an unsafe product, and no seller would be liable for any damage or harm caused by use of their product. Thus it is essential that students understand the non-neutrality concept and its implications.
For example, in order to keep students from sliding into the mistake of associating neutrality with lack of volition, terms such as “neutrality” or “value-laden” can be replaced with terms that better reflect the idea that designed form leads to distinctive function, such as “bias” or “inclination”. Any technology will surely be biased towards a particular use, because it was designed for that use. The terms “usability” or “utility” might be helpful as well. For example, it is easier to use a hammer for pounding nails, and a gun for firing bullets than vice-versa. Bias is perhaps a more understandable and acceptable term for students than “value-laden,” since it still leaves ethical agency in the hands of people. However, the bias is not simply that of the designer, but the whole social system (designer, manager, distributor, buyer, user, disposer). A number of authors discussed earlier (Schuurman, Monsma, and Ellul), have suggested the idea of non-neutrality as a kind of bias. Bush reflects on Ellul’s discussion of non-neutrality, using the term “valence” to describe this bias, this tendency of technology to be favored in certain situations.16

For other students, other pedagogical techniques might be needed, such as relating bias to the responsibility of manufacturers to produce safe products, use of real world problems with no single right answer, and examination of technology as an embodiment of human will. In a typical class one finds that some students quickly buy into the concept of bias, while others cling tenaciously to neutrality. The latter claim that obviously technology cannot be held morally responsible for the action a human user took with it. But that is not quite the claim I am making. I have found it useful to let this argument develop during class discussion so that I can point out that something can be biased without having agency. That is, technology can bias the user (who does have agency) towards certain actions and away from other actions. Yes, the gun does not by itself kill people, but a person with a gun is more likely to kill than without it. A useful demonstration I have tried is to bring into class a wooden board with two nails partially nailed into it, along with a sack containing two tools. I invite two students to come to the front of the classroom to complete the job of pounding the nails in. The first student is one who claims technology can be biased, and so is allowed to choose which of the two tools in the sack they will use for the job. The second student is one who claims technology is neutral, so they must use whichever tool is left in the sack. When they look inside the sack they find a hammer and a screwdriver. As the hammer-wielding student quickly finishes one nail while the screwdriver-wielder makes little headway, it becomes obvious that the tools are not neutral with respect to particular uses. I then make the further point that to the person holding a hammer, everything starts to look like a nail, i.e., because a technology is biased towards certain uses, we tend toward uses aligned with the biases of the technology. Discussions like this set the stage for presentation of more structured methods, such as design norms, that make identification and analysis of technology bias an intrinsic part of the design process17.

Approaches to Technology

There are an almost infinite variety of ways that society and individuals have approached technology, but here I will group them into a few broad categories. First, there are those that completely accept technology, with few, if any, reservations. Bill Gates is one example, and Nicolas Negroponte in his book Being Digital18 is another. Even some of the rhetoric of U.S. presidential elections falls into this category: American voters are promised health, wealth, security, and freedom – all through the wonders of technology. In a strange way, Jacque Ellul could be counted in this group, as he vilifies technology, but at the same time resigns himself and all of us to subservience to “technique”.

A second group completely rejects technology, with few, if any, exceptions. Lewis Mumford could serve as an exemplar of this group. A number of authors who rightly are suspicious of the complete acceptance approach go so far to criticize the first approach that they give at least the impression that they can find little good in technology. Another example is Neil Postman, who rails against an American society that too easily falls for the allure of technology in his book Technopoly19.

A third group balances the optimism of the first group with the skepticism of the second. Technology has great potential, but its power must be critically examined. Carl Mitcham describes the movement towards
this middle ground: “By the 1990s it had become clear that not only would those who criticized technology have to take into account its many obvious benefits, but those who defended modern technology would have to seriously consider issues of complexity and fragility in both the environment, and the technosphere and to consider the moral arguments of its critics.”

Many authors have explored how society might use technology in a way that prevents it from using us. Schuurman, Illich, Moore-Ede, Schultze, and Norman are a few examples.

These three approaches to technology parallel some of the ways that H. Richard Niebuhr describes the relationship of Christ and culture. Niebuhr sees some Christians in complete acceptance of culture, so that there is virtually no distinction in their behavior or way of life. He sees other Christians completely rejecting culture, e.g., Amish communities. However, for the middle ground of neither completely accepting nor rejecting culture, Niebuhr makes some finer divisions. He notes that Thomas Aquinas puts Christ above culture (a sacred/secular distinction), while Luther puts Christ in tension with culture, and Calvin advocates a Christ-transforming-culture approach. Technology is a significant culture forming activity, and thus Christians must decide how their faith will interact with their technology. It is my contention that the first two choices (total acceptance or total rejection) are not appropriate. Depending on one’s religious heritage, you might focus more on scripture that points towards Luther’s tension, such as the call to be in the world but not of it, or you may focus on passages that support Calvin’s transformationalist approach, such as in Romans 12, where Paul tells us to no longer be conformed to the pattern of this world, but to be transformed by the renewing of our minds. Paul also tells us that God’s plan of salvation is one that redeems (buys back) not only us, but all of creation (all creation groans waiting for the sons of God to be revealed). We can be part of this redeeming process, building the kingdom of God by claiming technology as under the sovereign rule of Christ. Christ’s redemptive influence pushes back sin’s sway, cleansing the creation of its taint. As redeemed Christians, we can, by God’s grace, identify how sin has infected our technology and work to identify the creational good in all of culture, including technology.

We don’t have much evidence about life before the fall – after only two chapters, the book of Genesis turns to the story of how sin entered the world. We’re told that the world is created good, but we only have a few hints as to how that plays out. The Biblical narrative spends much more time on how God calls humans to fight the effects of sin. Of course we do have another example of life without sin – the second Adam, Jesus Christ, shows us what true good is like.

Perhaps you have heard the riddle of the angel and the demon? A traveler comes to a fork in the road. One path leads to life, the other to death. Two guides stand in the road just before the fork, one an angel, the other a demon, but they look identical. The angel always tells the truth, while the demon always lies. The traveler is allowed to ask a single question of only one of the guides. Without any way of determining which guide is which, what single question should be asked to find the way of life?

This logic puzzle makes out the problem of sin to be rather simplistic. The demon is the exact opposite of the angel, always lying. But real life is not so simple. Sin is not the opposite of perfection, it is a corruption or taint – missing the mark. Sin-tainted reality is not the way it is supposed to be, but it is not so powerful that it completely erases any trace of the original good. We live in a world where the original good is still evident, but marred by sin. Sin is pervasive and pernicious, but not so much so that the essence of creation is completely obliterated. God’s grace limits and holds back the destructive influence of sin. So in my remarks that follow, I make some tentative steps in identifying creational nature as well as sinful influences within technology.

Creational Bias

What is the chief end of man? The Westminster shorter catechism says that it is to glorify God and enjoy him forever. Can you glorify God with technology? Certainly! Let’s first look at the most direct
understanding of glorifying God, in praise and worship. In Walter Miller’s classic science fiction work, *A Canticle for Leibowitz*, a character remarks on the engineering design work done by a monk: "I see nothing inconsistent in monks of Christ building a flying machine, although it would be more like them to build a praying machine." What would the nature of such a machine be? I suppose since a flying machine aids one in flying, so a praying machine would aid one in praying. Perhaps a word-processing program and computer could be thought of as a praying machine if the prayer is composed with their aid. Perhaps a microphone and sound system are a praying machine if a large congregation worshiping on Sunday morning uses them to aid in praying together as a community. A bit more broadly, a worship machine is one that helps us worship. In a traditional Church setting these machines might include: PowerPoint, microphones, instruments, lights, flexible seating, audio mixer board, architecture, language, video and audio recording, printed books and music. Now what about worshiping and praising outside of the church building? Singing along with the radio, driving an automobile to the beach to watch the sunset, seeing a picture of the earth from space, posting a prayer on the web. An almost endless variety of technologies can be an aid to worship.

Technologies can honor and thus glorify God even if they are not directly aids to explicit worship. Norms are guides for how things ought to be – in our case, how God intended the creation to work. Norms for design have been described elsewhere, so I will treat them just briefly here. *Responsible Technology* identified design norms based on the aspects of reality, or modalities, of Herman Dooyeweerd:

- cultural appropriateness based on the historical aspect
- openness based on the symbolic aspect
- communication based on the social aspect
- stewardship based on the economic aspect
- delightful harmony based on the aesthetic aspect
- justice based on the juridical aspect
- caring based on the moral aspect
- trust based on the pistic aspect

Methods of teaching these norms (though with a somewhat reduced list from that provided in *Responsible Technology*) were discussed in an earlier ASEE paper. A good design for a new technological product will honor creational norms. C.S. Lewis suggests in *Mere Christianity* that men innately know good from evil, and this knowledge comes from outside of ourselves. Perhaps in the same way we may be able to recognize both good and evil aspects in cultural products such as technology. Of course our own thinking and discernment is clouded by sin, so we will not have a completely clear picture and must be open to adjusting our viewpoint.

The norms described above were intended primarily as guides to design. However, we can use these norms not only as guides for designing but also for using technology. As we use technology we are also designing in the sense that we must decide on appropriate ways to use the technology from among many possible alternative uses. For example, the norm of stewardship should guide us to use prudence in purchasing technological products, in using them with care, and in disposing of them by recycling materials where possible. Stewardship helps us to break the endless cycle of computer upgrades if the purpose of the upgrade is simply to “keep up” rather than because it solves a real need. As an aside, one Biblical principle that does not seem to me to fit clearly within any of these norms is humility. Understanding our own finiteness and limitations is an important concept that surely applies to the design and use of technology. Humility might fit under the norm of openness or caring, but it is not an easy connection.
Sinful Bias

Before I describe the effects of sinful bias on technology, let me point out a few things (aspects of reality) that I believe are not sinful bias. First, human limitations are not necessarily due to sin. Man is a finite being and was finite before the fall. Only God is omniscient and omnipotent. There are math problems too difficult for us to fathom. There are mysteries for which we cannot put together all the clues. Even before the fall, Adam could not design a bridge that could support infinitely large loads with infinitesimally small supports. Even before the fall, Eve could not design a microprocessor with infinitely large processing power but infinitesimal power needs. The creation is finite. We are creatures of limited ability working with created materials that have their own limits. The fact that we are bounded is not due to sin but implicit in our created nature. Second, some hierarchical order was present before the fall – God has authority over all creation by virtue of being the Creator, and he delegates some of that authority to humans in the cultural mandate of Genesis 1:28, “God blessed them and said to them, ‘Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish of the sea and the birds of the air and over every living creature that moves on the ground.’” However, this hierarchy is somehow distorted in the fall – witness that part of the curse in Genesis 3 is that the husband now rules over the wife. Notice that the cursing of the ground is also a corruption of a creational good – the ground will continue to bear crops, but now with weeds and thistles as well.

In the face of the corruption caused by sin, we need the power of the Spirit so that by God’s grace we can fight those effects. The norms for design and use of technology can be of some help. For example, the norm of openness, which I prefer to call “transparency,” is important as a limit to the effects of sin. Without visibility into the inner workings of a design, the technology may be ripe for abuse, where those with expertise have power over those who do not. Another example is the norm of cultural appropriateness, which is important as a limit to the effects of sin. This norm requires that the designer carefully consider the effects of embedding a technological product within a particular social and cultural context. If this embedding is not intentional, then we must live with the unintentional consequences, and if we are sinful by nature, then those consequences are likely to be heavily influenced by sin.

New technology does not introduce any new sins, but merely puts new twists on the same old sins. In a sense, that is what sin is – a twisting of reality. Let us briefly examine the so-called seven deadly sins and see how technology provides motive, means, and opportunity for these transgressions. Greed is a sin familiar to many technophiles, as they hoard new technological products, using technology as a symbol of status and wealth. Information technology especially is constantly improving (Moore’s Law), motivating greed for the next best thing. Technology uses resources rapidly, building up large amounts of wealth quickly, providing the means, and mass production provides wide opportunity to exercise greed. The rapid advance of technology puts a new technology in the hands of one’s neighbor frequently, motivating us to envy. Mass media gives us constant opportunities to see and envy the lifestyles of the rich and famous. The power of technology motivates gluttony, the sin of excess – excess speed, excess goods, excess clothing, excess entertainment. Extremes become the norm with the power of technology. The power of technology also leads to pride, thinking of one’s self higher than one ought. Technology is a tool that empowers the user. 2 Chronicles 26 tells the story of king Uzziah, who used technology to fortify Jerusalem. “But after Uzziah became powerful, his pride led to his downfall.” (v. 16). He came to believe in his own greatness, a vanity based on the power of his technology. Today we flaunt our technology, making sure everyone sees (and sometimes hears) the latest gadget we have acquired. We take pride in the speed of our computers or Internet connections, in the power of our stereo, in the width of our television screens. Technology as a convenience can lead to sloth, since we can have the technology work for us. We buy appliances and lawn tools that reduce or eliminate manual labor so that we can “relax.” In fact the most common justification for purchasing an expensive new product is the labor savings it provides. Many vices related to lust are common on the Internet. This can be attributed in large part to the perceived anonymity of information technology. Privacy may certainly be a concern.
because of the potential for big government to abuse the power of personal identification information, but privacy is also a cover for sins of lust fed by Internet pornography. Technology teaches impatience, as we learn to expect quick computer response and rapid-fire sound and sight bites on our mass media. When real life does provide the instantaneous and complete response to our control, we easily succumb to anger.

Conclusion

Unlike real life, the traveler can easily discern the appropriate path by asking one of the guides (and it doesn’t matter which, since they look identical): “Which way would the other guide say I should go?” and then go the other way. If the guide turned out to be the angel, he would tell the truth about the demon and knowing the demon would lie, he would indicate the wrong path. If the guide turned out to be the demon, he would know the angel would tell the truth, so he would lie and indicate the wrong path. Thus the same (but wrong) answer is obtained from either guide and the traveler can confidently take the other path.

Biases in technology – are they from Creation or Fall? In fact, there are biases from both. There is a certain way things ought to be – built in by the Creator in all of creation, including in technology. But technology is affected by the Fall along with all of Creation. Uncritical acceptance of technology as neutral does not give sufficient caution for the depth of sin nor sufficient respect for the awesome complexity of the original creational good. In contrast to Kranzberg’s assertion of technology as neither good nor bad, I assert that it is both.

Acknowledgements

This paper is an expansion of some areas of thinking that I dealt with in papers presented at the Annual Conference of the American Society of Engineering Education in 2003 and in 2004.

References


Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/ceec

- 68 -


Christian Worldview and the Engineering Context

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Abstract

Baylor University’s recent commitment to “Vision 2012” has created implied imperatives for the faculty to seek ways of using Christian perspectives to shape classroom instruction and encourage the expression of Christian faith in the intellectual life\(^1\). Teaching from a Christian worldview is part of the University’s charge and Engineering faculty members are investigating how Christian perspectives might interact with various elements of the engineering curriculum. For example, engineering faculty are exploring avenues that incorporate Christian perspectives into engineering design methodology in such a way as to produce uniquely Christian contributions to the engineering design process, especially in terms of responsible and sustainable design. Central to this incorporation is the development of a methodology that creates and exploits meaningful categories and paradigms that are capable of informing and illuminating engineering practice. One example is the “Creation, Fall, Redemption” paradigm that is a central tenant of the Christian faith. Using this paradigm, it is possible to explore the fundamental nature and scope of engineering problems, ranges of possible and achievable design solutions, ultimate and desirable goals, and illuminate valuing processes.

Valuing and the Engineering Context

Technology is the product of the engineering design process. Monsma, et. al. define technology as “a distinct human cultural activity in which human beings exercise freedom and responsibility ... by forming and transforming the natural creation, with the aid of tools and procedures, for practical ends or purposes.”\(^2\) These authors further assert that “doing technology [engineering] is not a [morally or ethically] neutral activity but one that involves valuing of a profound, fundamental nature.”\(^3\) The philosophical basis for asserting that valuing is inherent in the engineering design process [technology] is that “any set of standards for determining what does or does not constitute a solution to a problem must clearly lie outside the problem itself”.\(^4\) In other words, the evaluation of whether a particular design is a “good” or “bad” solution is not self-determined by a particular solution. Therefore, the presuppositions and pre-commitments of the designer [engineer] must play the central role in alternative design evaluation. In particular, one’s worldview becomes an important factor in determining the final design solution.

Monsma, et. al. also define design as a structured “innovative activity whereby people [engineers] creatively use theoretical and practical knowledge and available energy and material in order to specify the size, shape, function, and material content of a technological object.”\(^5\) Furthermore, “design results in a blueprint or set of detailed instructions for the physical characteristics of a technological object – either a product or a tool. Instructions for facilities and procedures needed to fabricate the object are included in these specifications.”\(^6\)

This definition describes the design process as the quest for a solution to a problem that is intrinsic or inherent in the resultant object itself. However, the design solution [object] must exist in a real world context, which defines the extrinsic interactions or externalities of the object. These externalities include elements of aesthetics, economic factors, safety, risk, reliability, maintainability, sustainability, cultural and gender appropriateness, ergonomics, environmental impact, energy efficiency, and end-of-life resource recovery, among others. It is within the realm of a design’s externalities that cultural valuing is most intensely focused and therefore the area where an engineer’s worldview may have the largest impact on the design process.
Monsma, et. al. proposes a set of “eight normative principles” for regulating the design outcome. These normative principles are underpinned by the moral law, which is summarized in the two great commandments: “Love the Lord your God with all your heart, and with all your soul, and with all your strength, and with all your mind; and your neighbor as yourself.” Although these two commandments are central to the Christian faith and extremely rich compared to all secular and non-Christian moral codes, many of their practical aspects are present in the Codes of Ethics adopted by most engineering societies. Additionally, these normative principles focus on the human element and do not specifically address the broader aspects of creation, i.e. issues dealing with animals or the environment. Although the moral code (law) is part of a Christian worldview it is not the distilled essence of the Creation, Fall, Redemption paradigm.

Constructing a Christian Worldview

A worldview forms the conceptual basis for a human being's interaction with his/her world and is the basis for interpreting and organizing the world in terms of linguistic categories (semiotic systems) and intellectual (interpretative) activities, which give rise to permissible actions and values. A significant portion of one’s worldview is formed from the cultural narratives (stories) that are embedded in one’s learning and nurture environment. David K. Naugle develops these concepts of in "Worldview, The History of a Concept", especially chapter 10.

