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Faith Enablement for Civil Engineers: A Field Experiment Case Study

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1.0 Introduction

My personal goal as I teach courses in the engineering curriculum at Walla Walla College is to point students towards professional implementation of the three important factors stated as characteristic of a Christian life in 1 Corinthians 13: Faith, Hope, and Love. Given that engineering is an applied science, however, there are challenges in upholding these concepts - particularly faith - during lectures, laboratories and projects in the engineering curriculum. My function as a civil engineer is to use fundamental mathematical and physical concepts regarding soil and rock, surface water and groundwater to identify sustainable uses for the materials in construction or planning applications. For instance, I teach classes that characterize the impact that water seeping under a dam will have on the dam's stability, and how one can determine the likelihood that a municipal water well will become contaminated when a chemical spill occurs along an adjacent highway.

Engineers often have to make quick decisions on construction sites, be on top of continuously evolving technologies, and questioning established solution methods. These factors awaken a healthy skepticism in the engineer toward whether a particular solution is adequate or even possible. Personally and in my students I note a correlation between this uncertainty in professional accomplishments and an uncertainty in the presence of a meaningful relationship with the church and our heavenly Father. In this paper I wish to give some examples of the factors that cause engineers to be skeptical about their professional undertakings and present a field experiment that I used in my Hydrology course to try to use critical thinking for both interpretation of measured data and recognition of God's leading in the student's life. I present the objectives, some technical concepts, and the results of the experiment, and student responses to faith questions. Additionally, I provide a critique of the exercise with ideas for future changes.

2.0 Critical Engineers

Engineers have a tendency to disbelieve something that goes contrary to a fundamental principal or law of nature. This questioning nature can lead to uncertainty in one's own professional abilities as well. There are several factors, I believe, that can undermine engineers' faith in their own technical abilities. I believe it important to look at some of these factors and consider how they can be addressed in the engineering curriculum to increase faith in God, not decrease it. I consider three factors that create uncertainty in the engineering design process: relatively short lengths of time spent on projects, continuous changes and improvements in available technology, and the necessity to adapt accepted analysis or design methods to a particular application.

I recently called a couple of practicing civil engineering friends and asked them, on average, what length of time they spent on their clients' projects. Responses were generally a couple of weeks to several months. In that time they needed to identify with the client the scope of the project, gather background information, perform any site investigations necessary, suggest a preliminary design, incorporate client changes, analyze the design, make any required changes, and provide final plans. Due to the large number of tasks that make up a project, corners are often cut in site investigation or analysis of the design. This cutting of corners reduces the certainty that the final design will achieve its intended purpose. While we teach students to focus on the critical points of an analysis and learn where one can efficiently save time, most of the time-saving measures are learned with experience over a longer period of time than their training at Walla Walla College. Hence, the quick decisions made with limited knowledge dramatically reduce confidence that a solution is valid.

In addition to limited time that can be spent on engineering projects, rapid changes in technology used to complete engineering designs can also add uncertainty to engineering solutions. Moore's Law (Intel Corporation, 1998) followed from an observational rule of thumb that the speed of microprocessors over the last twenty years has doubled every 18 to 24 months. Sometimes the rapid advances can be quite helpful. For instance, when I estimated how long it would take to perform computer simulations for my dissertation in 1993, I determined that it would take approximately nine months. Actual implementation in 1995 took only three months, since faster computers were used. But technological changes can also be counter-productive. I spent 150 hours writing a graphics command program for a plotter to enhance my Masters' thesis presentation. Five years later, the plotter technology which I had used was very slow as compared to laser technology, making, the program I had written virtually useless. Changes in technology make it uncertain whether longer projects will remain solvable with a particular means throughout the life of the project. Specifically, for my students it is frustrating to not know if the analysis software they learn to use in my class will still be in use by the time they are looking for employment.

In addition to adapting to changes in technology, engineers have to be able to determine whether the techniques they use are applicable for a particular client. For example, hydrologists use a pump test to determine the safe yield of water that can be produced from a newly developed well. The most commonly used mathematical analysis tool for estimating how far water will be drawn down in the well for a given pump rate is the Theis solution. It, however, assumes that the geological unit from which water is being pumped has a constant thickness, infinite lateral extent, some type of confining layer (e.g. clay) above the unit and all water in the unit is supplied for production in the well only. Figure 1 indicates that this simple solution over predicts how much the water level in the well will drop if a neighbor's pump turns on during the test. If one knows the effect that a neighbor's well produces, then the analysis can be modified to account for the neighbor's impact. However, if little is known about the geologic setting (i.e. size of the geological unit, location of neighboring wells, or whether a confining layer even exists), the certainty of the engineer's prediction of the safe yield is small.

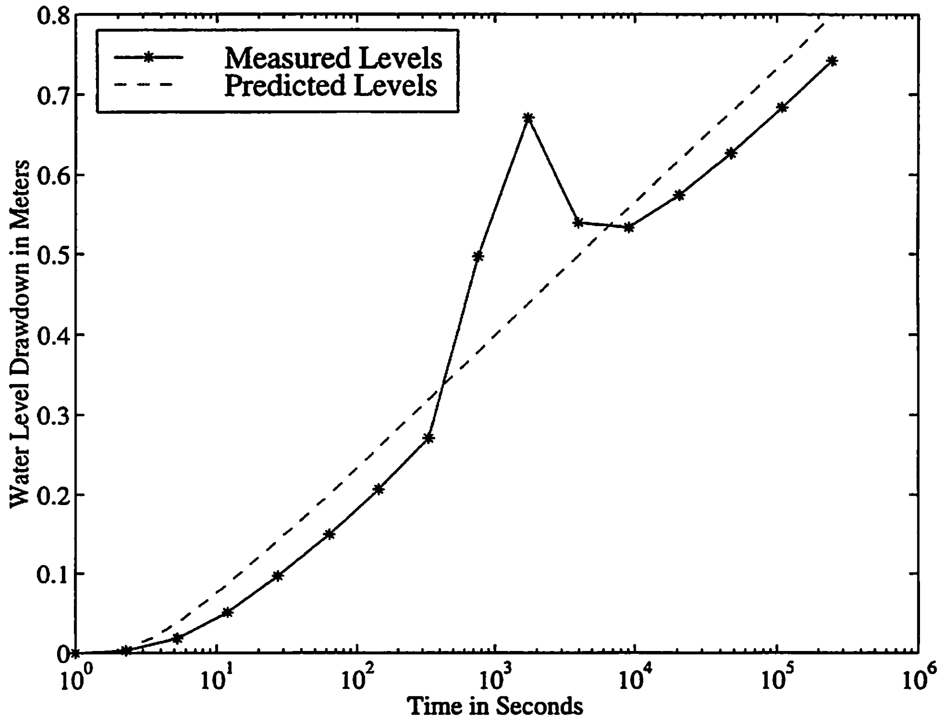

Figure 1: Example of pump test analysis. Theoretical matching curve doesn't fit measured data since it ignores pumping of water from a neighboring well.

Each of the three factors influencing an engineer's belief in the soundness of his/her work - short project duration, technology changes, and identification of solution adequacy - can be addressed effectively over time. Yet, I found these factors to be unsettling for my students. I believe that it is imperative that steps be taken to not allow uncertainty in technical endeavors to be mirrored in an uncertainty regarding God's guidance for my students' lives.

3.0 Growth of Faith Through Experimentation

It is true that no successful engineer was blessed with his or her abilities overnight; similarly, I believe that a mature faith must be gained through experience over time. Christ stated that unless we accept the kingdom of heaven as a child, we will not enter in (Mark 10:15). Even so, it is difficult for me to perceive of a mature adult being as certain of Christ's gift of salvation as a well-cared for baby is of a timely diaper change without having some previous experiences to base such a belief on. This past winter I chose to use an experiment in my hydrology class which was planned to serve a dual purpose. The goal was to provide a framework for reducing the uncertainty that a particular engineering application was done correctly and looking at parallel implications for determining God's will for our lives.

Previous to this laboratory experiment, I had tried to use some biblical perspective to help understand geologic principles in a soils engineering class. This met with significant opposition from students who were more worried about the collapse of the building on a particular soil than whether the soil particles had evolved over millions of years or been spoken into existence by a Creator in a second. I actually had one student thank me when I skipped over a section in the text that treated different geologic ages and stratigraphic dating. It occurred to me that my students were less interested in philosophical discussions on origins than they were in learning technical design skills to be of service. (Many of Walla Walla College engineering students choose to do senior design projects that involve work with academies, the Adventist Development and Relief Agency, and Adventist World Radio.)

Since I have seen the most consistent learning in classes where students have a laboratory afternoon to do an experiment - hydrology is a 3 hour per week lecture only class - I was inspired by the implication in the following quote (Mutch, 1987).