A specifically Christian worldview draws from the narratives of the Old Testament accounts of the nation of Israel and the New Testament accounts of the person and work of Jesus the Christ. From these sources, historical theistic Christianity has constructed various narrative interpretations, which form the basis of particular doctrinal and creedal statements. Most of these statements contain explicit references [narratives] about human origins [creation], the human condition [fall] and the purpose of human life [redemption].

Using these common terms, a meta-narrative framework centered on the concepts of Creation, Fall and Redemption can be constructed. [A meta-narrative is the ultimate or absolute narrative by which all other narratives are interpreted.] This meta-narrative declares: 1) God as beneficent creator (ex nihilo) of the universe (all that is seen and unseen) and the creation of man in God’s image (implying that man is to be a creator also, although only in a derivative sense), 2) the fall of humankind into sin and the introduction of stress and decay into creation, and 3) the process of redemption for man and creation in order to restore both to the pre-fall state.

Although the Creation, Fall, Redemption meta-narrative elements are ubiquitous in the Christian Scriptures, this meta-narrative is particularized by interpretive processes that exist within various Christian traditions and communities, for example, the Roman Catholic, Eastern Orthodox, Lutheran, and Reformed traditions or independent communities such as the Baptist and Quakers. Because of the diversity of Christian doctrinal beliefs and practices, there are, admittedly, a variety of narrative interpretations and thus a variety of worldviews that fall under the Christian umbrella. However, there are many Biblical references that point to a particularly useful interpretation of the Redemption meta-narrative element.

Certainly other paradigms do exist that could provide an interpretative foundation for existence. The dualistic “Light versus Darkness” paradigm would be an example. This paradigm emphasizes the radical separation of spiritual and physical in a manner, which, from the authors’ point of view, provides few meaningful categories capable of informing and illuminating engineering practice.

Some may find the limitation of “worldview” to narrative selection and interpretation, especially in light of traditional philosophical approaches to the topic, as overly simplistic and deficient. (Be that as it may, many engineering designs begin with simple design elements and add complexity when the simple becomes well understood.) Nevertheless, it must be recognized that the Scriptures are narratives rather
than philosophical treatises and that the primary source for all theological constructions are narratives and
their interpretations. Although non-Christians and Christians alike have contaminated the term
“narrative” to such an extent that it is hard to use without secondary implications, for the purposes of this
paper, the use of “narrative” is intended as a description of God’s self-consistent method of revelation as
it exists in the Old and New Testament texts.

A concern that is often voiced by engineering faculty who express a desire to use Christian perspectives
to shape their classroom instruction is that they feel inadequately prepared in terms of theological
education. One benefit of the use of Scripture narratives is that it lowers this theological education barrier
by allowing worldview formative narratives to serve as principle formative case studies, which are
familiar teaching vehicles in the engineering classroom.

**The Meaning of Creation, Fall, and Redemption**

Central to orthodox Christian beliefs is the self-existence of one triune God who is creator of all that
exists. Creation was designed to show forth God’s majesty and glory and divine attributes to
humankind. However, the human race chose not to honor God but rather to turn away for the light of his
self-revelation to worship the creation rather than the creator. In this state, God allows the effects of this
idolatry (fall) to run its full course and all that humans undertake is infected by malevolence and
corruption. The effect of this corruption spread not only within the human race but also overflowed into
the natural order so corruption is endemic and pervasive. The apostle Paul confirms the impact of man’s
fall into sin on the whole of creation:

“The created universe is waiting with eager expectation for God’s sons to be revealed. It was
made subject to frustration, not of its own choice but by the will of him who subjected it, yet
with hope that the universe itself is to be freed from the shackles of mortality and is to enter
upon the glorious liberty of the children of God. Up to the present, as we know, the whole
created universe in all its parts groans as if in the pangs of childbirth.”

Redemption was effected by God, when His Son, Jesus the Christ, paid the penalty for man’s unrighteous
actions. This redemption has a two-fold effect on humankind. First, it transforms the individual human
heart moving it from a state of self-centered corruption (fall) to a state in which God renews the heart
and mind in truth. In this renewed state, man becomes a true worshiper of God and understands that the
universe is an expression of the creative nature and will of God. In his redeemed state, man spiritually
returns to the original tasks of worshipping the One True God and “keeping and tilling the garden.”
Secondly, for the redeemed, the source of this redemption, Jesus the Christ, now is the inspiration for a
renewal and redemption of human culture from a positive and constructive position. From the Pauline
perspective, redemption was not just limited to humankind but was much more comprehensive, reaching
to all of creation. In fact, what God has accomplished through the work and personhood of the Redeemer
is fully eschatological in nature.

This redemptive message was central to the proclamation of the Gospel in the early church as seen from
Peter’s address to the Jerusalem crowd: “He [Jesus] must be received into heaven until the time comes for
the universal restoration of which God has spoken through his holy prophets from the beginning,” and
John’s apocalyptic vision of a “new heaven and a new earth.” Clearly, there is “a soteriological and
doxological purpose to human history, that God is glorying himself in the redemption of his people and
the cosmos, terminating in a final judgment and the creation of a new heaven and a new earth in which
righteousness dwells.”

**Worldview and Design**

From Monsma’s decomposition of engineering design into intrinsic solutions or technological objects and
extrinsic interactions or externalities of the designed object, it would seem obvious that a worldview...
impacts the design’s externalities to a much greater extent than it does its intrinsic elements. A Christian worldview is charged with perspectives that inform cultural valuing and at this nexus Christian faculty can make significant contributions that would guide engineering design in directions that value human life and ameliorate the impact of man’s destructive actions on creation, i.e. redemption in a derivative sense.

Christian faculty should not be apologetic about the interaction of faith informed cultural valuing but should unabashedly promote the high ethical ideals and values that are inherent in the Christian message (worldview).

The use of Christian perspectives to inform engineering design can be incorporated into classroom instruction by assigning particularly relevant scripture passages (narratives) as part of the background research associated with a customer needs statement. For example, when considering the cost benefits of additional design efforts to accommodate a device’s use by physically impaired individuals, relevant narrative passages from the Gospels that document Jesus’ healing miracles or passages from the Old Testament prophets related to God’s concern for the poor and downtrodden could be used to emphasize the importance of accommodative alternative designs.

A Proposed Response

Accreditation requires all engineering programs to include design elements but does not prescribe how to teach design. Individual programs must determine how design will be taught in a manner that satisfies accreditation criterion. In the criteria are statements such as “an understanding of professional and ethical responsibility,” “knowledge of contemporary issues,” and “a broad education necessary to understand the impact of engineering solutions in a global and societal context.”

Since elements of design are generally taught across the engineering curriculum, it is important that all engineering faculty take a holistic approach to design topics; teaching the extrinsic as well as the intrinsic elements of design. The holistic approach would generate opportunities for students to consider the insights their particular worldview (be it Christian or otherwise) might bring to the design table. Where a student’s worldview might appear to be deficient, the instructor should be ready to dialog with the student to expose fallacies and underscore the need for a thought-out value system.

Even engineering science courses, which may contain little design content, should contribute to a student’s awareness of extrinsic design elements. For example, electrical materials courses, which normally cover topics related to the electrical properties of materials, can address issues of materials toxicity and environmental impact, end-of-life recovery, and safety. Or a course in electromagnetics can cover the effects of EM radiation levels on living organisms. A course in software development could cover issues of human computer interaction that relate to system utilization by individuals with sensory impairment and other physical disabilities. A course in thermodynamics could address issues of energy conservation, energy efficiency and energy production by-products (pollution). A course in machine design might address issues of appropriate technology, sustainability, and maintainability.

The non-engineering humanities coursework should also support a student’s developing awareness of extrinsic design issues. Selected courses in religion, languages, literature, sociology, psychology, and world cultures, to name the obvious, generate a broad spectrum of preparatory and foundational materials that are necessary for a student to develop a comprehensive perspective of life (worldview). Assuming student’s exposure to such materials, engineering faculty should be able to efficiently address complex issues related to extrinsic design elements with some assurance of a meaningful dialog with students and a real hope that students will be able to produce holistic and non-trivial design artifacts. Concomitantly, engineering and liberal arts faculties must build bridges in support of shared values and compatible Christian worldviews to prevent the appearance of mutually exclusive and incompatible pedagogy.

A Christian worldview can also help engineering students evaluate the relative significance of potential career choices or provide insights on how to pursue a vocation in a manner that avoids the trivial and...
focuses on the significant. Admittedly, most young engineers struggle with larger life issues that are not addressed by typical engineering course content but which can be otherwise addressed by faculty mentors who possess a well thought out Christian worldview.

Conclusion

A good engineering program operating from a Christian worldview should engage the students in reflection on the motivations that underlie the engineering profession. Accordingly, using the Creation, Fall, and Redemption paradigm, Christian engineers are called to a vocation that is pleasing to God and which redeems human endeavors and enterprises and promotes good stewardship. From this vantage point, a pedagogy focused on the supporting aspects of a Christian worldview should raise each student’s awareness of complex issues of values and culture which can make a significant impact on the design process and outcome. If there is validity in this line of reasoning, then departments of Engineering at schools with a Christian heritage should develop and nurture pedagogic elements that give expression to Christian values and ideals (worldview) within their engineering curricula.

Baylor’s School of Engineering and Computer Science has made this commitment explicit though a published mission statement: “to provide a superior education through instruction, scholarship and service that prepares graduates for professional practice and responsible leadership with a Christian worldview.”23 However, the Department of Engineering faculty recently voted to remove the “Christian worldview” phrase from its program mission statements because of issues related to ABET assessment. If the point of view expressed by Monsma, et. al. and the authors of this paper are valid concerning the importance of valuing in relation to the extrinsic elements of design, and then there should be little concern associated with the assessment process, since design externalities must be addressed in some form to meet accreditation requirements.

References

[22] ABET Criterion, online at www.abet.org/criteria.html.
Incorporating Christian Worldview into an Engineering Program and Its Assessment at Baylor University

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Abstract

ABET EC 2000 has changed the way that engineering programs are evaluated for accreditation. As a result, each program must develop objectives and outcomes that are consistent with the university mission. At Baylor University, teaching with a Christian worldview is an important part of the university mission. As such, each department and program within the department must show support. This paper outlines the recent process used to develop Program Educational Objectives and Expected Graduate Outcomes at Baylor University. Comparisons will be made between Baylor University and other religiously affiliated universities. Some comment on what is currently done by the authors to teach with a Christian worldview in classes at Baylor University is included. Assessment of incorporating a Christian worldview and teaching in a Christian environment is also presented.

Introduction

Baylor’s mission statement is as follows:

“The mission of Baylor University is to educate men and women for worldwide leadership and service by integrating academic excellence and Christian commitment within a caring community.”

The accompanying narrative builds on this simple statement and clarifies the context for such phrases as: “academic excellence and Christian commitment within a caring community.” The narrative also states: “Baylor encourages all of its students to cultivate their capacity to think critically” and “to assess information from a Christian perspective…” While seeking to affirm Baylor’s mission, the engineering faculty must address how this Christian perspective is integrated into its curriculum to ensure graduates have the skills required by ABET and yet fulfill the University’s mission. Are the two compatible? What makes Baylor, and for that matter other religiously affiliated institutions, unique in the academic arena? Obviously, Baylor graduates must compete technically with those of other, non-religiously affiliated institutions. And they do. One must not imply that other institutions do not care as much about their students as Baylor does about their students. However, religiously affiliated institutions have another dimension upon which to build, that of spiritual formation. Spiritual formation is an important factor in developing the appropriate Christian perspective. It helps develops a worldview that then becomes the filter for all aspects of life.

The Baylor 2012 vision document, while controversial for some of the more established faculty at Baylor, provides direction for the institution within the context of its mission. Twelve times this document refers to the “integration of Christian faith and the intellectual life.” Fourteen times this document discusses vocation in light of Christian values. The document emphatically states: “Baylor’s Christian identity should give shape and direction to the entire educational mission – undergraduate, professional and graduate.” Baylor’s School of Engineering and Computer Science also has a mission statement:

“The mission of Baylor’s School of Engineering and Computer Science is to provide a superior education through instruction, scholarship and service that prepares graduates for professional practice and responsible leadership with a Christian worldview.”

Christian Engineering Education Conference 2004
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- 76 -
This statement clearly promotes the concept that each graduate should at least understand, if not embrace, a Christian worldview.

**Developing Program Educational Objectives**

The Department of Engineering also provides a mission statement:

> “The mission of the Department of Engineering is to educate students, within a caring Christian environment, in the discipline of engineering, by combining a strong technical foundation with an emphasis on professional, moral, ethical and leadership development.”

This statement reflects the concern on the part of the Department of Engineering that items relating to religious convictions are not easily measurable or even possible to instill in all graduates. With this position, the engineering mission statement is carefully crafted to state that the department will provide a Christian environment. It is easier to demonstrate a Christian environment than to require all students to graduate with a Christian worldview.

In light of this context, how is the Christian perspective integrated into engineering classes? What is the impact and how is it assessed? In order to answer these questions, the Mechanical Engineering Program needed to define its Program Educational Objectives (PEOs) and, having accomplished that, the Expected Graduate Outcomes (EGOs) (equivalent to ABET Criterion 3 a-k). Each degree plan, Mechanical, Electrical and Computer, and Engineering, accomplished these steps simultaneously with similar results.

The first proposed draft of PEOs was accomplished by the Mechanical Engineering Program Committee Chair after reviewing statements from several other schools. PEOs from a variety of institutions were examined, including non-religious institutions. Below are several religiously affiliated institution examples of mission statements/PEOs that include references to Christianity:

1. LeTourneau University
   
   “…This will be accomplished within an interdisciplinary framework and with a sense of Christian vocation and commitment to serving God in society.”

2. Calvin College
   
   “…servants whose Christian faith leads them to an engineering career of action and involvement, to personal piety, integrity, and social responsibility.”

3. Oklahoma Christian University
   
   “…The Mechanical Engineering Department will produce graduates with a commitment to the Christian worldview and the broad education necessary for lives of leadership and service in the workplace, home, and community.”

4. George Fox University
   
   “As an engineering program at George Fox University, our mission is to prepare technically competent and broadly educated engineers for a life of responsible service emerging from a Christian worldview.”

As can be seen, these institutions all include reference to Christian faith and, in particular, most include the idea of Christian worldview. Some of these institutions have a very homogeneous faculty and student body based on religious affiliation. Others, like Baylor, ascribe to a code of conduct for all students and faculty rather than affirm strict doctrinal requirements. Less than half of Baylor’s faculty and student body are Baptist, however, the Provost has asserted that all faculty are expected to educate “students
within the framework of Christian principles and the practice of Christian virtues.” The Provost further states that, though Baptist, Baylor is “willing to employ faculty members who have other denominational or religious affiliations, without requiring of them subscription to a particular or restrictive creedal or doctrinal statement.” Baylor has a diverse faculty and, as such, it is difficult to generate a common vocabulary that involves Christian worldview or Christian vocation and their influence on the classroom. Ideas of diversity and pluralism also generate problems when seeking consensus on religious topics. Also important to this discussion are issues of academic freedom and how much difference, especially with respect to religious affiliation, should be present. The Baylor University Personnel Policy (BUPP) #701 states:

“It is not expected that the faculty will agree on every point of doctrine, much less on the issues in the academic disciplines that divide faculties in any university. It is expected, however, that a spirit of Christian charity and common faith in the gospel will unite even those with wide differences and that questions will be raised in ways that seek to strengthen rather than undermine faith.”

When hiring new faculty, preference is given to those from the Baptist tradition but the only institutional religious requirement is for the applicant to demonstrate an active Christian faith. Thus, diversity is obviously within the Christian tradition. While BUPP #701 states the hope and expectation, the reality is that diversity can lead to further polarization on issues unless some common ground can be found. Usually the solution to diversity at Baylor University is not to address the issue rather than cause an area of possible dissention. Such is the experience in selecting PEOs and EGOs for the Mechanical Engineering Program.

**Baylor Program Educational Objectives**

In September 2003, Baylor’s Mechanical Engineering Program began discussions over the following PEOs:

Upon successful completion of the B. S. in Mechanical Engineering at Baylor University, the student will be able to

1. Use the knowledge and technical skills gained through this program in mathematics, science and, engineering to solve problems, conduct experiments, or continue their education in a graduate capacity. These students have the engineering fundamentals and a strong sense of Christian vocation that provides a basis for professional competence and life-long learning serving God in society.

2. Work in interdisciplinary teams and successfully communicate ideas through a variety of media, both oral and written.

3. Be a responsible professional with a strong sense of ethics and integrity that is consistent with a Christian worldview, enabling students to become leaders in their churches, communities, and society as a whole.

The mechanical engineering faculty eventually approved the following after three iterations and some lengthy discussion:

Upon successful completion of the B. S. in Mechanical Engineering at Baylor University, the graduate will be able to:

1. Apply their knowledge of mathematics, basic science and engineering design to creatively bring a project from problem statement to final design.

2. Be professionally competent and engaged in life-long learning, serving society in a professional career or by continuing their education in a graduate program.

*Christian Engineering Education Conference 2004*  
http://engr.calvin.edu/ces/ceec  
- 78 -
3. Work in interdisciplinary teams and clearly communicate ideas through a variety of media.
4. Be a responsible professional with a strong sense of vocation, ethics, and integrity developed in an educational environment shaped by Christian ideals, enabling graduates to become leaders in their churches, communities, professional societies, and society as a whole.

Noticeably absent from final PEOs are the references to Christian vocation, serving God, and the concept of Christian worldview. What is left is consistent with the department mission statement reference to Christian environment. The consensus was to leave out the original references. Faculty could not agree what was meant by Christian worldview and what that should look like in the classroom and department. The idea of serving God and Christian vocation are not descriptive statements for some of our students as Baylor students are not asked to declare their Christian faith upon matriculation to the university. The faculty decided that assessment of Christian worldview was not possible but that it might be possible to show the existence of a Christian environment.

Developing Expected Graduate Outcomes

Looking at EGOs from other institutions, only two institutions displayed the next level of program outcomes (similar to the ABET Criterion 3 a-k):

1. Oklahoma Christian University
   Outcome 13 - “Graduates will demonstrate an understanding of the Christian worldview and demonstrate personal faith through personal devotion practices and involvement in their communities, church, and government in roles of service and leadership.”

2. Calvin College
   Outcome (f) - “an understanding of professional and ethical responsibility from a Christian, holistic perspective”
   Outcome (g) – “the broad education necessary to understand the impact of engineering solutions in a global and societal context including an understanding of Christian stewardship of resources”
   Outcome (j) – “engaged contemporary issues demonstrating how their Christian faith relates to their profession”

The next step, to determine EGOs, was met with the same reluctance to include religious references in anything adopted by the committee. In fact, the committee decided to adopt the ABET Criterion 3 a-k in its entirety. No additional outcomes were adopted and the ABET outcomes were not modified to include any reference to religious identity.

Not including religious references in the EGOs is a “safe” approach to the accreditation process. If a program does not claim to have these elements then it is not required to assess them. What if religious outcomes are included? This would imply that the ABET evaluation team would then have to evaluate the assessment process for these outcomes. Is a secular organization qualified to assess things like Christian worldview or Christian vocation? One could argue that they are not qualified and therefore should not be allowed to evaluate outcomes associated with the religious nature of the institution. If the institution itself cannot agree on the definitions of certain religious topics how can an evaluation team be expected to understand the outcome let alone give an evaluation? On the other hand, if the ABET evaluation team only needs to see an assessment process, then a thorough understanding of the outcome is not necessary. Ideologically, Baylor Engineering has chosen not to explore this issue. In the opinion of the authors, this issue must be revisited and the department/program statements must include references which support the university and school mission. While the department chooses not to include references to the religious nature of the institution, the University’s mission does not allow them to dismiss inclusion.
of Christian worldview in the program.

What is clear from discussion within the faculty is that, like ABET and the accreditation process, faculty need to be educated on the university, school, and department mission. Faculty must be familiar with these statements and how they influence the vision and direction of the department. Informal discussions over lunch are a great place to start. These can lead to discussion groups where faculty can explore how diverse backgrounds can find common ground. It is necessary to look to university administrators, Provost, Dean, and Chair, to also articulate their interpretation of the mission statements and provide guidance and feedback on department documents. It is important to talk with other departments across the university to see their handling of the topic. A successful conference was held last summer at Baylor University to bridge the gap across departments. The conference, funded internally for Baylor faculty, addressed the issue of faith, science and technology but, of necessity, had to explore the concept of Christian worldview to find a common ground. All who participated were more aware of the views from other departments. The conference led to several papers exploring this topic.

Integration and Assessment of Christian Worldview at Baylor – Classroom

The classroom is one of the natural places to begin integration of Christian worldview into the engineering program. When approached about this topic, some faculty members were uncomfortable talking about how they integrate their Christian faith into the classroom. Some faculty intentionally do nothing in the classroom to support a Christian worldview. Clearly, the classroom is not meant to be a place to proselytize, as discussed by BUPP #701, however, when the topic is appropriate, the faculty member is able to include references to faith in the classroom. Freshmen classes include such topics as Christian vocation to help them understand their calling. In biomechanics, students use images such as Christ hanging on a cross to discover the forces that joints would endure in such a configuration. In fluid mechanics, examples from creation serve to reinforce Christian faith: birds flying in V-formation being studied by NASA for possible fuel savings during deployment of military aircraft; prairie dogs using the Bernoulli principle to build their shelters and avoid predators; Newton’s second law and the Navier-Stokes equations to describe the complexity of fluid flow; and how much is unknown about turbulence although it is being studied by many research groups. In heat transfer the peak in energy from the sun occurs in the visible wavelengths and shows God’s creation. In thermodynamics, both the first and second laws are natural places to begin discussions on how God created the earth. Students can also do five minute presentations on special topics related to the technical subject which can include references to creation. Often, all the professor has to do is to take a step back and remind the students where the topic fits into creation.

Another way to reinforce these topics is to have outside speakers who will address the topic of integration of faith, vocation, and science. Baylor is fortunate to have a world recognized expert in intelligent design who has addressed both freshmen and student professional societies. Another professor has written extensively on entropy production and intelligent design. This professor has addressed thermodynamics classes. Alumni have been invited to talk about their work and how their faith impacts what they do. An example at Baylor was an alumnus who was a fuel cell expert at NASA. This individual delivered an excellent presentation to the School of Engineering and Computer Science which ended with a statement of how faith integrates with her vocation. This was very effective with the students.

A natural place to talk about Christian worldview is in the area of design and ethics. Baylor has two design courses, one in the junior year and one in the senior year. Currently, ethics is addressed only in the junior year; however, there are considerations to expand this to other courses.

Assessment of students is being done informally in two courses taught by one of the authors. At the beginning of the semester in the spring of the junior year and the spring of the senior year a questionnaire is given to the students. This questionnaire asks the students to give some administrative information but
at the bottom of the form is usually one question designed to generate responses concerning a student’s Christian worldview. The questions asked are life issues that the students should be prepared to face. Once, the students were asked to define Christian worldview. All 18 students were able to give reasonable definitions. Several student responses are listed below:

1. Basing your actions and thoughts, both personal and professional, on values held in a Christian tradition.
2. Keeping things in perspective of Christ
3. To look at the world and its people from a Christian point of view, as laid out by Christ’s life. Most importantly to be loving and forgiving.
4. To look at the world the same way Christ would
5. It means looking at every aspect of life through Christian beliefs, guidelines, and responsibilities. I think it is a Christian’s responsibility not to limit their faith to church functions.

Other topics for discussion in previous years include:

1. A survey by George Barna, Christian researcher, of “born-again” believers has raised issues that I would like you to address. “Born-again” is defined as “those who report having made a personal commitment to Christ and expect to get to heaven because they accepted Jesus.” Please respond to the following statements:

   “All religions are essentially the same.”
   “A life of good works will enable a person to get to heaven”

2. What is your opinion about cloning and the recent claim to have cloned a human?
3. What is your opinion about stem cell research?
4. Please read the following and comment whether or not you accept all or part of this worldview and if you think it is prevalent today.

   “The universe started out about fifteen billion years ago with the big bang; our solar system was born about seven billion years ago; eventually, life appeared in the chemical broth of the ancient oceans, evolving first into simple microorganisms, then into higher, more complex forms, and finally into human beings. We humans are the apex of evolution with the intelligence to control nature and bend it to serve our purposes. The solution to our social problems therefore lies in our own hands, through the exertion of human intelligence and ingenuity. Through our ever advancing science and technology we will save ourselves.” (Summarized from Daniel Quinn, *Ishmael*, by Charles Colson.)

Results are tabulated and examples of the variation in answers are given as feedback to the class. This usually sparks discussion with the students and gives them an opportunity to develop opinions concerning the issues.

Typical student answers to cloning question were:

**Cloning**

1. “I do not feel comfortable playing God and bringing forth life. Yet I do support medical research for cures for diseases such as cancer. The hard question is where to draw the line of what is helping someone and what is taking the role of God. I do not support cloning, especially of a human.”

*Christian Engineering Education Conference 2004*

*http://engr.calvin.edu/ces/ceec*
2. “Now that cloning is possible, somebody will do it, and therefore moral ethical people should go ahead and proceed if for no other reason than to have moral, ethical people at the forefront of a controversial field….”

3. “I would certainly wait for DNA tests to verify their claims. I would be extremely hesitant to cloning an entire individual. First it requires the destruction of an embryo to denucleate. Second, it raises great questions to the nature of the human soul and spirit. Finally, who would you want cloned anyway? (i.e. who picks who is recreated, the great minds, the great athletes, etc.) Now, if one could clone individual body parts for transplantation purposes, I would find that quite useful and worth further considering.

Typical student answers to worldview question were:

Worldview

1. “I have no problem with evolution, but last I checked we still couldn’t bend all of nature to serve our purposes. However, the solution to social problems is our responsibility and we will have to use intelligence and ingenuity to solve many of our problems. Ultimately our “salvation: is not our decision but we still have a responsibility to do the best we can on earth.”

2. “God is the salvation and we need to know and glorify and make Him known as our main objective. We are called to be stewards of nature and not recklessly try to control it. I believe in the Biblical time scale and the creation story it presents.”

3. “I believe there is a happy medium between science (this statement) and religion (according to the Bible) on how and when the universe began. So, I would have to say I accept part of this worldview, but not all of it.”

The author might not talk about his beliefs in the class and if he does, it is after the students are finished with their discussion. Students are invited to continue discussions on these topics and any other topic in the office at anytime. What is highlighted during class is the fact that controversial topics will be confronting them in the workplace and throughout their life. It is important for our students to think these topics through and be prepared to answer. A discussion of these results with the Department Chair usually follows. Other topics important for seniors as they prepare to graduate are jobs and money. Resumes are read and salaries discussed. In this context, an article is given to the students which asks the questions about how much money is enough and what can you do with your money to further God’s kingdom. All of these topics are of interest to students. Consideration is being given to using student professional societies to cover more topics relevant to the profession, job and preparation for life in general.

Integration and Assessment of Christian Worldview at Baylor – Outside of Class

Most professors are very cognizant of the role model that they portray to students when outside of the class. Baylor University works hard to achieve small class sizes so professional relationships with students can be developed in a more relaxed atmosphere, such as the office. Each faculty has an institutional requirement to demonstrate an active Christian faith. This is usually thought of as church attendance and participation in a spiritual activity but active Christian faith can have a wide range of application. It is important for our students to see this active faith modeled by the faculty in churches and in university/school/department activities. In the office, extra instruction in the academic topic takes place as well as discussions on life experiences. This privilege was summed up by Dr. Chris Marsh, an Associate Professor of Political Science at Baylor University. He said:
“Once I came to Baylor, I quickly became aware of another important facet of our Christian mission – counseling students who are deeply religious. At Baylor, when discussing issues such as graduate school and career plans, my students regularly tell me about how they have been praying about their futures and how they feel called to a certain field. I am comfortable talking to such students and I believe I help them with these very difficult decisions. But I wonder, how would these students be counseled at a secular institution? And more importantly, if Baylor were to lose its Christian identity, how will such students be counseled at Baylor?"

The opportunity exists to pray with students, help them with their problems and even share the gospel if the situation warrants. This is the freedom that exists at Baylor with the students.

Since Christian environment is important to the mission statement of the Department of Engineering, evaluation of this environment is extremely important. Evaluation is primarily done with the senior exit survey. This survey asks for feedback on the EGOs as well as selected topics in a narrative format. The question that pertains to Christian environment is:

“In what ways and how successfully does the Department of Engineering contribute to the University mission of offering academic excellence in a Christian environment?"

Typical student responses are:

“The Engineering Department created a great balance of academic excellence in a Christian Environment. It kept us focused on our true purpose in learning, which would one day be used to serve others and God.”

“For the most part, all the professors displayed their Christian side during classes. This made for a warm and comfortable environment even when classes were at their hardest.”

“This professor takes class time to discuss the current issues and applies them to all that we do and will do in our profession. He also asks questions to stimulate our thinking on where we stand on moral and ministry issues. Overall the department is loving and understanding and strives to form meaningful relationships with the students. This allows them to share their faith and personal experiences.”

Not all responses are positive:

“Christian ethics and morals obviously underpin everything done in the department. However, when discussing Christian thought, the department needs to stick to engineering related subjects. Intelligent design and creationists teachings concerning the origins of man have no place in an engineering classroom, unless they are a part of discussion that includes the accepted and practiced theory of evolution by natural selection. Teach Christian values when appropriate, but don’t "brainwash" your students in subjects you are not fully educated in.”

“Some professors make an attempt to integrate faith and learning but it could be improved. So much of what we do as engineers especially reveals the glory of God. Ethical issues facing engineers could be more closely taught with our faith. This should be reinforced on a holistic level in many courses.”

As an institution, Baylor does not need to apologize for its Baptist and Christian heritage but it does need to be sensitive to the needs of the students and maintain the Christian environment. Clearly it is deeply appreciated by the students.

Conclusion

The concept of integration and assessment of a Christian worldview at Baylor University will be widely discussed and debated for many years to come. At least one hopes that it will be. Forums must be

Christian Engineering Education Conference 2004
http:// engr.calvin.edu/ces/ceec

- 83 -
established for this discussion and each professor must eventually find his/her comfort level with respect to Christian worldview to use both in and out of the classroom. The important concept to communicate is the genuine love for Christ that motivates a faculty member in their dealings with the students. It is an important task that lies ahead of each engineering faculty member, to develop young men and women to be engineers with a Christian worldview.

References

[10] BUPP #701 Institutional Academic Freedom
An Engineering Student Perspective on Ethics

William Jordan and Bill Elmore
Louisiana Tech University, Ruston, LA

Abstract

As engineering educators we have a responsibility to promote the competent and ethical practice of engineering by our students as they enter the work place. To effectively do this, we need to understand the students’ perspective on ethical issues. In this paper we report on our students’ attitudes concerning several cheating related issues. We surveyed engineering students attending Louisiana Tech University, which is a medium sized public university in the rural south. This paper follows up on a paper the first author wrote in 1991. That paper utilized student surveys taken during 1986-1990. We have retaken the survey during winter 2004. In this paper we will examine the change in student opinions over the past 15 years, and what this means to the way we teach and grade our courses.

Comparing the two survey results, our students claim they are less likely to cheat than their counterparts 15 years ago. However, the results are discouraging when these results are correlated with other questions. More than 40% of the students who claimed to have never cheated admitted they have sometimes done things they did not think was cheating, but that they knew violated the professor’s official standards.

It appears that our students think they are honest because they are redefining their ethical standards to accept what they are actually doing. This is a very post-modern approach to ethics. This is a challenge for Christian engineering professors to persuade the students to stop redefining ethical behavior solely on the basis of their own opinions.

It is not enough to just teach the students that engineers need to obey the ethical code of our State Board of Registration. While this code has the force of law behind it, many students do not believe they will be caught and have no fear of the engineering code of conduct. Students need an internal reason to do what is right.

To help motivate our students, the first author has taught in our senior seminar class how our ethics come from our worldview. We have mentioned four classical ethical theories: utilitarian ethics, duty ethics, rights ethics, and virtue ethics. We have discussed real world engineering ethics case studies and outlined how people would respond based on their personal ethical perspectives. We endorse a virtue ethics approach for it is consistent with our Christian belief system. It is something that can be openly taught in a public university classroom. Virtue ethics is consistent with most parts of the engineering codes of conduct.

Rationale for Paper

This paper is partly based on the authors’ experiences in engineering education at Louisiana Tech University, which is a medium sized public university in the rural south. While it is a state supported school it is in a very conservative part of a very conservative state. Most of our students come from north Louisiana which is heavily influenced by a conservative church culture.

Both of the authors are part-time administrators as well as tenured faculty members. Dr. Elmore is the Academic Director for Chemical Engineering, Civil Engineering, and Geosciences, while Dr. Jordan is the Mechanical Engineering Program Chair. The authors are both evangelical Christians who attend different churches in Ruston, Louisiana.

The issue of cheating is not a new problem. Anecdotal evidence indicated the amount of cheating was increasing. The first author had a serious problem in the spring of 2003 when about 8 members of a
graduate class (of 30) were caught plagiarizing published sources as well as each other on homework assignments. This incident motivated the authors to do a serious re-evaluation of the cheating issue.

The first author had published a paper on student attitudes concerning cheating\(^1\). This survey was done during 1986-1990 and published in 1991. Junior and senior students who were taking a required engineering ethics course were surveyed concerning the subject. The authors decided to retake this survey during winter quarter 2003-2004 to evaluate how student opinions might have changed during the last 15 years.

**Student Attitudes Concerning Cheating**

Students in several different classes were surveyed. The first group was Mechanical and Chemical Engineering senior students. The second group was the junior students in Chemical Engineering. The third group consisted of students who were in one of our freshman introduction-to-engineering courses. These students were in their second quarter of their education program.

In order to make it easier to compare results, the very same questions were asked in 2004 that were asked in 1986-1990. If we were starting over, they might have phrased some of the questions differently. However, we believed it was important to phrase things the same way so that comparisons might be more meaningful.

The surveys were taken anonymously. The surveys were done in groups, so we know which class the students were in. On some of the results, there were differences in attitudes between the different classes.

Our general observation is that the amount of cheating is probably underreported. We do not know of a motive for a student to admit cheating, when he has not done so. However, some students may have had a motive to deny cheating for fear that they might be caught.

The results to the basic question of whether or not they have cheated are shown below in Table 1.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Have you ever cheated in college?</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Students</td>
<td>Percentages of Students responding to question</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Never</td>
<td>Once</td>
<td>Few Times</td>
<td>Frequently</td>
</tr>
<tr>
<td>1991 Paper</td>
<td>259</td>
<td>30 %</td>
<td>14 %</td>
<td>51 %</td>
<td>2 %</td>
</tr>
<tr>
<td>Weighted average 2004</td>
<td>141</td>
<td>57 %</td>
<td>17 %</td>
<td>25 %</td>
<td>0 %</td>
</tr>
<tr>
<td>2004 Seniors</td>
<td>55</td>
<td>47 %</td>
<td>19 %</td>
<td>32 %</td>
<td>0 %</td>
</tr>
<tr>
<td>2004 Juniors</td>
<td>20</td>
<td>55 %</td>
<td>25 %</td>
<td>15 %</td>
<td>0 %</td>
</tr>
<tr>
<td>2004 Freshman</td>
<td>66</td>
<td>67 %</td>
<td>12 %</td>
<td>21 %</td>
<td>0 %</td>
</tr>
</tbody>
</table>

The 2004 students claim they have cheated less than their counterparts 13 years ago. This is not consistent with our anecdotal observations.

When the 2004 results are broken out by class an interesting difference is noted. As students progress...
from freshman to junior to senior years, they report they are more likely to cheat in their classes. There are several possible conclusions to this. Students may be getting less ethical as they progress in the curriculum. They may be facing more trying and demanding courses that create more temptations to cheat. Or they may be just getting more honest about what all of them have always been actually doing.

The next step was to analyze whether the students overall grade point average correlated with their likelihood of cheating. The 1991 paper showed a slight correlation of grades with cheating. Students with higher grades were slightly less likely to cheat. It should be noted that the students surveyed in that paper were all juniors or seniors taking a required course in engineering ethics. Results for the 2004 survey are shown below.