> "It may be that an in-depth study of ways to integrate faith and learning will lead to the conclusion that this can be done in the most satisfying way by helping young people to take responsibility for their own integration of faith and learning. Perhaps students should be taught that a productive and exciting life is really a set of experiments that test the many hypotheses that emerge during growth and observation."

Certainly Gideon's fleece experiment in Judges 6 suggested that great things could come from using experimentation to buoy up one's personal faith. Since I needed to be out of town for two weeks winter quarter, I scheduled a 3-hour field experiment on a Sunday to make up some class time to specifically allow students time to reflect on God's leading in their lives while still learning technical expertise in obtaining hydrological data.

4.0 Objective and Evaluation Framework

The experiment I used involved using temperature gauges to sense the temperature in a stream and the stream bed. The objectives of the project were divided into technically-oriented and spiritually-oriented points as indicated by the subheadings below. Each objective is followed by the method for evaluating the level of success in achieving the goal with this experimentation tool.

4.1 Technical Considerations

Objective 1.) Increase the individual student's knowledge of proper calibration and implementation of a hydrological measurement tool.

Evaluation Method 1.) After data had been taken/reviewed, the experiment worksheet required short answers for stating the accuracy of the temperature gauge and the required time for the gauge to reach equilibrium in the stream and with the stream sediments.

Objective 2.) Use multiple tests and subjective considerations to evaluate usefulness of a hydrologic measurement tool.

Evaluation Method 2.) The worksheet required short-answer responses on the utility of a particular gauge to sense stream and sediment temperatures. Further, students were encouraged to make suggestions for improvement of the measurement techniques to make them pro-active in their evaluation of the technique.

4.2 Spiritual Considerations

Objective 1.) Correlate certainty with decisions made regarding technical results with certainty that God is leading in student's professional endeavors.

Evaluation Method 1.) Worksheet required short-answer responses for the basis for belief that the temperature measurement methods would/would not work and the basis for the student's choice to take engineering.

Objective 2.) Encourage students to think about the implications of a Christian life for their careers.

Evaluation Method 2.) Students had to formulate a question regarding the impact of their Christianity on their careers. They were to provide initial essay answers to the question, submit them to the instructor for a response, and then critique and/or rebut the responses with a further essay.

5.0 Experiment Conceptual Background

Protection of water resources and containment of polluted water often involves both surface water and groundwater. Regulatory agencies try to look at holistic approaches to water quality protection. But to manage regional water use effectively and accurately, one must use complex computer models, which require significant data regarding the movement of water and chemicals between surface water (lakes, streams, and oceans) and groundwater.

Given limited budgets for obtaining rates of water flow between streams and groundwater aquifers, inexpensive estimation of seepage rates using temperature measurements has been suggested previously (Cole et al., 1997; Silliman et al., 1995; Silliman and Booth, 1993; Stallman, 1965). The concept used for seepage estimation is that the temperature in the sediments beneath the stream depends on the daily variation of the temperature in the stream and the heat transfer properties of the sediments. By using a heat transfer model and varying the estimate of seepage velocity of surface water into the ground, the stream temperatures can be used as inputs to simulate the sediment temperatures (see Figure 2). Matching these temperature estimates against measured values determines the seepage velocities.

To use this technique effectively, however, the temperatures must be accurately measured. In the laboratory experiment I had students use temperature gauges to determine:

1.) What was the accuracy of the temperature gauge, i.e. if the gauge is consistently biased high or low in its measurements by how much is it off?

2.) How long must an intrusive temperature gauge be placed in the stream and sediments to reflect the temperature of the surrounding medium?

To answer these questions, we utilized manufacturers specifications, measured the temperature of ice water, and took measurements of stream and sediment temperatures at a field site. Results from the experiment are shown in the following section.

6.0 Temperature Measurements and Interpretation

6.1 Manufacturer Specifications

A certificate of calibration was provided with each VWR Water Resistant temperature gauge that was used for the experiment at the time of purchase. Calibration of the temperature gauges was performed by the manufacturer by comparing its measurements in a controlled water