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once</th>
<th>Few Times</th>
<th>Frequently</th>
<th>Often as needed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Students</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1991 Paper</strong></td>
<td>259</td>
<td>30 %</td>
<td>14 %</td>
<td>51 %</td>
<td>2 %</td>
</tr>
<tr>
<td><strong>1991 GPA</strong></td>
<td>3.12</td>
<td>2.91</td>
<td>2.94</td>
<td>2.75</td>
<td>2.75</td>
</tr>
<tr>
<td><strong>average for each group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2004 senior</strong></td>
<td>66</td>
<td>47 %</td>
<td>19 %</td>
<td>32 %</td>
<td>0 %</td>
</tr>
<tr>
<td><strong>2004 GPA</strong></td>
<td>3.47</td>
<td>3.11</td>
<td>3.12</td>
<td>--</td>
<td>3.20</td>
</tr>
<tr>
<td><strong>senior average for each group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2004 freshman</strong></td>
<td>55</td>
<td>67 %</td>
<td>12 %</td>
<td>21 %</td>
<td>0 %</td>
</tr>
<tr>
<td><strong>2004 GPA</strong></td>
<td>2.98</td>
<td>3.23</td>
<td>3.21</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>freshman average for each group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2004 unweighted average GPA</strong></td>
<td>141</td>
<td>3.23</td>
<td>3.17</td>
<td>3.17</td>
<td>--</td>
</tr>
</tbody>
</table>

On an overall basis there appears to be no correlation between grades and likelihood of cheating. However, there is a trend seen when the separate responses of the seniors and freshmen and broken out. The seniors showed results similar to the 1991 paper. Students with higher grades are slightly less likely to cheat than those with lower grades. However, there appears to be no observable trend between cheating and grades with the second quarter freshmen who were surveyed. This may be the result of them not having faced a serious temptation to cheat in their first two quarters.

While our university has some overall standards governing student misconduct, there is room left for each professor to have slightly different ethical standards. This is seen in the university bulletin statement on academic misconduct²:

Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/ceec
- 87 -
Academic misconduct at the University is determined by the faculty member, committee, or other supervisor(s) under whom such misconduct occurs. The misconduct may occur in an individual class... Penalties may range from dismissal from the University or an academic degree program to a failing grade or lesser penalty as determined the faculty member, plan of study committee, or supervising authority.

Many of the students recognize that the different nature of various classes means that some of the details concerning academic misconduct can be different in different classes. This is shown in Table 3 below. This is a reflection of different goals and teaching methods requiring different approaches to some of the details in the code of conduct. However, a majority of students still feel that the standards should be exactly the same in all classes.

<table>
<thead>
<tr>
<th>Should all professors have the same standards as to the definition of cheating?</th>
<th>Number of Students</th>
<th>Yes</th>
<th>Don’t Know</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991 paper</td>
<td>259</td>
<td>35 %</td>
<td>17 %</td>
<td>48 %</td>
</tr>
<tr>
<td>Weighted average 2004</td>
<td>139</td>
<td>55 %</td>
<td>18 %</td>
<td>27 %</td>
</tr>
</tbody>
</table>

Students were asked their opinion of the legitimacy of students working together on out-of-class work. We asked them whether it was legitimate for students to work together on the following assignments:

- Homework
- Lab reports
- Computer programs
- Projects
- Oral presentations

In all of these cases, the students said yes by large majorities. An example of this is seen in the table below, which tabulates their opinions about working together on homework.
Table 4

| Is it fair for students to work together on homework? |
|-----------------|-----------------|----------------|-----------------|----------------|
|                  | Number of Students | Yes | Depends on class | Depends on assignment | No |
| 1991 paper       | 259               | 62 %| 23 %             | 12 %             | 3 % |
| Weighted average 2004 | 147           | 71 %| 13 %             | 15 %             | 1 % |

It is interesting that over 70% of our students said yes to working together on homework, irrespective of the individual professor’s policy on it. The students have created their own definition of cheating, and working together on homework is defined to not be cheating, even if an individual professor has stated otherwise.

This student created definition of cheating is shown with more emphasis when we asked them if they sometimes do something a professor might think is cheating, but they honestly feel is acceptable cooperation. Results for this are shown in the table below.

Table 5

| Do you sometimes do something a professor might think is cheating but you honestly feel is acceptable cooperation? |
|---------------------------------------------------------------|-----------------|-----------------|-----------------|----------------|
|                                                              | Number of Students | Never | Sometimes | Frequently | Almost Always |
| 1991 paper                                                    | 259              | 21 %  | 66 %      | 11 %        | 2 %           |
| Weighted average 2004                                         | 142              | 45 %  | 48 %      | 7 %         | 0 %           |

A majority of the students admit that they sometimes or frequently do things they think are acceptable, but that they know have been defined to be unacceptable by their professor. This is a very post-modern position. The students have created their own definition of cheating. Based on their definition of cheating, they are behaving honestly. The fact that this definition of cheating is not the official one of the professor in charge of the class does not seem to mean much to our students. The students in 2004 are once again claiming to be more ethical than those in 1991. That does not necessarily mean the 2004 students are more ethical.

While surveys were done anonymously, it was possible to correlate each student’s answer on different questions. A significant proportion of those who claimed to have never cheated, admit that they have done things they knew their professors regarded as cheating. This is shown in the following two tables, which show the results from the 1991 paper from the 2004 survey.
Table 6

Correlating answers to questions

Have you ever cheated in college? and

Do you sometimes do something that a professor might think is cheating but you honestly feel is acceptable cooperation?

1991 Results

<table>
<thead>
<tr>
<th>Have you ever cheated in college?</th>
<th>Never</th>
<th>Once</th>
<th>Few times</th>
<th>Frequently</th>
<th>Often as needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentages based on 70 students</td>
<td>39 %</td>
<td>27 %</td>
<td>30 %</td>
<td>1 %</td>
<td>3 %</td>
</tr>
<tr>
<td>Do you sometimes do something a professor might think is cheating but you honestly feel is acceptable cooperation?</td>
<td>Weighted 1991 averages</td>
<td>30 %</td>
<td>21 %</td>
<td>5 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Never</td>
<td>48 %</td>
<td>74 %</td>
<td>76 %</td>
<td>0 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Sometimes</td>
<td>18 %</td>
<td>0 %</td>
<td>19 %</td>
<td>0%</td>
<td>0 %</td>
</tr>
<tr>
<td>Frequently</td>
<td>4 %</td>
<td>5 %</td>
<td>0 %</td>
<td>100%</td>
<td>50 %</td>
</tr>
<tr>
<td>Almost always</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The first row of numbers show the answers to the question: *Have you ever cheated in college?* Then within each column are how each subgroup answered the question: *Do you sometimes do something a professor might think is cheating but you honestly feel is acceptable cooperation?* For example, 39% of the students said they never cheated. Of that group that claimed they never cheated, 48% admit to sometimes breaking a professor’s standard, while 18% admitted they frequently did something a professor would not approve. Seventy percent of the students who claimed to have never cheated admit that they sometimes or frequently do things that their professors would not approve.

For those who claimed to have cheated only once, 79% of them admit to sometimes or frequently doing things they know their professor has defined to be cheating. This indicates that the number who has never actually cheated is much lower than claimed.
Table 7

Correlating answers to questions

Have you ever cheated in college?

and

Do you sometimes do something that a professor might think is cheating but you honestly feel is acceptable cooperation?

2004 Results

<table>
<thead>
<tr>
<th>Have you ever cheated in college?</th>
<th>Never</th>
<th>Once</th>
<th>Few times</th>
<th>Frequently</th>
<th>Often as needed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>58 %</td>
<td>17 %</td>
<td>25 %</td>
<td>0 %</td>
<td>1 %</td>
</tr>
</tbody>
</table>

Do you sometimes do something a professor might think is cheating but you honestly feel is acceptable cooperation?

<table>
<thead>
<tr>
<th>Weighted 2004 averages</th>
<th>Never</th>
<th>Once</th>
<th>Few times</th>
<th>Frequently</th>
<th>Often as needed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>57 %</td>
<td>39 %</td>
<td>26 %</td>
<td>0 %</td>
<td>0 %</td>
</tr>
<tr>
<td></td>
<td>39 %</td>
<td>61 %</td>
<td>57 %</td>
<td>0 %</td>
<td>100 %</td>
</tr>
<tr>
<td></td>
<td>4 %</td>
<td>0 %</td>
<td>17 %</td>
<td>0 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Almost always</td>
<td>0 %</td>
<td>0 %</td>
<td>0 %</td>
<td>0 %</td>
<td>0 %</td>
</tr>
</tbody>
</table>

In 2004, for the students who claimed to have never cheated, 43% of them admit to sometimes or frequently doing things they know their professor has defined to be cheating. For those who claimed to have cheated only once, 61% of them admit to sometimes or frequently doing things they know their professor has defined to be cheating. This indicates that the number who has never actually cheated is much lower than claimed.

The 2004 students have claimed they are more honest than their counterparts in the early 1990’s. For example in 1991 70% of the students who claimed to have never cheated admitted to violating a professor’s standard. In 2004 only 43% of the same group of students admit to having done so. We are not convinced the students are more ethical, but it appears that the students think they are more ethical.

These last several tables show that many students have created their own definition of cheating. They believe they are ethical for they have redefined cheating to mean what they want it to mean. This is a very post-modern approach.

One of the issues we could not isolate in this survey relates to the moral relativism of the students’ apparent definition of cheating. Is the issue the definition of cheating or who has the right to define cheating? Some students may not be rebelling against the definition of cheating as much as they are rebelling against the professor’s right to define it. This is also an ethical issue, but not one we have been
able to analyze in any detail.

**Post-Modern Attitudes among Engineering Faculty**

Unfortunately, students are not the only post-modern people in engineering colleges today. This perspective is shown by many faculty as well. Some engineering faculty are teaching a post-modern relativistic worldview in their courses. The first author reported on this in a 1991 paper given at the annual meeting of the American Scientific Affiliation.

This problem was brought to the first author’s attention by a paper by Richard Culver. Culver applied William Perry’s model of intellectual development to engineering education. Perry had nine positions or stages of intellectual development. They range from the lowest level (where all knowledge is known) to the highest level (commitment within relativism). His university based its new freshman and sophomore introduction to engineering course sequence on this model. Culver noted that a lack of a unique solution in engineering design appears to fit in well with Perry’s view that intellectual maturity involves a commitment to a relativistic world view.

A short explanation of Perry’s model has been provided by Felder. Felder describes how students who are at different positions in Perry’s model would respond to a test given in an engineering course. Perry’s nine levels are commonly grouped into four categories. The following summaries are adapted from Felder’s paper.

- **Dualism** (Levels 1 and 2). Knowledge is black and white and every problem has only one correct answer.
- **Multiplicity** (Levels 3 and 4). Some questions may not have answers now but the answers will eventually be known.
- **Relativism** (Levels 5 and 6). Knowledge and values depend on context and individual perspective rather than being externally and objectively based.
- **Commitment within relativism** (Levels 7-9). Students begin to make commitments in personal direction and values, evaluate the consequences and implications of their commitments, and finally acknowledge the conflicts may never be fully resolved.

Culver’s correlating the lack of unique solutions to design problems with Perry’s view of intellectual maturity clearly upset some people. The first author replied in a letter to Engineering Education:

> They have made several assumptions about the nature of design and applied them to a philosophical issue. To state that there is not a unique solution to an engineering problem is not the same as stating that all solutions are acceptable. Clearly, in a real-world design there are unacceptable answers... They state that to become intellectually mature, you need to believe in a relativistic world...These statements say a great deal about their own personal world views and nothing about the intellectual maturity of students.

There was also a response paper presented at the 1991 ASEE annual meeting. Graff, Helmer, and Leiffer wrote:

> Most engineering educators would agree, as we do, with Perry’s goal, to develop independent critical thinkers...Educators who use the Perry Model attempt to emphasize a process, but invariably they will teach content...Perry’s model is not value neutral...It assumes that there are no absolutes. This is a philosophical position.

A very relevant question is why should the authors bring up this old controversy? The simple answer is that this problem has not gone away, it has only gotten worse. The issue is still before us. It has moved from just being an issue about design education to an issue concerning the way engineers teach in all of
our classes. We have reported on part of this problem in our paper at the 2003 ASA Annual Meeting. Under the umbrellas of active learning, some dangerous concepts are being introduced. To understand this problem we first need to define what we mean by active learning. We embrace using active learning concepts in our classrooms. However, some faculty members have used a constructivist approach to go far beyond the issue of improving teaching by actively involving the students in the learning process. Active learning concepts are not new. They have been around College of Education circles for some time. They have also been around Engineering circles for some time under a different name. Engineering professors called them labs. What is new to many engineering faculty is incorporating these concepts into a typical lecture class. Many of these concepts have a constructivist base. This is shown in a document written by the NSF’s Succeed Coalition.

The basic idea of constructivism is that knowledge must be constructed by the learner; it cannot be supplied by the teacher. In order to promote active learning, we need an innovative curriculum that provides for students to inquire, explore, experiment, collaborate, and experience the joy of discovery.

If the above quotation were all that constructivism means, we would not have any concerns. However, many faculty have gone far beyond that point. This is shown in a paper by Bodner, Klobuchar, and Geelan:

Traditional theories assume that our minds contain images that somehow represent reality as if they were copies or pictures. If one accepts this assumption, knowledge can be judged as “true” or “false.” Constructivist theories of knowledge are based on a fundamentally different assumption: Knowledge is constructed in the mind of the learner. From the perspective of the constructivist and radical constructivist theories knowledge should no longer be judged in terms of whether or not it is true or false, but in terms of whether it works. The only thing that matters is whether the knowledge we construct functions satisfactorily in the context in which it arises.

Bodner and his colleagues emphasize they do not share the radical position that all knowledge is constructed by each learner. They accept the world as being real apart from our construction of it. However this distinction may not be caught by all the people who teach using constructivism or by those who are taught from a constructivist perspective. This constructivist perspective on knowledge appeals to some engineers, who are used to only being concerned with “what works”. However, what works in a class setting (such as getting an answer your group can agree on and feeling good about your answer) may not work at all in an actual engineering design.

The above discussion shows how cheating is only one aspect of the problem faced by engineering professors. In addition to many students believing in a post-modern perspective, some professors are also using a post-modern approach in their teaching. Some faculty are teaching that reality can be constructed by each student. Some are doing this intentionally, but others are doing so unintentionally. This is a perspective the authors believe is incompatible with a Christian perspective.

The authors have assumed (for the sake of this paper) that the following statements are true. This belief is at the core of a Christian response to this issue.

- As Christians, and as engineers, we believe that there are some things that are true about our world
• As Christians, and as engineers, we believe that there are some things that are not true about our world.

There are several dangers to this constructivist approach. Students may construct a reality that is not true. They may firmly believe that their false reality is as good as the true reality. For example, we believe that cheating is objectively wrong. However, many of our students have constructed a reality in which what they are doing is acceptable, for they do not consider what they are doing is cheating.

Responding to the Problem

We have responded to the problem in three different ways. Our first response concerns the way we handle homework assignments. While we seek to uphold rigorous standards as to plagiarism and copying, we need to accept the fact that students will work together on homework, whether or not we say they should. The first author used to use homework as an evaluation tool (similar to short exams). It is now used as a learning tool. Since students will work together, homework does not count as a large percentage of the grade. However, it still has some value to the grade to motivate lazier students into doing it.

Our second response concerns our post-modern faculty colleagues. We have attempted to deal with the post-modern faculty by writing papers (such as this one) that present an alternative perspective. Some of the papers are given in explicitly Christian settings, such as the Christian Engineering Education Conference and the annual meeting of the American Scientific Affiliation. Some of them have Christian perspectives embedded in papers presented at secular meetings, such as the national and regional meetings of ASEE. We are certainly not the only professors using secular meetings to make points that have Christian implications. Two excellent papers by Leiffer and Graff have been presented at A.S.E.E. conferences. Their first paper deals with the subject of culture, and how it is important for engineers to understand the culture within which they are working. Their second paper deals with the effect of an engineer’s worldview on how he practices engineering. This is a fine example of how professors can present Christian perspectives on important issues at secular engineering education conferences.

Our third response has been trying to help our post-modern students. We have attempted to communicate with them a better approach. We need to recognize that we cannot (by ourselves) change the basic perspectives of our students. However, we wish to expose them to concepts that will force them to think through what they really believe. This means that we try to teach them engineering ethics in some fashion. We make the point that engineering ethics includes conduct while still a student.

Teaching Engineering Ethics

The first author became involved with teaching engineering ethics in the late 1980’s. At that time there was very little material that could help. Now there are many engineering ethics resources. Some of them are quite good, while others are, at best, mediocre. Several of the more useful ones will be discussed below.

One of the first major books in the area was by Martin and Schinzinger. While their book states some things that would be upsetting to many Christians, the authors have found their description of different basic moral theories to be very useful. We will use their characterization of moral theory types in this paper. A relatively recent book that has impressed the authors is the one by Seebauer and Barry. They defend a virtue ethics perspective. They present many ethical dilemmas that students might face. This is done in the context of a set of essays describing the responses of a group of students as they go through various events in their senior year.

An interesting Christian perspective is in the book by Geisler. He presents different ethical perspectives in the context of answering a series of questions (Are there absolute standards? If yes, how many? If no,
are there general standards?). We believe that this approach would appeal to many engineers who are used to working through decision matrix trees such as this. We have not used his book much in class, for his approach to moral theories is not very traditional. We wish to expose the students to moral theories in a way they might see them in other contexts.

The book by Johnson\textsuperscript{16} contains essays about a number of different issues that engineers might face. Some of them are quite insightful, but others are of less value. The small book by Fleddermann\textsuperscript{17} is good for introducing ethics concepts in a lower level class or when the professor might have less time to cover the material.

On an overall basis, we would recommend the book by Harris, Pritchard and Rabins\textsuperscript{18}. Their book contains many real world case studies. The use of actual cases (rather than just theories) appeals to many engineering students.

We have used case studies in a number of different classes. They have real value as students are exposed to problems they might face as practicing engineers. Examples of this are two papers the first author presented at the 1996 FIE\textsuperscript{19,20} conference. These papers have some engineering calculations for the students to do as part of solving the ethical dilemma. Most engineering students are more comfortable dealing with this type of ethical problem. These two case studies were developed as part of an NSF sponsored workshop at Texas A & M University. They have a web site that contains these cases as well as many others\textsuperscript{21}.

While we still use case studies, they do not use only case studies. This is because the case study approach is limited because the students still need to have a standard to use to aid in the decision making process.

To aid in this, we have written a paper that uses engineering codes of conduct to evaluate several real world situations the first author faced when he worked as a metallurgical engineer in the steel industry\textsuperscript{22}. However, many students do not really care that much about the engineering codes of conduct, so professors need to provide them a better reason to be ethical. Our next step was to use moral theories to evaluate a typical engineering code of conduct. The code developed by the National Society of Professional Engineers (N.S.P.E.) was examined\textsuperscript{23}.

Many engineering students are very uncomfortable thinking about such philosophical things as moral theories. However, we believe that exposure to these concepts will help students to better understand how and why they make the decisions that they make. We have found the characterization of moral theories in Martin and Schinzinger’s book\textsuperscript{13} to be useful. They list four broad categories of moral theories:

- Utilitarian Theories
- Duty Theories
- Rights Theories
- Virtue Theories

Each of these theories defines what sorts of action it approves. Utilitarian theories state acts are morally right when they produce the most good for the most people. This is probably the most common view held by engineers (and society at large). There are many times when engineers use this approach to decide which engineering project should receive the limited available resources. One limitation to this approach is the issue of what if the bad done to the few is more severe than the good done to the many? How will the engineer weigh which one is more important?