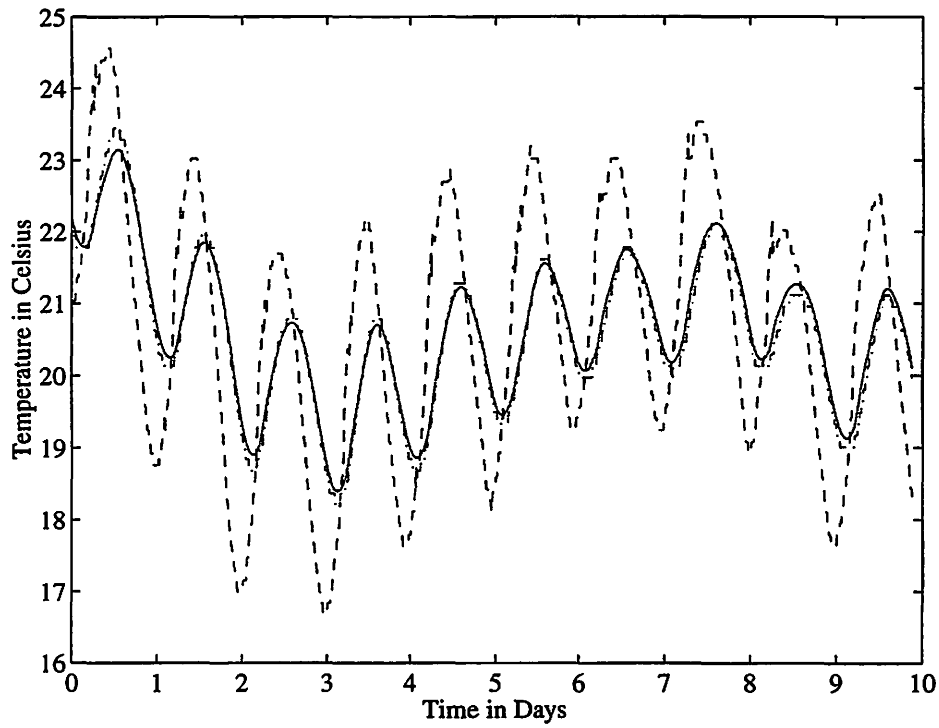

Figure 2: Example of using stream temperatures (dashed line) and a one-dimensional heat transfer model (solid line) to match temperatures in the stream bed sediments (dash-dotted line).

bath to that with a precision gauge for temperatures between 0.0 to 60.0 degrees Celsius. Results indicated that the VWR water resistant gauges were at most 0.6 degrees Celsius different than the precision instrument, which was an acceptable difference considering that the production company marketed the device claiming it had an accuracy of plus or minus one degree.

Students were required in this section to simply note the maximum accuracy error that the manufacturer had measured in the calibration process. Further, they had to note the precision of the gauge (0.1 degrees). In a short essay they explained what was the true accuracy of the gauge. Specifically, they were to discuss the accuracy of the precision gauge and the influence the craftsmanship of the VWR gauge had on their impression. Since the accuracy and precision data were plainly stated on the calibration certificate, every student completed the worksheet correctly for these values. Nearly every student assumed that the accuracy of the precision bath was significantly greater than the VWR gauge. Each of these students appeared to have no basis for this belief, other than it made sense that you would want to have a very accurate gauge to calibrate another gauge. In the end no one could answer what the absolute accuracy of the gauge was.

6.2 Ice-Water Adaptation Time

Since there was no data indicating the accuracy of the standard on the calibration certificate, an attempt was made to determine the absolute accuracy of the temperature gauge by measuring the temperature of ice water, which should be 0 degrees centigrade at atmospheric pressure. The students were to estimate the length of time that was required for the temperature gauge to reach equilibrium with the cold water. Students placed ice in a water-filled beaker with a magnetic stirring bar. The beaker was placed on a plate with a rotating magnetic field which caused the magnet to spin, stirring the water. Students placed the temperature gauge in the water bath and noted the temperature in 30-second intervals. Results from one groups measurements are shown in Table 1. Students noted the adaptation time in terms of when the temperature stabilized and what the test indicated about the absolute accuracy of the temperature gauge. The adaptation time for the gauge was determined by the students to be about 90 seconds.

Table 1: VWR Measurements of Water-Bath Temperature in Degrees Celsius

Minutes	Initial	0.25	0.5	1	1.5	2	3
Temperature	18.7	3.4	1.9	1.0	0.6	0.6	0.6

However, students questioned the ability of this test to identify the absolute accuracy of the temperature gauge, since they felt it was dubious whether the ice water actually reached the freezing point. It appeared the basis for this judgement was uncertainty with the test itself, since another group had a low temperature of 3.7 degrees centigrade. However, that the measurements were all higher than the freezing point, while the comparative calibration with the standard temperature bath indicated the gauge underestimated the actual temperature, made the use of this measurement of the absolute temperature even less believable. As an observer of the students' work, I was impressed that the students were much more willing to put faith in the accuracy of a test done with a standardized technique that they did not observe, than they were with a test they performed themselves and could see potential shortcomings of.

6.3 Stream and Sediment Temperature Measurements

Given the calibration certificate and laboratory results, students took the temperature gauges to the field site on the Little Walla Walla River. The temperature gauges were affixed to a 1.2-meter-long fiberglass rod such that they could measure stream and sediment temperatures without having to experience the cold February water temperatures personally. Stream temperatures were measured over a ten minute period and students identified the equilibration time of the instrument.

From the sample data in Table 2 taken by one group, the students correctly identified that the equilibration time was quicker than in the laboratory. A couple of students noted that the reason for the difference in the equilibration times was the temperature gauge in the stream had a relatively constant temperature (except the water's temperature increased by 0.1 degrees after 7 minutes), while the temperature of the water bath was changing during the laboratory test.

Table 2: VWR Measurements of Stream Temperature in Degrees Celsius

Minutes	Initial	0.5	1	1.5	2	3	4
Temperature	10.3	8.8	8.8	8.8	8.8	8.8	8.8

Minutes	5	6	7	8	9	10
Temperature	8.8	8.8	8.9	8.9	8.9	8.9

Subsequently, the students inserted the temperature probes into the soft silt sediments in the bottom of the stream to a depth of 15 centimeters. Temperature readings were taken for 30 minutes, resulting in the data in Table 3. Different groups - dependent on their measurements - noted that the equilibration time was four to ten minutes. Most students stated that since the temperature changed more slowly in the sediments, the equilibration time should be longer. This is actually correct, however, the answer was incomplete. A temperature probe that is warmer initially than what it is measuring will increase the temperature of its surroundings. For the laboratory beaker and stream, this additional heat was dissipated very rapidly. In the sediments, however, there is very little water movement, thus, the heat dissipates more slowly (Cole and Cole, 1998). The instructor was not aware of this at the time of the field experiment, hence, the students could not have their supposition reinforced.

Table 3: VWR Measurements of Sediment Temperature in Degrees Celsius

Minutes	0.5	1	2	3	4	5	6
Temperature	8.1	8.0	7.9	7.8	7.6	7.6	7.6

Minutes	7	8	9	10	12	14	16
Temperature	7.6	7.6	7.6	7.5	7.5	7.5	7.5

Minutes	18	20	22	24	26	28	30
Temperature	7.5	7.5	7.5	7.5	7.5	7.5	7.5

7.0 Questions for Reflection

7.1 Temperature Measurements

Students were asked two questions to summarize their understanding of the temperature gauges: 1.) What their perception was of the ability the VWR temperature gauge to accurately measure the difference between the sediment and stream temperatures, and 2.) What suggestions they would have for improving the accuracy of the method. Most students felt quite confident that the temperature gauge could be used to predict the temperature difference within the one degree accuracy that the temperature gauge claimed that it could. Since the largest temperature differential between the three gauges used by the different groups was one degree, students concluded that it should be a very repeatable result. Further, they expected that an individual temperature gauge would be consistently low or high for both temperature readings. To help quantify their certainty, students were asked to quantify their belief in the accuracy of the calibration bath on a scale of 1 (uncertain) to 10 (very certain). The average answer was 8, with most stating that the calibration measurements were consistent with the other measurements that they took. Additionally, however, the same ten point scale was used to identify students' certainty that their explanation was correct for the differences in equilibration times. Here the average was only a five. Nearly all students stated that they placed significant belief in the water bath measurements, since it was a standardized reading. In contrast their explanations for equilibration times were based on their best engineering judgement which they felt was lacking significant knowledge of heat transfer.

Never-the-less, all but one student had a couple suggestions for improving the heat sensing technique. A couple students suggested using a different - thinner - temperature probe which would require less time for equilibration. Most thought that a guide that allowed penetration to a constant depth would provide the greatest improvement in consistency between temperature meters. It was evident from student responses that the requirement for making suggested improvements to the measuring technique made them think more about the mechanisms that cause heat transfer between the stream and the sediments than simply taking temperatures. All students stated, however, that they believed that their final measurements for the water bath, stream and sediments accurately reflected the temperature of its environment within one degree of the actual temperature - consistent with the claim of the manufacturer.