Duty theories state that acts are morally right when they fall under principles which respect the autonomy and rationality of persons, and which can be willed universally to all people. If someone thinks what they are doing is right, he should ask the question: what would happen if everyone did what I am doing? One limitation to this approach is there can be a vigorous disagreement as to what is the duty for each person.
Rights theories state that acts are morally right when they are the best way to respect the human rights of everyone affected. One limitation of this method is how does someone make a decision when some people are affected positively by a choice and some people are affected negatively?

Virtue theories state that acts are morally right when they most fully manifest or support relevant virtues, where virtues are traits of character making possible the achievement of social goods. This approach does not concentrate on how to make good decisions, but on how to be a good person. It assumes that good people will make good decisions.

The authors believe that a Virtue Ethics perspective is:

- Consistent with our Christian world view.
- Consistent with most of the various engineering codes of conduct.

Virtue ethics can be openly taught in public universities. Christian faculty members can put a Christian “spin” on what virtues someone should seek to develop in his life. An excellent book on this perspective is the one by Seebauer and Barry that has been published by Oxford University Press. We are not saying virtue ethics is the only perspective that can be adopted by Christians. We are saying that virtue ethics is an approach that can be presented in a manner consistent with our Christian faith.

We followed up on our 2002 ASEE paper with a Christian perspective on the issue at the 2002 CEEC conference. In this paper the authors examined what the Bible has to say about the nature of engineering. We then used the Bible to examine the N.S.P.E. code of engineering conduct. While there were some Christian concepts embedded in the ASEE paper, these two papers should be seen as a unit, using moral theories and the Bible to examine engineering codes of conduct.

The first author has used codes of conduct to evaluate case studies, and moral theories to evaluate codes of conduct. The next step was to directly use moral theories to evaluate case studies. This was done in a paper presented at a regional meeting of ASEE. The first author has used this material in the Mechanical Engineering Senior seminar course at Louisiana Tech University.

This previous paper is an example of how Christian professors can apply these concepts in a public university. We can refer (and do refer) our students to our more explicitly Christian work. For example, our 2002 CEEC and 2003 ASA presentations are on the first author’s university web page. This one will be added to it after the conference.

Moral theories can be used to show students how different perspectives can still lead to the same conclusion: cheating in engineering classes is wrong.

Cheating is incompatible with utilitarian theories. Cheating can produce incompetent and unethical engineers whose actions can hurt many people. This is not producing the most good for the most people.

Cheating is incompatible with duty theories. No one has a duty to cheat. Cheating fails the test based on the fact that if everyone cheated there would be real problems. Cheating can produce unethical and incompetent engineers.

Cheating is incompatible with rights theories. The public has a right to the competent and ethical practice of engineering. Engineers who cheat as students are not ethical and may not be competent.

Cheating is incompatible with virtue theories. Cheating is reinforcing the wrong kind of character trait in the student’s life.

In addition to the internal motives for honesty that can be provided by moral theories, there are still some external motives for the students to not cheat. Faculty need to uphold rigorous standards, even if students do not believe in them. Enforcement of these rules by the professors may provide students with an external motive to be ethical.
Professors should also make the point that there is such a thing as an engineering community. Real engineers are ethical and do not cheat. If you want to be part of the engineering community, you also need to be ethical.

**Conclusions**

Surveys of engineering have revealed that there is a continuing problem with students having a post-modern perspective on ethics. They have redefined cheating in such a way that they believe they are acting ethically, even if the professors think otherwise.

We have discussed how this post-modern approach had affected many engineering faculty as well as engineering students.

We have outlined ways to expose the students to other ethical perspectives in the hopes of leading some of them to abandon their post-modern perspective. The teaching of virtue ethics as part of this has been encouraged.

**References**


*Christian Engineering Education Conference 2004*

[http://engr.calvin.edu/ces/ceec](http://engr.calvin.edu/ces/ceec)


Observations upon Entering the Kettle

Gary Spivey
George Fox University

Abstract

An oft told parable relates how a frog, when dropped in a kettle of hot water, will instantly jump out. But if you drop that frog in a kettle of cold water, and slowly heat it up, the frog will not be aware of the gradual change in its environment and will die in the kettle. I had formerly limited the kettle analogy to the broad concepts of the “worldly culture” alluded to by pastors who use this imagery. Then, after completing educational experience at major state universities and a fifteen year career in industry, I decided to enter upon a career as a professor at a small, Christian, liberal arts university. This change has been quite a shock to my system, but unlike the clever frog, I did not immediately jump out. This experience alerted me to the fact that the kettles in which we live are much smaller and more distinctive than I had previously thought. Furthermore, it is quite likely that the environment of these kettles may be gradually changing, and the results of these changes might affect me in ways that I might find … unpleasant.

In having my eyes opened to the Christian-college culture, I have made a few observations about how this kettle seems quite different from the others in which I have previously existed. These observations include aspects about the people who make up this institution, the purpose and mission of the institution, and the operation of the institution. For example, I have been stunned by the diversity of this small group of mostly white, American, Christians. This diversity has profound effects on the mission of the University, as well as the communities of the students and faculty in ways that I did not expect. We have factions, battlegrounds, independent agendas, differing personality traits, insightful viewpoints, and all of these differ wildly from what I have experienced in “other kettles.”

It is not my purpose in this paper to set about an agenda for change. As a first year faculty member, I think that it would be naïve of me to assume that I not only have the answers, but that I can even adequately determine the questions. This paper simply purports to put down many of my observations about this culture and to ask myself to what degree I want to reject, embrace, or engage these elements. I reserve the right to change my opinions in the future (which may be seen as adapting to the kettle).

Finally, I would like to stimulate dialog amongst other engineers who have gone through this process and ask them where they find that they have rejected, embraced, or engaged this culture – and to what degree these actions were intentional. It may very well be my Lord is asking me to be like the frog and to die in a number of areas – that these observations might indicate not what is out of balance at this institution, but what is out of balance in my own life and in the other kettles in which I have existed.

Please forbear me any grievances you might have against my questioning of ideas or institutions that you might hold dear. It is my desire that we all come together in unity for the cause of Christ. It is my hope that this conversation might help us to do so together.

Introduction

An oft told parable relates how a frog, when dropped in a kettle of hot water, will instantly jump out of that kettle. However, if you drop that frog in a kettle of cold water, and slowly heat it up, the frog will not be aware of the gradual change in its environment and will die in the kettle. I had formerly limited this kettle analogy to the broad concepts of the “worldly culture” alluded to by pastors who use this imagery. I have recently applied this imagery to myself. After an educational experience at major state universities and a fifteen year career in industry, I decided to enter upon a career as a professor at a small, Christian, “liberal arts” university. This change has been quite a shock to my system, but unlike the clever frog, I did
not immediately jump out. I also noticed other ‘frogs’ in the kettle that seem quite comfortable within the kettle. I have decided to remain within this kettle, yet, like some of the other ‘frogs’, I find myself beginning to adapt to this new kettle – sometimes in ways in which I am not particularly comfortable.

This paper is a response to the question – “Academic culture – reject, embrace, or engage?” I am not prepared to completely or even adequately answer this question. It is not my purpose to offer any sort of generalized statement about the characteristics of my university, or any other university. I am merely telling my story of my first year teaching from my perspective. In this regard I hope that the reader will not expect a scholarly paper, but simply allow me an opportunity to dialogue. I expect that my experiences may be in many ways unique, but may also be in many ways shared. It is not my purpose in this paper to set about an agenda for change. As a first year faculty, I think that it would be naïve of me to assume that I not only have the answers, but that I can even adequately determine the questions. This paper simply purports to put down many of my observations about this culture and to ask myself to what degree I want to reject, embrace, or engage these elements. I reserve the right to change my opinions in the future (which may be seen as adapting to the kettle).

Finally, I would like to stimulate dialogue amongst other engineers who have gone through this process and ask them where they find that they have rejected, embraced, or engaged this culture – and to what degree these actions were intentional. It may very well be my Lord is asking me to be like the frog and to die in a number of areas – might indicate not what is out of balance at this institution, but what is out of balance in my own life and in the other kettles in which I have existed. The process of writing this paper has been quite cathartic for me and I hope that it might stir up something within all who read it. I realize that I will only have one chance to have this ‘frog in the kettle’ experience in this environment – for in the future, I will be in the kettle with everyone else – adapting in ways that I don’t even recognize.

In this paper I will discuss my personal background and some of the reasons I had for this change in life, in addition to some of my expectations about what this life would be like. Upon arrival, I had some personal interactions with others already at the institution. These interactions rapidly and radically altered my expectations and helped me begin to recognize something about the diversity of ideas and opinions that exist in this environment. I began to understand that one of my primary assumptions, that all of the employees had a singular purpose, was both naïve and narrow. I then began to see a wide assortment of groups that existed to further their own interests. Many people appeared to align themselves with one or more of these groups. These groups sometimes acted harmoniously, sometimes ambivalently, and sometimes had a long history of conflict. Initially, I was disconcerted at not only the existence of these seemingly divisive groups on what I thought was to be a ‘Christian’ campus, but I was shocked at the acceptance of these conflicts by other faculty. It was this observation that first brought me to the frog in the kettle analogy. I could not initially understand how easy it was for certain individuals to accept things in a Christian university setting that I was not willing to accept in a secular professional setting. However, I began to recognize that I was allowing myself to identify with certain groups as well, and unbeknownst to me, I was myself, slowly adapting. In the end of this paper I will discuss what this has meant to me at the conclusion of my first year as a university professor.

Please forbear me any grievances you might have against my questioning of ideas or institutions that you might hold dear. It is my desire that we all come together in unity for the cause of Christ. It is my hope that this conversation might help us to do so together.

Background

I was born and raised as what others would label a fundamentalist – specifically, a Pentecostal. I would call myself an evangelical Christian, reared in a home by parents who were also evangelical Christians. It was an imperfect, yet loving home, similar to many other God-fearing, evangelical, Christian homes. I attended the University of Arizona and studied electrical engineering. While at the University, I met my
future wife and was active in Chi Alpha, the Assemblies of God campus ministry. Upon graduation I accepted a position with the National Security Agency (NSA) and moved to Maryland. During this period I continued worshipping in an evangelical Christian church, but was growing more frustrated at the inability of my faith to transform me into the type of individual that my understanding of the gospel required me to be. Four years later, after the birth of our first child, I accepted another position within the Agency and moved to Scotland. It was in Scotland that my spiritual life would make a dramatic change. I had, while at Arizona and Maryland, read a book by Richard Foster, entitled “The Celebration of Discipline”. In Maryland, I taught a simple Sunday school class using the book. However, upon arrival in Scotland, I felt prompted by the Holy Spirit to do a little more than read and teach the book. I felt a strong inner prompting to actually do the things that the book taught. This period in my life forever changed how I view myself, my Lord, and my faith. I was involved with a wonderful church, great fellowship and support, and my faith blossomed. I would be remiss if I did not mention that we had our second child in Scotland at this time. It is not germane to the discussion, but I would hate to leave my son out of the story.

Three years later, when our tour in Scotland had concluded, we returned to Maryland, again with the NSA. Finding a church home and fellowship was not easy upon returning to the U.S. My faith had grown and become much more relevant and I found a growing discontentment with the traditional models for church that I had encountered. It was also at this time that I felt prompted to resume graduate studies at the University of Maryland. These studies, coupled with the responsibilities of being a husband and father of what would rapidly become four children, left me with little time and energy to delve more deeply into this growing spiritual discontent.

During this time in my life I had achieved a certain measure of professional success and was respected professionally within my organization. However, after completing the MSEE and the coursework for the Ph.D. at the University of Maryland, we felt the winds of change stir in our hearts and accepted a position with a small defense contractor in our original hometown, Tucson, Arizona. We returned home to happy grandparents and siblings and we were certain that this would be the place where we would put down roots and raise our family. This occurred in 1999. We were wrong.

In Tucson I stayed active working toward the completion of my Ph.D. dissertation. I had also been reading more about spiritual formation including books by Richard Foster and Dallas Willard. Both of these men are involved in a ministry called Renovare. One night while browsing the internet, I was perusing the Renovare website (www.renovare.org) and discovered a little line at the bottom of the website that stated “This site graciously hosted by George Fox University.” I had never heard of George Fox University and clicked the link to see who they were. I found it interesting that they were a small, Evangelical Christian college in the northwest, but even more interesting that they had an engineering program. I began examining the engineering program and found an ad for an EE professor. Upon further investigation, I was shocked to find that the opening matched my experience perfectly. Almost too perfectly. A bit unsettlingly perfectly. So perfectly that the thought didn’t leave me for quite some time. I sent off an e-mail of inquiry about the position (mostly out of curiosity). As I had not yet finished my dissertation, I decided that the timing wasn’t quite right and put it behind me and continued working toward the completion of the dissertation. During the next year, I completed the dissertation, grew more frustrated with my job, and more frustrated with the church in general. All the while, this little thought about this little university was kicking around in my head. Finally, one day I went back to the George Fox website and noticed that the job was still open. One year had passed and the job was still open. Hmmmm. I broached the subject to my wife who was none too excited about the possibility of leaving family, but who was thankfully, completely dedicated to the cause of following Christ wherever he may lead. I contacted Fox again and began a process of toying with the idea of applying for the position. One line came to me that I had read in John Eldredge’s “Wild at Heart” – something to the effect of “don’t do what you think the world needs – do what makes you come alive – the world needs people who come alive.” I had been doing some work with college students as a part of my job and was electrified every
time I set foot on a college campus.

We decided to interview for the position and I was completely overwhelmed with the quality and dedication to Christ of the people who I would be working with. I must say, the salary wasn’t overwhelming, but my wife and I went away feeling quite drawn by the Lord to this opportunity.

Ultimately, we accepted the position and haven’t looked back since. Well, maybe glanced occasionally – well – maybe even wondered what on earth we had done. But after finally making it through my first year as a professor, I can’t imagine anything I would rather be doing or anyplace that I would rather be. That said, the transition has not been simple. I had some expectations that were not appropriate and should have had some other expectations that would have helped me understand this year a little better.

Expectations

I call myself a “recovering fundamentalist.” What is more correct is that I am an evangelical Christian who holds unswervingly to my best understandings of the fundamental Christian creeds and the statement of faith that I signed at George Fox University, and that I no longer need to hold unswervingly to a lot of the doctrines of my age and my culture. Having lived as a Christian at secular universities and in the secular marketplace, I had developed a rather polarized view of Christianity. Basically, and this is a gross generalization, there exist simply two groups – the Christians and the non-Christians. While the “world” likes to speak of diversity, it can often be viewed (at least in my American experience) as a group of people who want to live for themselves, do whatever “ism” they want to do, and expect everyone else to allow them to do this. We have learned to call this tolerance. In opposition to this are a large number of ‘Evangelical Christians’ who believe that the scriptures are anywhere from literally true to ideologically authoritative, and that there is some measure of absolute rights and wrongs. It has been my experience that while within Christianity there may be many different areas to debate (and God bless those Calvinists and my own Pentecostals for providing much fodder in this area), in “real life,” where Christians are actually living in the world, we tend to congregate in polarized bodies of “us vs. them.” It is very easy to put aside doctrines of limited atonement or glossolalia when we are confronted with issues like the lordship and deity of Christ. We are very good about dismissing the “in-house” debates and coming together around the things that we believe are of supreme importance. Of course, I must admit that even in the world, the Christians that seemed to congregate together were typically the same set of “Evangelical Christians” that shared not only a large set of common spiritual beliefs, but political and social beliefs as well, such as abortion, drugs, and human sexuality. It was my hope that this experience would broaden somewhat when I came to George Fox University. I was not necessarily challenging these views, but desirous of a broader understanding of what in my views derived from my culture rather than from Christ.

I was growing in many ways in my own spiritual life. In the period before coming to George Fox I had begun reading quite a bit of Brian McLaren’s works regarding what Christianity will look like in the postmodern world (and even agreeing with some of it). I expected that I would find many people like myself who would be excited about the possibility of growing in our faith in new ways. I expected that all of this growth would be anchored in the fundamental creeds of the Christian church and in the Statement of Faith subscribed to by all University employees.

Furthermore, I expected that at a Christian University, I would find many people who were excited about the conversation. I had grown weary of interacting with non-Christians in my secular environments. I had heard and learned from their atheistic worldview, I had learned to respect the rationale of their position and my complete dependence on my faith in Christ (or on Christ for my faith). It was my desire however, to move beyond that conversation. When I finally recognized that faith was not derived from reason, I wanted to accept the faith for what it was and then move on into deeper things. It was my hope that this would be not only a part of the Christian University experience, but one of the fundamental parts of the
I expected that the Christian university community experience would be superior to my frustrated church experiences. I expected that the individuals who worked at the University would be working there with a sense of ministry – eager to do all things for the cause of Christ that was so clear to the Christian groups parting which I have participated.

Finally, I must say that I naively expected that I would somehow be entering into a Christian utopia. This was not a conscious expectation – in fact, I distinctly remember telling myself and others that I was not expecting that. And yet, in some ways, deep down, I think that my hope to find one expanded deeper into a sense of expectation.

I want to emphasize that many of my expectations have been met in wonderful ways. I don’t want to in any way give the impression that George Fox University is not a wonderful place to serve Christ. I am, after all, intending to stay as long as they will have me and I am looking forward to the development of the engineering program as the Lord leads. But I must admit that not all of my expectations were completely met …

White People and Diversity

I would like to take a chance here to expound a little on the diversity that I have encountered here and what effects this has on who we are. George Fox is located in Newberg, Oregon, about 30 miles south of Portland, Oregon. There are not quite 20,000 people in the town. Let me begin by saying that there are, in my perception, more white people here in this part of Oregon than in any place I have been in the world. At least in Scotland we had enough military involvement to diversify the little Scottish community. I noticed this lack of racial diversity during my interview and expected that I would be moving to a little town that would be almost completely made up of white Christians. In some ways, this is true. Even the non-believers are nice people who would, some of us might say, make very good Christians. I expected a rather homogenous experience and it appeared that my friends from my former job were going to be correct when they suggested that I would miss the diversity that their office afforded.

However, rather than encountering a homogenous workplace, I have landed in a more diverse environment than I could have imagined. It seems to me that diversity is not about the color of your skin but the content of your ideas. As I stated earlier, the ‘world’ does not seem to me to be as diverse a place as people want to make it. It generally is made up of people who want to live for themselves in some way, do their own thing, and be left alone to do it. George Fox University is full of many people who have a wide range of beliefs regarding what it means to serve Christ.

Before I explain this range, let me digress into another observation. Often, students refer to their experience at George Fox as being “in the bubble.” This is a pitiable statement. They think that they are somehow isolated from the world here. I think that they couldn’t be further from the truth. I look at my experiences and recognize that while at the University of Arizona, surrounded by 35,000 students, I was actually involved with about 20 in my dorm and in my major and about 50 others in my Christian group on campus. That was about it. After college, I moved to Maryland where I interacted with about 50 people in church and another 50 at work. Later, when we moved to Scotland and I interacted with about 50 people at church and another 50 or so at work. Back to Maryland, and maybe 20 people at the University, 50 at work, only a few at church, but 15 or more in the neighborhood (kids showed up). Back to Arizona where there were maybe 40 at work and maybe 30 at church, and then family. Most of these people fall into the two group category of “Christians” and “Non-Christians” that I defined earlier. Now, that means that at any given point in my life, I interacted in some meaningful way with less than 100 people, generally half of which were Christians and the other half were generally professional relationships. Seems to me that this was rather insular and … uh … bubble-like. These students at this University can easily interact with several hundred students and professors, all of whom are asking these
diverse questions. Rather than a bubble, it seems to me that it will be the most expansive and free environment that they will ever be placed in.

Another way to look at this is to define what a “normal” life is. Students often appeal to this “normal” life or “real world” as opposed to their “bubble” experience. Let’s examine my aforementioned job, where my friends felt I would miss the diversity when I left for a homogenous, Christian school. As it turns out, that office was populated with a couple of minorities and maybe 20 women in a workplace of 100 people, approximately 80 percent technical and the rest support staff (about half of the women were support staff). Of the technical population, there were approximately thirty computer scientists. The rest were made up of mathematicians, physicists and primarily engineers, three quarters of whom held advanced degrees – about 20 of those with Ph.D.’s. I cannot conceive of any way that this environment can be construed as “real world” or in anyway outside of a “bubble.” I have learned to be very careful with the phrase “real world.”

Personal Interactions

And so, I arrived at George Fox bright-eyed and bushy-tailed, unaware that I would be entering an environment of such diverse Christian viewpoints. I was eager to engage other faculty members and bask in the glory of this Christian environment. This was a rather naïve dream. As it turns out, my first expectation that went unmet was the notion that everybody else wanted to have this conversation. As it turns out, this isn’t true. Spending a career around a bunch of engineers does not adequately prepare one for life outside of that environment.

I do not intend to make any bold sociological assertions here. But let me attempt to explain my interactions as best as I can using some generalities. Engineers appear to me to be an abnormally objective breed that, generally speaking, do not obtain their self-worth from the approval of other individuals. I have been on both ends of technical discussions – often quite loud discussions. While I have seen enemies made and friends won, typically, I have seen individuals disconnect their technical ideologies from their relationships. It could be said that the topics of discussion were not worthy of emotional involvement, however conversations at lunch and outside of work often revolved around topics of religion and politics. Again, I am not offering reasons to justify my experiences; I am simply attempting to provide a framework for my understanding of them.

The simple truth is that a much larger number of people in my new environment had a significant emotional attachment to certain ideas. I discovered that simply inquiring about these ideas could be construed as a hostile argument. As an example, I was informed that certain discussions involving race would be unwelcome. Frankly, this surprised me at the time and still does. Some may derive their self-worth or security from their intellectual positions and feel threatened when these positions are challenged. I find this surprising as these individuals are all not only at the highest level they can achieve academically and have already been validated by the world, they also have the acceptance of Christ. Of course, I shouldn’t be surprised by this as I also, very often, lapse into deriving my self-worth from what others think of me. I wonder what those of you who are reading this paper think of me.

I did however, find individuals who were emotionally attached to certain ideologies, and these were not because of personal issues. Some of these individuals have a broader (or differently narrow) interpretation of Christianity than I have been exposed to. This is the diversity of opinions about “what it means to serve Christ” that I alluded to earlier. Christian feminism and pacifism are topics that this white male, formerly employed by the defense department, has not been heavily exposed to. It appears that some of these issues are as important to some individuals as my faith in the authority of scripture. This surprised me as well – and I will admit that I am emotionally involved with the Christian creeds. I was not prepared to find this same level of emotional involvement with elements outside of the creeds.

Maybe another way to say this is that when I thought about leaving the secular world and the ideas that
they had against Christ, and entering into the Christian University, I expected that the elements that we would all ascribe to as essential would be, in fact, the same elements. I suppose I was hoping for a set of ideas that the Orthodox would say were held “everywhere, always, and by all.” I am now thinking that this was also naïve – a chasing after the wind as it were. Maybe this is what I expected in some way when I said that I thought that the university would be like a church – a common gathering of people who share “like, precious faith.” I don’t know that I can assume this at my university – and I don’t know that this is a negative thing. Part of my desire in coming here was to have my faith broadened and deepened. I suppose it was somewhat silly of me to expect to have it broadened in ways that I could have anticipated.

Mission

Diversity is not without its difficulties. Where there is diversity, there can also be division. One place this can show up is in the mission of the University. If there is a diversity of opinions about what this mission might be, (and there is), the organization may find it more difficult to stay on course – or more appropriately, define a course.

When I worked for the National Security Agency, the concept of mission was ubiquitous. The mission of that National Security Agency is simply “the ability to understand the secret communications of our foreign adversaries while protecting our own communications.” Politically, one can have different opinions about the usefulness and/or ethics of this endeavor, but its focus seems quite clear. It was relatively simple at the NSA to determine if a project related to the mission of the organization.

The mission of George Fox University is “To demonstrate the meaning of Jesus Christ by offering a caring educational community in which each individual may achieve the highest intellectual and personal growth and by participating responsibly in our world's concerns.” Again, regardless of what one feels about the mission statement, this mission statement is open to quite a bit more interpretation about what it means to “demonstrate the meaning of Jesus Christ” – specifically, feminism, pacifism, universalism, sexual orientation, thoughts about the varying degrees of authority one can give the scripture, the catholicity of the church, even some questions about some orthodox views of who Christ was. Different interpretations of these various ideas are expressed, and not all are endorsed by the university. Again, I am not asserting that this diversity of interpretations is necessarily a negative thing, but it was more diverse than what I expected.

Groups

In the process of seeing how different individuals gave strength to different interpretations of our Statement of Faith and university mission, I observed that we did not all classify ourselves into the same groupings – in fact, many different groupings developed.

My initial assumption was that we would be one unified community seeking Christ. As it turns out, there are a plethora of unique groups. I had expected something like the council in Jerusalem. It appears to me that we are in some ways closer to the church of Corinth where some follow Paul, some Apollos, and some Christ.

The first grouping that emerged to me was along this line of three groups – the Denominational representatives (in our case, the Friends), the Scholars, and for want of a better word, the Christians. I don’t want to make it sound like the Denominationalists or the Scholars aren’t Christians, just as I don’t think that Paul intended to characterize those that followed either himself or Apollos as non-Christian. Some individuals give allegiance to blends of these three groups, and some tend to fall primarily into one of them. I freely admit that these groups are not as clearly defined as I present them. I am certain that our faculty is much broader than this narrow representation; however, it is distinctions of these groups that I find interesting. Once again, I do not intend this to be a sociologically advanced study, simply an observation by someone new to the environment.

Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/ceec
The Denominationalists are extremely concerned, and possibly rightly so, about preserving the defining characteristics of that denomination with George Fox University. In the case of the Friends, there are some with passion for varying types of pacifism and feminism, and there are some who strongly believe that meetings should not include votes but should move ahead only on consensus. As I have only observed this for one year, I will not comment on more than these elements, although there are other Friends elements that seem to be somewhat absent. The Denominationalists, (and by no means do all of the Friends adherents subscribe to this philosophy), are intent on George Fox University not simply being a quality Christian school, but a profoundly Friends Christian school. I can imagine that other denominational universities have a similar component and I must commend the Friends at George Fox as they have managed to maintain a rather strong denominational element whilst becoming a minority on campus. I expect that this might be a rather unique situation in Christian universities. It could also explain the intensity of this group that could very easily disappear by simply being overrun in a university growing with Christians of other denominations.

The Scholars are the group who intend, and possibly rightly so, for George Fox University to become an elite scholarly university. There is a debate on campus about exactly what the phrase “scholarship” might mean at a predominantly teaching focused University. With the Scholars, there is no debate. It means the same thing that it has always meant at other university – specifically, publication in peer-reviewed journals. While the Scholars are concerned with the Christian aspects of the university, and some of them the Friends aspects, some of them are willing to place Scholarship as the driving force of the university. They seem to have the idea that the scholarly level of a faculty is at least as important, if not more important, than the spiritual component that a faculty member might bring to the community. I have not heard of anyone who commends the hiring of faculty who do not necessarily comply with the Statement of Faith in order to achieve a higher reputation scholastically. However, this is one of the fears that others sometimes perceive when interacting with this group.

The Christians are the group who intend, and possibly rightly so, for George Fox University to completely adhere to an idealist understanding of the gospel lived out on earth. This group can often be discounted as impractical as it is very easy for this group to say all of the right things about who we as a University ought to be in the world, but fail to actually bring in any money to help the university survive. If it isn’t obvious already, I will inform the reader that I am a member of this group. It is easy for me to offer criticisms of situations on campus, but have no alternative to offer. Let me give a rather innocuous example. It seems slightly odd to me, for a Friends school where titles are eschewed as part of the Friends tradition, to accept donations from individuals and then honor their giving by placing their names on facilities. This is not a unique way of bringing funds into the university. It seems somewhat un-Christian and quite un-Quaker to me, and yet, it helps to pay my salary and allows me to minister Christ to students who want to learn about him. I have, at present, no alternative to this arguably lamentable situation.

I would like to point out that I don’t think that any of these three groups are completely “right.” In his first epistle to the Corinthians, Paul doesn’t condone any of the three groups either. The point Paul seems to be making is that they need to quit having divisions and come together in unity. I pray that a dialogue of this nature might be useful in that regard. I think that it is also important to avoid discounting the issue of groups as something natural. It is exceedingly natural. Paul commands us to knock it off. We are supposed to be “supernatural” (and here comes my idealistic Christian side).

There are quite a few other groups that are easy to recognize. There are the Liberal Arts vs. the Professionals. There are sometimes conversations in which the efficacy of different approaches is argued and elitist statements are offered by both sides. There are the Humanities vs. Sciences. This debate often shows up in the meaning of “scholarship” and in the distribution of funds.

One grouping that has been, in my one year estimation, surprisingly Christian in its interactions is the rigidly defined administrative, faculty, and staff groups. While there are always individuals in any group...
that can have conflicts, this set of groups has, from a mission’s perspective, seemed to operate in full cooperation. This strikes me as a distinctly positive statement about George Fox University as the conflicts are not necessarily occurring where the “rubber meets the road.” It might also be used as further evidence of the quote attributed to Henry Kissinger – “The reason that academic debate is so vicious is that, so little is at stake.”

However, on a personal level, there is very much at stake. I am becoming aware of my affinity to shift my focus from the good of Christ to the good of my group. With regard to these groupings, I have been posing this situation. Imagine if I proposed an idea that was going to be tremendously useful for the university, but horrifically bad for the body of Christ. I would think that most individuals on campus would say that this would be a resoundingly bad idea. Now imagine if I proposed an idea that was simply going to be tremendously useful for the university. What I have noticed is that the second question – “Yes, but what about the purposes of Christ?” This question sometimes goes unasked.

In light of this I need to recognize that this unity begins with me in the smallest of areas. On our campus we have an engineering department with two mechanical engineers, two electrical engineers, and one physicist. I was ranting one evening to my wife about some of these issues and then began a rant about something in our department involving the ME’s and the EE’s. My wife calmly asked me “are you only worried about your own agenda?” I suppose that’s what the word “helpmeet” means – somebody to rapidly and pointedly indicate my failings. Through my wife’s insight I was able to recognize that it is exceedingly easy to identify my group’s agenda as Christ’s agenda. This phenomenon has been used in the past to justify many a non-Christian endeavor in the name of Christ.

As a result of this observation, I find myself in a university full of individuals like myself, with different ideas about the mission of the university, who classify ourselves into different groupings, and all too easily identify our purposes with those of Christ. This can be quite an ugly picture when you look at it through idealistic glasses.

**Job/Ministry**

This situation is not hidden in any way and I doubt that many would disagree with the basic concepts I am expressing. We live in an imperfect world and we ascribe to perfection. How can we deal with the inconsistencies? I am afraid that some in this kettle have decided to simply accept the inconsistencies in some way. The typical way that I have discovered is to carve out a section of the campus and make that an island of refuge – not unlike denominations in the world of Christianity. I was unsettled by some occurrences on campus and another professor (from the Christian group) stated “that sort of thing happens on that side of campus.” Beyond any analysis of his statement, what shocked me the most was his acceptance of the situation. This was my first indication of the “kettle” syndrome occurring in front of me. This professor had simply adapted to the kettle and given up on the hope of unity among us.

Some handle the inconsistency by calling their involvement on campus a job rather than a ministry. They attempt to isolate their personal Christian experience from the job – appealing to the phrase “it’s a job” whenever something that is inconsistent with the concept of Christian unity rears its ugly head. One professor told me that if you think about it as a church, you will be frustrated, but if you think about it as a job, “it’s a pretty good job.”

I find this response unsatisfying as well. I am disappointed that it took this experience to make me recognize that I have been doing this for many years in the secular world. It now seems clear to me that I should have been more intentional laboring at my former ‘jobs’ as though they were ministries. However, there are some differences within the Christian university. We make great efforts to call ourselves a place where we attempt to integrate faith and learning. It is absolutely inconceivable that we would attempt to teach students how to integrate their faith into their lives, preparing them for life in the “real world” when we choose to opt out of our faith obligations as it relates to our “job” in a Christian University. I had a

Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/ceec

- 107 -
“job.” I can make a lot more money for myself and my family at another “job.” This is a response that I find to be far from the purposes for which I feel Christ called me here. It is also the very response that I find myself falling into. It is the most dominant part of the kettle occurring around me. I hear myself getting frustrated with some situation and making statements like “well, I will simply come in and do my job and go home – forget about them and that situation.” This terrifies me. It is all too easy to opt out of the call of Christ and accept the contentment of smaller, more peaceful surroundings.

The Students

In my first year of academia, friends would often ask how I enjoyed Oregon. I would respond “Oregon? I live in Wood-Mar Hall – I am not yet aware that there is such a thing called Oregon.” They would also ask how I enjoyed teaching. Similarly, I would respond “I don’t know – I haven’t started teaching anyone yet – I have spent the year being a poor instructor, simply disseminating information – maybe I can begin actually teaching next year.” In this year of life change I have had little time to actually think about the very students that I am here to serve. This all came home to me one evening.

At George Fox University, this was a bit of a special year for the engineering program as we graduated our first set of seniors. Prior to this year, George Fox had offered a 3/2 program in engineering. At the conclusion of the year we held an engineering banquet which proved to be a pleasant and rewarding evening. Both the faculty and the students were permitted to share thoughts about their experiences at George Fox University. I felt that the entire evening refocused us on the nature of what we are doing here at George Fox. Many of the students spoke of the spiritual growth that they had experienced while students here. One student in particular caught my ear when he thanked the faculty for their daily prayers for the students. When I heard him say this I thought to myself, “gee – I’m sorry, I really didn’t pray for you today – in fact, I didn’t pray for you this week – in fact, I didn’t pray for any of the seniors this week – and in fact, I don’t know that I prayed for any of the students this year – well maybe that one student that I had an issue with – no … wait – I think I prayed for myself and how I should deal with the situation. So – sorry fella, I didn’t pray for any of you all year.”

This was a rather convicting revelation and it began to make me wonder – what makes me any different than a faculty member at a secular school? Firstly, Christian faculty members may actually pray for their students at secular schools. I could likely learn something from them. But I also began to wonder, in the midst of this entire year of change, what is my true function here at George Fox University? What is my mission? Am I simply to teach engineering and is there anything wrong with that? Am I to pray for students and interact as I assume Christian professors at state institutions might do? Or am I to go beyond that level and truly minister the life of Christ to these students – to participate in the discipleship process as a mentor and a friend?

Thinking about what it means to be a Christian seems to make it clear that I am to go beyond a casual level. Something about the freedom of being a faculty member at a Christian school seemed to make this rather obvious to me. But as I began to apply this idea to my specific life, it seemed obvious that all Christians are to “do all things for the glory of God.” This is a statement about our intentional focus in how we live our life. I fear that my words are incapable of expressing my ideas here. It seems to me that there are so many things that pull at us from so many angles – and that Christ simply calls us to obedience and a life of bearing fruit and being poured out to others.

Practically this means that the growth of the soul of the student becomes the exclusive primary goal of the faculty member. I sometimes seem to think that it is the faculty’s role to dispense knowledge – some of us more detailed and technical – some espouse to a more classical or liberal arts view. Whatever our view, we sometimes equate the dispensing of knowledge with power. This was basically my situation as an “instructor” in my first year of teaching. I am beginning to realize that for me, I want to reach more of the student than the mind. I want to involve their passions, spiritual disciplines, character, relationships, AND

Christian Engineering Education Conference 2004
http://engr.calvin.edu/ces/ceec

- 108 -
knowledge in this university experience. Some might think that this is a job best left to the church or “Student Life” or some other “trained” entity. I don’t know the way ahead in this area, but I do know that at least one student seemed to indicate that it was his understanding that I was to be doing something in this area – and that my heart resonated with this calling. This is why I came to a Christian university.

I don’t know what the next years hold for me in this regard. I have been working with ideas about spiritual formation groups among the engineering students. I wonder if a relational program of spiritual disciplines would do for my students what it has done for me. I wonder if engineering students have time to pray. I can understand their situation as, I had little time as a new faculty member myself.

**Conclusion**

I get one shot at this life. This reality drives me. I heard a quote in one of my children’s movies – “the brave may die, but the cautious never truly live.” I don’t want to adapt to this world, or accept the failings of men or the institution. I want to be “in the kettle, but not of it.” I want to reach for the ideal. I want to “know Christ and the power of his resurrection and the fellowship of sharing in his sufferings, becoming like him in his death, and so, somehow, to attain to the resurrection from the dead.” That part about sharing in his sufferings has always frightened me.