7.2 Determination of God's Will

After students had been asked to state how believable the temperature gauge's measurements and their interpretations of its performance were, they were asked to provide a similar statement of how certain they were that God had led them to choose engineering as a career. I gave them four choices as a starting point: 1.) Information resulting from career interest exams, 2.) a feeling for a God-given talent, 3.) a direct answer to prayer, or 4.) a random selection. I was amazed by the similarity of the responses. Nearly all mentioned similar levels of the first three choices as being the major reason they were taking engineering at Walla Walla College. Specifically, everyone mentioned that tests had pointed out engineering as a potential interest, they felt that God was generally blessing them in the pursuit of their engineering degrees, but they relied most on the feeling that their talents and interests were primarily in practical technology applications which required significant design analysis. Until they heard God's pointing them in another direction, they would continue along their chosen paths. Due to the consistency of results, I wondered if responses would have been significantly different if I had provided other alternatives, or simply stated the question with no potential explanations.

8.0 Questions Regarding Christian Professionalism

The final section of the field experiment synthesis required students to formulate a question regarding Christianity and its impact on their professionalism. They were to provide an initial response, send it to me while I was traveling via electronic mail, and submit comments to the response I sent them with the final field experiment worksheet. The goal with this exercise was to have the students actively consider God's impact on their professional undertakings. In essence it was a parallel measure to having them make suggestions for improving temperature measurements.

There was no repetition among students with these questions. In general, half of the student questions involved hypothetical situations where there were conflicts with work colleagues or moral questions that arose while working; two students continued with the idea of how God can impact our day-to-day work philosophy, and two students used the opportunity to vent frustrations about a church doctrine or the instructor's teaching style that limited them from more fully experiencing God's guidance for them professionally.

Three of the questions, initial answers and the instructor's responses have been reproduced in the appendix. Unfortunately, only 1/2 of the students provided a rebuttal statement, and due to the instructor not keeping a copy of the final statements, only one of the exchanges has been reproduced in its entirety. Three things were evident from the results. First, the two week lapse between when the field experiment was done and when it was turned in to the instructor provided adequate reflection time for the thought questions for some students, while the break allowed other students to completely forget the requirements on the worksheet, i.e. providing a rebuttal for the instructor's comments. Second, combining professional decision making in a Christian context with normal classwork assignment was a novel experience. Two students specifically commented that they thought it was appropriate and appreciated. Finally, it was apparent that each student was capable of using their Christian belief system and applying it to a real-life or a philosophical question that involved their professionalism. Even the students that really didn't understand the assignment still showed no hesitation to trying to use a Christ-centered approach to answering a question about life. While not providing a proof for George Mutch's thesis (1987) that students using experiments to test their own faith through learning would be the best method for integrating faith and learning in a scholastic setting, it was evident that each student was engaged in the activity and appreciative of the fact that the instructor didn't have all the answers.

9.0 Synthesis and Critique

From the students' short-answer responses and their valuation, it was evident that both the technical objectives of the field exercise (calibration of field equipment and identification of the tool's utility) were successfully met. Of particular interest was that each of the students thought the gauge would work well for sensing temperatures, despite the ice-bath measurements failing to provide an absolute measure of the accuracy of the temperature gauge. Student responses regarding laboratory calibration of the temperature gauge that were written on the manufacturer's calibration certificate indicated that fundamental questions of the gauge's ability to sense temperature accurately were well understood for controlled settings where intrusive measurements do not alter the temperature of the system they are measuring. For field measurements, students also indicated a good understanding for different response time requirements for the temperature gauge in the sediment than in the stream itself. However, there was no question in the experiment worksheet that caused them to reflect why there was a difference between the two measurements. Since the experiment already takes three hours and introduces quite a few new concepts - both technical and spiritual, I perceive that using a subsequent lecture to have students reflect on what mechanisms cause the delayed equilibrium response in the sediments would be most beneficial.

Specifically, the results from a finite element representation of heat transfer from the temperature gauge to its surroundings (Cole and Cole, 1998) should provide an independent perspective for students to comprehend how temperature measurement methods actually affect the systems they are evaluating. Another homework assignment would be required to reinforce students' understanding of the heat transfer involved with temperature measurement. Since civil engineering students do not take a specific course in heat transfer, they have only a few lectures in physics to help them understand convection, conduction and heat storage. Having them investigate the impact of different heat transfer parameters on the temperature equilibration time using the finite element solution would be beneficial in reinforcing both heat transfer mechanisms and what the temperature measurements are actually used for.