Sometimes I think that wisdom states that I should sit quietly and defer to my elders. That I should learn in quietness and submission. This may be a very wise thing indeed. However, I am troubled in some ways with the state of the church in which I have been raised. Some of the questions about the institution have made me wonder to what degree the elders have adapted. Whom do I trust? Some might say that I should trust the scriptures. Some might say that I should trust the church. The simple answer is that I trust Christ. But what does this look like practically?

And so I am left in a swirl of confusion, grasping at air for some cosmic meaning. I have found it more peaceful to ask more specific questions. Things like, “Lord, what do I do about this particular situation in this particular moment?”

I suppose I should end with some answer to the question that got me started on this whole paper. “What standard do I use to accept, engage, or reject this culture?” If the culture contributes to the call of Christ on our lives to reconcile men to God, then I would embrace it. If it attacks that call, then I would reject it. Otherwise, I want to engage it and attempt to understand which it really is. That sounds like the Christian group response, all full of Christian imagery but devoid of any practical reality.

To be quite honest, I think the best answer at this time is simply, “I am not sure.” I can make a few statements about what I want:

As to diversity,

I want an institution that is open to a conversation beyond our traditionally cultural and modernist aspects of our faith. I also want an institution that holds unwaveringly to the faith that we profess. I suppose that I am simply restating the old quote “in essentials, unity; in non-essentials, liberty; in all things, charity.”

As to Personal Interaction,

I want an institution where individuals are open to the conversation. I want the freedom to ask questions without fear of offense. I want to be accepted as an individual that is searching for the truth and hasn’t yet found it. I want to learn to afford others that same benefit. I want this quest to be anchored in the accepted facts of our shared orthodoxy.

As to groups,

I want an institution where we feel no need to defend our “groups” and where we no longer “own” our groups but give up all things for the sake of Christ. I want an institution that does not feel the need to
academically justify every proposition or “win” every argument, but one that can find peace in the leading of Christ through study of the Holy Scriptures and the guiding presence of the Holy Spirit. In this matter, I think the Friends church has an excellent pattern that we can model. That said, it does present difficulties when the community expands. I would pray that we could find a way to make this model work in our institutional setting.

As to mission and purpose,

I don’t want to fall into the trap of viewing my role at this university as a ‘job.’ I want to always be reminded of the ‘call’ that brought me here. I want to be part of a community – a university rather than a multiversity. I want this university to be abundantly clear about its primary mission so that the community has a clearly defined foundation to build upon.

As to students,

I want a relationship with other faculty members that will attempt to ensure that we never forget the reasons that we are here. I want to encourage others that those reasons go far beyond the dispensation of knowledge to the formation of soul and spirit.

In many ways I think that what I want exists right here at George Fox University. Aspects of it need to be clarified, stirred up, and worked upon a little bit, but there is truly a great community here. I think that my expectations coming from outside a Christian institution were so rose-colored that my shock at the institutions imperfections has been in somewhat overstated. However, the kettle analogy still holds in a somewhat ominous manner for me. Christ calls us to be perfect as our Father in heaven is perfect. I do not want to come to a place where I accept my imperfections.

It has been an enriching, rewarding, and often very trying year. I don’t know what the future holds, but I am excited about the possibilities. As I said earlier, I reserve the right to change my mind, contradict myself, and/or ridicule the thoughts proposed in this paper. I wanted to write this paper for myself so that I would have a record of my thoughts before my adaptation began. I really don’t know how impertinent it sounds or if it can be motivating to others at all. Thank you for taking the time to read it – I expect that you can be of more service to me than I have been to you. I look forward to hearing responses. Please feel free to contact me.
Faith in Christ and His Attributes — A Basis for Ethical Behavior

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Abstract

Ethical dilemmas are among the toughest problems with which we deal. Since they often require “heat of the moment” decisions, the philosophy that forms the foundation of our decisions must reflect deeply held convictions. When convictions are founded on a knowledge and faith in Christ and His character, our actions are motivated by a desire to emulate Him and to do as He did. Our faith in Christ and commitment to strive to live a Christ-like life will aid us in resolving dilemmas. To help resolve dilemmas, it is important to have faith, based on knowledge that: 1) Jesus Christ is the Son of God, 2) Christ’s (and the Father’s) true character and 3) By seeking to develop the mind of Christ and committing to live a Christ-like life, dilemmas can be solved correctly.

Introduction

Helweg, in a paper presented at the 2002 CEEC, wrote the following:\(^1\):

Promoting moral behavior which emanates from a person of character is really the bottom line of what we would like engineers to demonstrate. One sociologist has characterized strength of character as people whose actions minimize their cognitive dissonance . . . we in academia, have, in a lemming-like race, been caught up in a fear of promoting any kind of religious basis for ethical behavior. Not only is this a practical mistake, but it is philosophically flawed. One reason for this is that a major, if not the main problem in unethical behavior is not one of knowledge, but one of character . . . the problem is not knowing what to do, but doing what we know.

Spitzer described four cultural conditions that he believes have contributed to ethical problems that have plagued many businesses the past several years.\(^2\) These are:

1) the move from principle-based to utilitarian criteria,
2) the decline of traditional principle-based instruction,
3) the complexity and rapidity of decision-making and the failure to integrate ethical reflection into it, and
4) the misuse of “case precedents” in resolving ethical dilemmas.

According to Spitzer, principle-based ethics involves the following essential characteristics:\(^2\):

1) It associates ethical conduct with particular acts (e.g., on the negative side, it associates evil or unethical behavior with harming unnecessarily, lying, cheating, stealing, being unfair; and on the positive side, it associates good or nobility with honesty, fairness, altruism, and even love).

2) It considers the above associations to reflect “inviolable principles.” “Inviolability” generally refers to an unwillingness to engage in a particular “evil action” unless one is compelled to do so in order to avoid a greater evil or an evil of greater magnitude. In short, wherever the principle of “lesser of two evils” does not obtain, “inviolability” means “not crossing the line.”

3) As such, principle-based ethics holds that “the end does not justify the means,” that is, that one cannot use an evil means to achieve a good or beneficial end. Though principle-based ethics allows one to use an evil means to avoid an even greater evil end (e.g., self-defense), it does not permit the use of an evil means to achieve a beneficial end. Therefore, even if an action should produce a benefit for one hundred people, it cannot justify doing an unnecessary or unfair harm to a single person in order to achieve it.
In brief, principle-based ethics asks the question “should we?”, relies upon a sense of inviolable principles, and does not allow the end to justify the means, though it will allow for “the lesser of two evils” to resolve ethical dilemmas.

Some of the cultural trends that have aided in the shift from principle-based ethics include society’s emphasis on empathy, respect for the individual person, care, and tolerance. All of these appear to be good, but when carried to the extreme, has moved people from thinking about “rules-based” to “ends-based” ethics. Technology and the development of multi-layered organizations have also had an impact. Our need to act more quickly on important decisions has frequently led to the inability to consider ethical ramifications that result from those decisions.

Ethical dilemmas often require ‘heat of the moment decisions’ and the philosophy that forms the foundation for those decisions must reflect deeply held convictions since it is these convictions that lead to spontaneous behavior. The authors agree that a principle-based approach to teaching engineering ethics is needed. They further propose that the foundational principles that should form this basis are a knowledge and faith in Christ and His characteristics and attributes. When convictions are thus founded, individuals will be seeking to develop the mind of Christ (see 1 Cor. 2:16) and actions will be motivated by a desire to emulate Him and to do as He did. This faith in Christ and commitment to strive to live a Christ-like life will aid dilemma resolution.

**Foundational Principles and Living a Life of Consistency**

In Hebrews 11:1, Paul defines faith as “the substance of things hoped for, the evidence of things not seen.” The Greek translation allows the substitution of the word “assurance” for the word “substance.” Consider the future as being things not seen. We hope that certain things will happen, e.g., that the next paycheck will come, that the car will start and we will be able to drive to our destination, etc. Faith is the assurance of all of these things for which we hope. We rely on faith to act as if the things for which we have hoped will come to pass. All actions are preceded by this hope and faith. It is recognized that not all actions are good. There are other human desires and needs that influence our motivation. However, it is faith that moves us to act toward some end, some purpose that we have as a goal for the future.

Rasmussen, after reviewing the works of many of the world’s great thinkers regarding the supreme goal that most people seek has summarized their thoughts in the following statement:

> Faith prompts them (all intelligent beings) to plan, to prepare, and then to act so as to obtain some purpose or end which lies yet in the future. But what end? . . . There is an ultimate end for which all men naturally search. Its name is happiness.

Although happiness is what all of us seek as our goal, there is a variety of definitions for it. The Savior, however, spoke of a strait gate and a narrow way that leads to it (see Matt. 7:13). Most of the wise would agree. Aristotle said that happiness is “an activity of soul in accordance with virtue.” There are two important points that Aristotle is making with this statement. First, it involves an activity. Second, the activity is virtuous. Earlier, it was stated that faith and hope precede all actions. Faith, based on virtue, will lead to actions that will lead to happiness.

When faced with an ethical dilemma, we must act out a decision of our choice. The action we choose will be a product of our knowledge and faith that certain outcomes will result. Our faith then becomes a critical ingredient when we are confronted with a dilemma. Will our faith motivate us to correct or incorrect actions? The answer to that question lies in part upon what our faith is based and how committed we are to the basis.

Before discussing the basis for our faith, there is one other important issue that deserves mention. The author of Proverbs said the following (Prov. 23:7), “for as he thinketh in his heart, so is he.” This
suggests that there is an inner source of all of our outward actions; i.e., everything we do outwardly is first thought of in our minds or felt in our hearts. The Savior stressed the importance of our thoughts in his teachings on the Sermon on the Mount when discussing such things as adultery and anger. Allen, in his book *As a Man Thinketh*, has commented,

> As the plant springs from, and could not be without the seed, so every act of a man springs from the hidden seeds of thought, and could not have appeared without them . . . Man is the master of thought, the moulder of character, and the maker and shaper of condition, environment and destiny . . . Circumstance does not make the man; it reveals him to himself.\(^5\)

C. S. Lewis has also written about this:

> When I come to my evening prayers and try to reckon up the sins of the day, nine times out of ten the most obvious one is some sin against charity; I have sulked or snapped or sneered or snubbed or stormed. And the excuse that immediately springs to my mind is that the provocation was so sudden and unexpected: I was caught off my guard, I had not time to collect myself. Now that may be an extenuating circumstance as regards those particular acts: they would obviously be worse if they had been deliberate and premeditated. On the other hand, surely what a man does when he is taken off his guard is the best evidence for what sort of man he is? Surely what pops out before the man has time to put on a disguise is the truth? If there are rats in a cellar you are most likely to see them if you go in very suddenly. But the suddenness does not create the rats: it only prevents them from hiding. In the same way the suddenness of the provocation does not make me an ill-tempered man: it only shows me what an ill-tempered man I am.\(^6\)

Rasmussen has further commented on the relationship between our inner thoughts and our faith:

> Faith as the principle of outer action is first of all the principle of inner action that provides the basis for the outer one. This fact needs to be remembered and constantly emphasized in an age such as ours, which tends so much to prize tangible results and observable consequences. The point is not that these are unimportant but that in order to have real worth they must follow from a virtuous inward action of the soul that intended them.\(^3\)

Relating this to our goal of happiness, we find that in order for us to be truly happy with ourselves, we must have our outer actions consistent with our inner thoughts and feelings. To help accomplish this, we frequently make promises with ourselves to do certain things. By analyzing the results of our actions and comparing them with these promises, we can measure the consistency of our inner and outer actions.

Consider the following examples, which illustrate the concept that true happiness comes when our outer actions are consistent with our inner thoughts and feelings that are founded upon correct principles. For an additional example, the reader is referred to the life of David in the Old Testament (see Psalms 51:1-19).

- Near the end of the play *A Man for All Seasons*, Thomas More sat in an English prison waiting a day in court and certain beheading. More was in this position because he was unwilling to swear an oath of loyalty to Henry the King of England. Henry had asked for this oath because he needed More’s support for his wedding to Anne Boleyn, for which the Catholic Church had previously denied permission. More, an intensely religious man and possessing great integrity, had sided with the Pope on the matter. More’s daughter visited him in prison and asked him to swear the oath outwardly to the king but retain the oath inwardly in his heart, “Then say the words of the oath and in your heart think otherwise.” More responded, “What is an oath then but words we say to God? . . . When a man takes an
oath, Meg, he’s holding his own self in his hands. Like water. And if he opens his finger then—he needn’t hope to find himself again. Some men aren’t capable of this, but I’d be loathe to think your father one of them.” More believed it was better for a man to remain happy with himself and choose to die than for his outer actions to be inconsistent with his inner thoughts and feelings.

- Victor Frankl described an experience during his imprisonment in a World War II German concentration camp in which he came to feel the inner peace that comes with this consistency. Toward the end of his stay in Auschwitz, he had an opportunity to escape with another prisoner. As he and his friend gathered the provisions and waited the moment where they would make their escape, he made a quick last round of his patients. He came to an old friend, a fellow countryman, who was dying. Frankl had made it a goal to save this man’s life.

I had to keep my intention to escape to myself, but my comrade seemed to guess that something was wrong (perhaps I showed a little nervousness). In a tired voice he asked me, “You, too, are getting out?” I denied it, but I found it difficult to avoid his sad look. After my round I returned to him. Again a hopeless look greeted me and somehow I felt it to be an accusation. The unpleasant feeling that had gripped me as soon as I had told my friend I would escape with him became more intense. Suddenly I decided to take fate into my own hands for once. I ran out of the hut and told my friend that I could not go with him. As soon as I had told him with finality that I had made up my mind to stay with my patients, the unhappy feeling left me. I did not know what the following days would bring, but I had gained an inward peace that I had never experienced before. I returned to the hut, sat down on the boards at my countryman’s feet and tried to comfort him; then I chatted with the others, trying to quiet them in their delirium.

In order for faith to lead to true happiness, it needs to be well founded in God and His Son, Jesus Christ. In the authors’ engineering ethics class, the importance of the knowledge of the following foundational principles is stressed to the students:

1. Jesus Christ is the Son of God
2. Christ’s (and the Father’s) true character
3. By seeking to develop the mind of Christ and committing to live a Christ-like life, dilemmas can be solved correctly

Wilson has written:

The knowledge of his existence is only preliminary to our knowing his characteristics and attributes. When the challenges and traumas of life arise—and they are a natural part of this mortal experience—though we know there is a God, the issue will depend more critically on what he is like. The questions in those difficult times will center on whether I can depend on and trust in him implicitly. Does he, for instance, have knowledge and power sufficient to save me? And for that matter, does he have the mercy and desire to do so?
Applications of Individuals Demonstrating Christ-like Characteristics

Although the Holy Scriptures contain many of God’s characteristics, in the interest of brevity and for the purposes of this paper, examples of the following will be discussed:

1. God is omnipotent
2. God changes not
3. God is omniscient
4. God is truthful and cannot lie
5. God is just
6. God is no respecter of persons
7. God is merciful and gracious
8. God is love

The examples discussed below demonstrate how individuals, who have their faith founded upon these characteristics, addressed solutions to life’s challenges with proper ethical behavior. Some of the examples refer to a person having faith that God possesses the attribute and others refer to the development of the attribute within the person. See the last section of the paper to see how these are presented in a course.

The following examples may appear to be simple but there have been many people throughout history who have made the “wrong” decision in cases just like these. The degree with which someone considers these simple or difficult dilemmas has to do with their capacity to do “right.”

God is omnipotent (all powerful)
There is an excellent example of this characteristic in the Biblical story of Elijah and the woman of Zarephath found in 1 Kings 17. Elijah is directed by the Lord to Zarephath where he asks a widow woman to fetch him some bread to eat. The woman responds that she has only enough food to make her and her son one more meal before they will die. Elijah says that if she will do as he asks, her barrel of meal and cruse of oil will not run out. Believing in Elijah’s word and the power of God to sustain her, she is obedient to Elijah’s wish.

Modern day applications of this characteristic involve the power or influence that individuals gain by exhibiting integrity or the loss of influence that people feel when showing a lack of integrity as the following two stories illustrate.

H. Burke Peterson recalled to the authors an experience that he had as he was attempting to build a small, young civil engineering firm that focused on the design of roads and highways. The company experienced early success and was growing rapidly in the state of Arizona and gaining a good reputation. At this time, Peterson’s responsibility in the company was to find new business. There were fifty employees in the company who depended upon him to perform his task.

Peterson soon learned of a project for the Interstate highway in a nearby state. After submitting a bid for the project, he visited the nearby state highway department and began talking to their representatives. He told of his company, discussed his and his partners’ qualifications, and explained how they would like to expand their business. One of the state officials took him into a room where the two of them were all alone. The state official told him that his company had been successful with the bid and would be awarded a very lucrative contract. The official then indicated that it was policy for the
bid awardee to make a contribution back to the state officials. This kickback was made to seem routine. Peterson knew his company needed the work and that all of the employees were depending on him to bring back the contract. However, he also knew that kickbacks were not appropriate. He decided to refuse the contract and told the official that he and his partners did not do business that included kickbacks. The contract was soon let to another firm.

Unknown to Peterson and these state officials, a congressional committee had been investigating the use of interstate highway funds and related contracts. The committee made public their review, which had uncovered corrupt practices being conducted by several states’ highway departments, including the state highway department where Peterson’s company had made their bid. State officials were reprimanded and collaborating engineering firms lost respect. Peterson and his company gained respect during the process.

In his book *How Good People Make Tough Choices*, Rush Kidder describes a story involving a former chief executive officer of Bath Iron Works (BIW).11

Since the end of World War II, the number of shipbuilders in the United States has shrunk to two, BIW and Ingalls Shipbuilding. Both BIW and Ingalls Shipbuilding are their respective states’ largest private employers and carry much prominence and significant influence. These two shipbuilders have stayed in business largely due to contracts that they have received from the federal government to build ships for the U.S. Navy. When a request for bid is made to build a destroyer or some other ship, the bidding is intense between the two competitors. In May of 1991, personnel from the U.S. Navy met with personnel from BIW and an independent consultant. They met to review the existing contract that the government had let to BIW for the construction of the destroyer *Arleigh Burke*. The review was significant to BIW for the government was soon to award contracts for the construction of five more destroyers, each worth about $250 million.

The review proceeded normally, but the next morning a maintenance worker found a document left behind by the consultant. The document was found to contain highly confidential economic analyses of the cost estimates of both shipbuilders for the construction of the destroyers. It was information that fell under the protection of the Procurement Integrity Act, a federal law that requires that contractors state that they have never been in possession of proprietary information belonging to competitors. That morning, the document eventually ended up in the office of the CEO of BIW, William Haggett. Haggett had been with BIW for 28 years and was highly respected in both his own state of Maine and in Washington D.C. He was considered by some to be a gubernatorial candidate in the future. Haggett quickly went through the document and, as he rushed off to a meeting in a nearby city, ordered that a photocopy be made and the original returned to the meeting room where the consultant had left it.

In his absence, BIW personnel placed some of the economic data in their computers and began an analysis and comparison of the data. Later in the day, the president of the company, Duane D. Fitzgerald, was informed of the finding of the document, the photocopying, and the subsequent analysis of the data by BIW personnel. Realizing that what had been done was unethical, he ordered that the photocopy be destroyed and the
information and analysis in the computers be erased. Upon his return, Haggett discussed the matter with Fitzgerald and agreed with his assessment of the situation and his actions. The navy conducted a thorough investigation. It was concluded that Ingalls Shipbuilding had not been hurt by BIW’s actions and both BIW and Haggett were absolved of any possible error as long as those familiar with the data in the document were not allowed to participate in BIW’s subsequent bid.

This, however, was not the end. Shortly thereafter, Haggett resigned as CEO of BIW at the suggestion of his own colleagues, who were concerned about the company’s reputation in the community. BIW had forged a good reputation through years of diligent efforts of developing trust and building relationships of integrity. Haggett’s actions had damaged that reputation.

In this case, the power and honorable influence that one man had created by living a life of integrity was lost in one moment of poor decision followed by questionable acts. His colleagues lost their trust, or faith, in his ability to lead them.

*God changes not (being consistent in all things at all times)*

An example of this characteristic is demonstrated in an experience shared by Dr. Douglas M. Chabries, current Dean of the Ira A. Fulton College of Engineering and Technology, Brigham Young University.12

In the mid-1970s Dr. Chabries, worked as a civilian research engineer for the United States Navy. On one occasion, Dr. Chabries was required to install a system on a ship that would make its sonar more sensitive. As a part of the normal routine, he conducted a test of the sonar system before installing the new enhancement. In this test, he lowered a sound source from the side of the ship to a position a few feet from the sonar dome and listened for the tone in the sonar system. To his surprise, the sound was not audible.

Concerned that the sonar was unusable, Dr. Chabries felt it was necessary to stop the ship from proceeding to its next mission. This is done by issuing a "casualty repair," a serious step, since it places the ship and all its crew out of commission. In wartime, a casualty repair is issued when a ship is seriously damaged, and the ship is withdrawn from service for repairs.

With the issuance of the casualty repair, the Navy brought in some technicians to test and repair the sonar system. Following the procedure outlined by General Electric, the sonar’s manufacturer, they tested the system and determined that the system was functioning properly, so they gave notice to clear the casualty repair. Once again, however, Dr. Chabries lowered the sound source over the side of the ship to discover that the ship’s sonar was still silent.

This was repeated twice more with General Electric’s own technicians and Naval Laboratory design engineers. Still, Dr. Chabries’ simple test demonstrated that this was not the case. He was forced to file another casualty repair.

This was more than Navy officials could tolerate. Every test performed on the sonar showed that it was functioning properly, but Dr. Chabries refused to proceed with his installation because his test did not agree with the other, more technical diagnostics performed on the system. The Navy informed him that it would be launching the equivalent of a court marshal hearing on him. If he failed to provide a satisfactory
At the hearing, representatives from the Navy, General Electric and the Naval laboratory gave long, technical explanations to defend their position that the sonar was functioning properly. Realizing that this admiral may not be well versed in technical matters, Dr. Chabries’ rebuttal sought to give a simple explanation. He played a tape recording of his sound source that he had used in his test, then a recording of what the sonar heard. In this second tape, only noise was audible. He then set up an oscilloscope and demonstrated that the second tape’s noise was the sound of the ship’s own sixty-cycle pump. All the sonar could hear was the sound of the ship’s own power source. To Dr. Chabries’ relief, the admiral stated, "Any fool can see that this sonar is broken."

After the hearing, a search for answers led to an electrical cabinet in which leads from the sonar system’s transducers met. In this cabinet the wires were configured such that it acted as a transformer thus amplifying any nearby electrical field. This produced a buzz in the sonar that made it impossible to hear the sonar echoes.

The problem with the sonar hadn’t been discovered because the first step performed when testing the sonar was to short the wires between the cabinet and the transducers, so the sonar was isolated from the rest of the system. The test then proceeded on the transducers and the associated electronics. The electrical cabinet was never included in the section of the system being tested, so its effect on the system went undetected.

Once the problem was found, a message was sent to the entire U.S. fleet to check the wiring in all similar cabinets. The word soon began coming back — every vessel in the fleet had the problem. It had not been discovered because there had not been a need to use the sonars. Orders were quickly issued to repair the entire fleet.

Dr. Chabries, instead of being court-marshaled, was given an award. The letter accompanying the award said, "Thank you for maintaining your courage and integrity in the face of assurances by GE, by the naval designers, and by the naval personnel that you were wrong."

A knowledge and faith in the Savior’s example of remaining constant throughout His life, but particularly during moments of severe persecution, can aid those facing difficult and challenging circumstances of their own. Dr. Chabries’ commitment to Jesus Christ and the ideal of integrity led him to remain constant and steadfast during his dilemma.

God is omniscient (all knowledgeable)
In professional careers, individuals frequently find application of this characteristic of God when they are asked to do something that seems beyond their ability. The problem is studied. Past experiences and knowledge are drawn upon but a solution is not found. At this point, an individual can approach God in prayer, having faith in His knowledge that He will assist with the problem.

One of the authors recalls a time when this happened with his employment while developing a process to produce a certain product. He was asked to do something that he felt was beyond his capabilities. After asking God for help, he was directed to a solution that involved some mathematics that he did not understand. After working out the solution, He and his supervisor decided that they would implement it in the process development. Testing of the final product confirmed that his use of the mathematics had been correct. God’s knowledge is unlimited, and He is more than willing to assist us in those areas where ours is lacking by sharing His knowledge with us if we have the faith necessary in both His omniscience and His willingness to convey that knowledge to us.
The authors don’t mean to imply that all solutions will be provided to engineers by God. People are not always capable, willing, or ready to receive or even seeking God’s help. But one who does trust in God’s omniscience may approach Him for help.

*God is truthful and cannot lie*

Frequently, individuals find their honesty being tested as they face ethical dilemmas. One such case involves a former engineering dean, Dr. L. Douglas Smoot and one of his former graduate students (referred to here as Kyle, a fictitious name).

Kyle’s Ph.D. project was funded by a 4-year grant from the U.S. Department of Energy (DOE). The project was fraught with challenges and difficulties that led to many delays and frustrations. At one point, he informed Professor Smoot that he was going to abandon his research and accept a job. Including the time spent in obtaining his Master of Science, he had been in graduate school over five years. His family had grown, and he was feeling pressure from them and about their financial situation. Troubled by this decision, Dr. Smoot worked hard to change Kyle's mind. Kyle's coursework was complete, over 85 percent of the research was done, about that same amount of the budget had been spent, and only eight months remained in the contract to complete the work. Furthermore, it would be nearly impossible to find another student to take Kyle's place to complete the work in the remaining contract time. After much persuasion, Kyle agreed to remain at the university through the remainder of the contract.

During the next several months, Kyle completed the difficult tests, analyzed the data, and wrote his dissertation. The contract final report, which was primarily composed of Kyle's dissertation, was sent to the DOE. Kyle also presented his work at an international coal conference in England and published it in a journal. With Kyle's responsibility to the university and the DOE fulfilled, the university awarded his doctoral degree, and Kyle accepted a position with a prominent company.

During a follow up project, questions arose about the accuracy of Kyle’s data. Dr. Smoot worked with other faculty and students to resolve the questions but found they couldn’t replicate Kyle’s work. Dr. Smoot approached Kyle with the concerns and invited Kyle to respond to them. Kyle, at first took offense to the questioning of his work but later admitted that he had fabricated the data. Now, Dr. Smoot was faced with a dilemma. He knew that there could be serious ramifications, not only to Kyle and himself but also for BYU. Committed to a life of integrity, there was no alternative for him. He quickly reported the situation to DOE personnel. Dr. Smoot also realizing he had a conflict of interest as dean of the college gave up all college decision-making responsibility to an associate dean.

Dr. Smoot received approval from the university to use a personal research account to reimburse the DOE for expenses related to the fabricated work. He also notified the professional journal that had published the research paper and a disclaimer notification was printed in the next edition. Copies of the dissertation were destroyed and removed from any university databases. The final report to the DOE was sent back to the university and a new report was written.

Dr. Smoot was not only a dean of his college but also a leader in his church. Being true to his word was simply a way of life that had been forged through his commitment to his Christian life style.

*Christian Engineering Education Conference 2004*

*http://engr.calvin.edu/ces/ceec*
God is just (insuring that fairness is applied in all circumstances)

An interesting dilemma illustrates this characteristic. Away from work while shopping with his family, an engineer overheard two other engineers discussing proprietary information concerning a potentially marketable product. He realized that the two worked for a competitor and that the information could help his own company secure an advantage over the competitor. His dilemma was whether he should continue to listen, since it was not his fault that he was in position to overhear the proprietary information, or ignore the conversation, since the two other engineers were innocently discussing the information in what they thought was a private conversation. Because of a deeply, engrained sense of fairness, cultivated over years of church attendance and a commitment to Christ, he chose a third alternative. He interrupted the conversation, pointed out to them it was a public place, and suggested that they might want to curtail their discussion since he worked for their competitor. They embarrassingly stopped their discussion and thanked him for his ethics.

God is no respecter of persons (favoritism is not given to anyone)

Peter, a leader of the church following the Savior’s death, learned an invaluable lesson regarding this characteristic. While visiting the apostles at the sea of Tiberias, Peter was instructed to teach the gospel to others. Peter assumed that he and his companions were to go to the Jews and teach them the gospel. Peter later received a vision in which he is instructed to take the gospel to the Gentiles. Following that vision, Peter has the following experience recorded in the book of Acts.

> While Peter thought on the vision, the Spirit said unto him, Behold, three men seek thee. Arise therefore, and get thee down, and go with them, doubting nothing: for I have sent them. Then Peter went down to the men which were sent unto him from Cornelius; and said, Behold, I am he whom ye seek: what [is] the cause wherefore ye are come? And they said, Cornelius the centurion, a just man, and one that feareth God, and of good report among all the nation of the Jews, was warned from God by an holy angel to send for thee into his house, and to hear words of thee. Then called he them in, and lodged [them]. And on the morrow Peter went away with them, and certain brethren from Joppa accompanied him. And the morrow after they entered into Caesarea. And Cornelius waited for them, and had called together his kinsmen and near friends. And as Peter was coming in, Cornelius met him, and fell down at his feet, and worshipped [him]. But Peter took him up, saying, Stand up: I myself also am a man. And as he talked with him, he went in, and found many that were come together. And he said unto them, Ye know how that it is an unlawful thing for a man that is a Jew to keep company, or come unto one of another nation; but God hath shewed me that I should not call any man common orunclean. Therefore came I [unto you] without gainsaying, as soon as I was sent for: I ask therefore for what intent ye have sent for me? Acts 10: 19-29

Although Peter knew that there could be ramifications because of his violating the Mosaic Law, he obeyed the Spirit because he had faith in the fact that God was no respecter of persons. He later visited Cornelius and taught him the gospel and bore testimony of this characteristic.

> Then Peter opened [his] mouth, and said, Of a truth I perceive that God is no respecter of persons: But in every nation he that feareth him, and worketh righteousness, is accepted with him. Acts 10: 34-35

In a modern example, a beautiful story is told about a group of high school students who because of a belief in the fact that God possesses this characteristic, decided to put into practice their belief.

... a modern-day miracle which occurred a year or so ago at Murray High School near Salt Lake City, where every person was a winner, and not a loser was to be found. A newspaper article highlighted the event. It was entitled "Homecoming Shows True Spirit: Students Elect 2 Disabled Girls to Murray Royalty." The article began, "Ted and
Ruth Eyre did what any parents would do. When their daughter, Shellie, became a finalist for Murray High School homecoming queen, they counseled her to be a good sport in case she didn't win. They explained only one girl among the 10 would be selected queen. As student body officers crowned the school's homecoming [royalty] in the school gym Thursday night, Shellie Eyre experienced, instead, inclusion. The 17-year-old senior, born with Down syndrome, was selected by fellow students as homecoming queen. As Ted Eyre escorted his daughter onto the gym floor as the candidates were introduced, the gym erupted into deafening cheers and applause. They were greeted with a standing ovation. Similar standing ovations were extended to Shellie's attendants, one of whom, April Perschon, has physical and mental disabilities resulting from a brain hemorrhage suffered when she was just 10 years old. When the ovations had ceased, the school vice principal, Glo Merrill, said, "Tonight . . . the students voted on inner beauty.' . . . Obviously moved, parents, school administrators and students wept openly." Said one student, "I'm so happy, I cried when they came out. I think Murray High is so awesome to do this.""m13

God is merciful and gracious
The following story is contains an example of a young woman when faced with a difficult dilemma responded in part because of her belief in the Savior’s mercy.

In the course of the Armenian atrocities, a young woman and her brother were pursued down the street by a Turkish soldier, cornered in an angle of the wall, and the brother was slain before her sister’s eyes. She dodged down an alley, leaped a wall, and escaped. Later, being a nurse, she was forced by the Turkish authorities to work in the military hospital. Into her ward was brought, one day, the same Turkish soldier who had slain her brother. He was very ill. A slight inattention would insure his death. The young woman, now safe in America, confesses to the bitter struggle that took place in her mind. The old Adam cried “Vengeance,” and the new Christ cried, “Love”. And, equal to the man’s good and to her own, the better side of her conquered, and she nursed him as carefully as any other patient in the ward. The recognition had been mutual, and one day, unable to restrain his curiosity, the Turk asked his nurse why she had not let him die, and when she replied, “I am a follower of Him who said, ‘Love your enemies and do them good,”’ He was silent for a long time. At last he spoke, “I never knew that there was such a religion. If that is your religion, tell me more about it, for I want it.”m14

The example of Saul of Tarsus illustrates how faith in God’s mercy and grace motivate individuals to good actions. Initially, he fought against the church and its members, but then received a visit from a heavenly being that brought him a message of repentance, mercy, and grace. Following this, he desired to share his experience with others in order for them to feel the Savior’s mercy and grace. He was ridiculed, persecuted, and later killed for his actions. Faith in and knowledge of this characteristic of God, has led millions of men and women to seek forgiveness for their sins. Many then apply their knowledge to extending mercy and grace to others, and like Paul, render lifes’ of service whether it be in their profession or in other ways.

God is love
The following news story is used to demonstrate an example of an individual doing the right thing because of a knowledge of God’s love.

His store is not a large one. It is not in the supermarket class. But it is profitable. His customers know him for what he is. They respect his principles, and admire him for holding to them.
He is a man who had been reactivated (in his church) after a long period of religious inactivity. Previously his store had been open on Sundays, and he had sold beer and tobacco.

“But then I got my eyes opened,” he said, “and when I saw the light, I lined up with it. I closed on Sundays and sent all my beer and tobacco back to the wholesalers. They thought I was crazy.”

Then he said that he almost thought so himself, for a time, because he lost many of his customers, and as his volume went down, his profits disappeared.

One day he and his family met together to talk about either quitting business or trying to hold on for a while longer. His lovely and faithful wife said, “Why don’t we fast and pray as a family, and tell the Lord what we have done and let Him know that we did it for Him. He will inspire us in what to do.”

Her advice was followed. Within the next week things began to change. A different class of people started coming into his store. They didn’t ask for either beer or tobacco, and none of them mentioned Sunday trade.

Within a month, his losses stopped and his books showed only black figures. At the end of a year his volume was greater than it had been before he made the change. And he knew why.

Now with his present philosophy, he has peace of mind as well as a good living.

“It all depends on how much you think of the Lord,” he said again, “and I just happen to love Him.”

The greatest example of one who, because of his knowledge of God’s love for all mankind gave of himself and rendered selfless service, was our Savior, Jesus Christ. A knowledge of his Father’s love motivated him to perform the atonement and provide the way for us to be able to return to our Father in Heaven.

In a familiar parable, that of the "Good Samaritan," the Savior explained how an individual can behave properly by ignoring social and racial barriers of the day and honor all men as equals because of a knowledge that God loves all of his children.

And Jesus answering said, A certain man went down from Jerusalem to Jericho, and fell among thieves, which stripped him of his raiment, and wounded him, and departed, leaving him half dead. And by chance there came down a certain priest that way: and when he saw him, he passed by on the other side. And likewise a Levite, when he was at the place, came and looked on him, and passed by on the other side. But a certain Samaritan, as he journeyed, came where he was: and when he saw him, he had compassion on him, And went to him, and bound up his wounds, pouring in oil and wine, and set him on his own beast, and brought him to an inn, and took care of him. And on the morrow when he departed, he took out two pence, and gave them to the host, and said unto him, Take care of him; and whatsoever thou spendest more, when I come again, I will repay thee. Which now of these three, thinkest thou, was neighbour unto him that fell among the thieves? And he said, He that shewed mercy on him. Then said Jesus unto him, Go, and do thou likewise. (Luke 10:30-37)

The resolutions of many ethical dilemmas have been and will continue to be influenced by this singular characteristic of God.

Teaching the Above Concepts in an Engineering Ethics Course

The authors incorporate the above concepts in their engineering ethics course by:

1) defining the roles of faith and knowledge on behavior;
2) defining and discussing Christ’s characteristics;
3) discussing examples of how people have made correct choices by having faith that Christ possessed a particular attribute;
4) discussing examples of how people have made correct choices based on their own attribute development.

The above stories are given as readings in a manuscript that has been prepared for use in the course (“Faith: The Foundation for Ethical Behavior”, ISBN 0-7003-8498-7). They are presented and discussed as examples of using faith in addressing both simple and complex dilemmas. They are used to help prepare the students in addressing even more difficult dilemmas following a presentation of a dilemma resolution procedure discussed in the text.

The authors have anecdotal data from students in end of course student evaluations that suggest they like the faith-based approach to solving ethical dilemmas. Most students feel that the practical approach to this course supplements very nicely their other religion courses that they are required to take at BYU.

Conclusion

It is hoped that this paper has shown that a knowledge of and faith in Jesus Christ and His characteristics and that the seeking of the mind of Christ and the committing to live a Christ-like life will aid in the successful resolution of ethical dilemmas. Modern day examples as well as some from the Holy Scriptures have been discussed.

References

[10] Personal account to the authors.