I was very pleased with the results of the field experiment in terms of the two spiritual objectives as well. The transition from certainty in technical decisions and certainty of God's presence in career goals appeared well understood by students and their short answers provided significant insight in to how they look to God to lead them in their careers. I will look forward in future years to see if the similarity in reasons for choosing engineering as a career continues. Furthermore, there are other questions concerning uncertainty with aspects of professional practice that could be considered, also. Given the length of the experiment and the emphasis of having the students develop their own questions, the transition question is likely adequate as implemented herein.

The personal questions and the exchanges with students were a success in the sense that there was significant effort on the part of students to consider their personal beliefs in making ethical decisions or shaping their philosophy about the contribution of belief to their careers. I was disappointed that only a little over half of the students correctly completed the communication exchange as it was outlined in the worksheet. I believe that it is necessary in future years to remind students of the requirements for the belief questions. It was evident that for two students, that they were perturbed by the fact that they lost points on the assignment simply because they didn't provide a final word to the responses I wrote to them. I find it imperative both that they have the final say regarding their questions, and that the experience not be soured by a few points being subtracted after they have put significant effort into formulation and initial answers to their questions.

10.0 Conclusion and Acknowledgements

My initial thesis maintained that engineers have several professional considerations which may cause them to have inherent difficulties comprehending the will of God for them with any certainty: short project duration, frequent technological changes, and required method modifications for most projects. The goal of this field experiment was to use an exercise with a less-than-certain outcome and see if making conclusions under those circumstances could be similar to making decisions on spiritual matters with something less than God providing an answer written in stone on a daily basis. It was apparent to me while reading student responses for the calibration of the temperature gauge that they truly wanted to believe that the gauge was accurate within one degree of the actual temperature as the manufacturer had claimed. When they had two independent analyses - the manufacturer's calibration and field measurements that verified the one degree accuracy, they appeared completely unperturbed by the laboratory measurements that could have been interpreted as contra-indicative to the manufacturer's statement. This was the same impression I received from their responses regarding their choice of engineering. They believed that God had provided them with talents and they genuinely wanted to be blessed with the certainty that he was leading them to that decision.

Students wish to know that God is leading in their lives. Experiments like this can be developed that acknowledge uncertainty, but help students see that conclusions can be reached even without complete answers. Hopefully, these measures will hinder a career choice from derailing one's belief in God and supply the student with more confidence in their professional judgement. I doubt that such professional difficulties are present just in the engineering field, hence, combining spiritual views with career considerations or in answering technical questions should reinforce in students' mind for many disciplines that God wishes to be integrally involved in all aspects of our lives. "Christ is both the truth and the way to it" (Copiz, 1989, p. 271). Hence, reliance on him and his revelations are the only certainties in questions of theology, medicine, and engineering.

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APPENDIX

Three of the questions regarding professionalism with students' initial answers and the instructor's responses are listed below. Unfortunately, the students final responses were returned after the worksheets had been graded; only the last question includes the student's final response.

11.1 How do you explain to a client that God gives you extra wisdom if they don't believe in God's power? Is it your duty as an ethical engineer to tell them?

Preliminary Answer: I believe that God should be a large part of my life and my career, but I don't believe that every client will understand this or agree with it. It is important to ask God to guide in all decisions including engineering decisions, but this doesn't mean that every impression you receive is an impulse from God. I think it would be important to ask God to help us make the correct decisions based on our engineering knowledge. But it is also important to be able to explain to a client why you made the decisions or choices that you did and give them well-based answers, not "God impressed me to".

Instructor Response Thought 1: I am interested in what "extra wisdom" you might be addressing here. Have you felt during your college experience that God has helped you achieve more than you could on your own? Do you think that he would help you gain a competitive edge over other clients? Or would this be more along the lines that simply knowing that there is a God that you can trust, that you believe that he will help you in all your undertakings as long as you wish to submit yourself to his will?

I ask this only because I have the feeling that if you are to share some of this "extra wisdom" with a client, it will need to be tangible or maybe better stated would be describable.

Instructor Response Thought 2: I wonder how the admonishment to "Pray without ceasing" would fit into your answer. I prayed for two years for God to help me integrate more considerations regarding reliance on him into my coursework without upsetting the potential expectations of my "paying clients" for focus on technical knowledge. I didn't feel there was much of a response until I started thinking about this lab while I was doing my field research. Yet, I believe the potential for being a problem is still there. However, the way that things came together in the lab preparation suggested to me that I should continue. I believe that you are on the right track in going at such revelations to your clients gingerly. However, I caution you that I don't know that you will ever feel that you have a "well-based answer" for your client. I know I certainly don't have many except that God certainly shows me the way in some decisions. But, I think that going forward in discussions with some of your clients in a spirit of humility, i.e. "You know, I've found that my faith in God and prayer life has at times allowed me to understand more of the problem that I am trying to solve than I thought possible in the time I had to solve it ..."

Good question. It certainly was clear enough such that I could respond to it. Hopefully the response was comprehendible!

11.2 How do we draw the line between what God's will is in our lives and our own interests in a profession? I prefer to follow God in whatever I do, but His still, small voice seems a bit too small at times. I have had to face this question on several occasions, particularly when I was recently trying to decide if the engineering profession was where God wanted me. His answer was never loud and clear, so I have continued with my decision, in part, based on the idea that He has not presented anything He would rather have me doing. My question is then, what is the best way for me to discover God's will as I make decisions on a profession and particular fields of that profession?

Preliminary Answer: In order for me to even recognize God's will in my life I must establish a crucial line of communication with Him. Communication with God takes time and effort just as it does with anyone here on earth. Prayer is the most vital of our communication links with God, daily prayer and what I have personally coined "integrated prayer". "Integrated prayer" is when I try to do my praying throughout the day, before I do anything of significance and even when I am not. I am trying to involve God in everything I do and in every decision I make.

Only by taking time to pray and more importantly, time to listen to God can I know or comprehend His will in my life. When it comes to my professionalism I think God has supported me thus far and as long as I intend on keeping his will as my upmost in my profession, He will support and aid me in my decisions. God has given us a freewill with which we must make our own decisions. In my case I think it was a matter of my freewill to choose a profession, now that I have I think God will support and bless me if I continue to use my decision to honor Him.

Instructor Response Thought 1: From the Bible it seems that God led people to different tasks and they basically kept the same "career path" for the time it took to narrate their story. I don't know if the reporting was incomplete, or whether we simply live in a substantially different world than they did. I think of Joseph's example where God moved him from different jobs while Joseph continued in his devotion to Christ and flexibility in his willingness to work in adverse conditions or not. My guess is that scenario may reflect our contemporary work environment better.

Instructor Response Thought 2: I cannot agree with you more that I think your "integrated prayer" is the best way to keep in touch with God. If you are in constant commune with him, you are not only able to talk to him about the bigger "career move" decisions, but about the everyday relationship or technical decisions which may be an even greater impact on your professional peers.

11.3 If I own my own business and I am struggling and therefore decide to be open on Saturday, 1) will I look like a faithless weakling, 2) be sinning and hurting God, 3) lose the blessing that comes with the wonderful rest on the Sabbath, 4) gain profits and get back on my feet, or 5) becomes a shrewd businessman and gain the respect of the colleagues that have witnessed my brilliant climb up the corporate ladder?

Preliminary Answers (my opinion):

1) In the eyes of my family and loved ones, who would still support me, I would see disappointment and confusion in regards to my decision. 2) I would be sinning. But God's sadness would stem from pity He feels for my lack of time to spend with Him, not from anger. 3) I would lose the only truly happy day and the blessings that come with it. 4) I think that God would bless me even more if I didn't open on Sabbath. 5) I don't think my colleagues would respect an overworked, grumpy, unsatisfied, and difficult person as well as a rested, happy, satisfied, confident person who stands up for what he believes.

Instructor Response Thought 1: To me the biggest loser regardless what those around you think of you or how your business responds would be you. True you would be breaking the fourth commandment, hence, I think both the old and new testament suggest strongly that such behavior would be construed as sin in terms of the law. But Christ points out directly that while Sabbath is the Lord's day, it was made especially for man. Hence, one of the greatest blessings that God made for us in this life, you would be foregoing to simply be "successful".

Instructor Response Thought 2: Given the world around us, I am not so certain that these tangible measures couldn't potentially swing in the opposite direction. In the short run, your family and friends might be "understanding", your profits could boom, and your colleagues might want you to run for public office due to your savvy. But it might be that God was suggesting to you that he had a different success story in mind for you when he allowed your business to go downhill - or even go under. To me the greatest act of faith - and potentially the greatest long-term reward for you - might be to keep the Sabbath even if it means the failure of your company. It may be that you find what else he has in store for you to be twice as rewarding!

Student's Final Response: I agree with you on all counts. In fact, my question that I sent you is not really one that I feel needs addressing in my life since my beliefs about the Sabbath and its importance are firmly planted in my mind. I wanted to hear your opinion!