

Would it naturally happen? – faith and engineering integration at a Christian university

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Abstract

In 2016, at Eastern Mennonite University, we started a new Engineering program. We emphasize service-learning experiences in our program. Students are also required to take core curriculum courses in areas such as Christian faith in our university. With the help of these built-in curricular elements, does faith animating learning (Davis 2017) in engineering happen on its own, or do we need to do something more deliberately to achieve it? This is a particularly important question for us to address when developing and implementing our engineering curriculum.

To that end, I have conducted surveys and interviews with students in the Engineers for a Sustainable World (ESW) club to learn about how they have experienced faith and learning in the engineering program at Eastern Mennonite University (EMU), with a goal of a systematic approach to integrating faith into our engineering curriculum. From this study, I found that students understood the importance of serving others and recognized the importance of Biblical morality in engineering study and practice. However, they are less sure about using Biblical illustrations and presenting Biblical truth to address issues in engineering. Students would like to see examples of faith in action in real-world situations and desire systematically organized discussions about faith and engineering. They noted that the service projects in the ESW club have helped them gain knowledge of faith applied in engineering.

This study has helped us decide to include a unit on faith and engineering integration in the Engineering Ethics course. Students also expressed that they would appreciate group discussions with various topics and different group sizes.

Keywords: service-learning, faith and engineering integration, curriculum

Introduction

We started our Engineering program (with two concentrations: mechanical and computer engineering) in 2016. What would the uniqueness of our engineering program be? What would an engineering program in a Christian liberal arts university entail? We asked these questions at the conception of the program, and we continue to address them today.

Choi (2015) provided views for the question, how Christian higher education in engineering may be directed, in six aspects. The author suggested, “we need to raise our future engineers with visions and callings from God, [... and] should help students to cultivate characters and attitudes that are suitable for mature and responsible Christian engineers who are not of the world but are still actively living in the world in order that they may transform the world.” Brue

(2015) suggested sowing seeds of grace in an engineering profession and preparing the soil for grace via an engineering curriculum. Jordan (2015) observed that Christian worldview construction is the liberal arts component of a curriculum such as literature and philosophy, while disciplines such as physics and engineering might be considered minimally worldview oriented.

In the process of developing our engineering program, we have considered collaborations with various departments in the university as well as organizations outside of the university concerning the integration of engineering education and faith. For example, we consider collaborating with the Bible and Religion Department in the development of our new Engineering Ethics course, where they offer Ethics in the Way of Jesus course. Also, the cross-cultural study is an integral part of students' experience at EMU. We plan to develop and implement a cross-cultural program via collaborations with the Mennonite Central Committee, a worldwide ministry of Anabaptist churches, for humanitarian projects.

While exploring the best practice of and a systematic approach to integrating faith into our engineering curriculum, I, further, turned my learning to my students. I conducted a research study titled "The course of faith animating learning in engineering at EMU." The goals of this study were (1) to learn about the current status of faith integration in engineering at EMU; (2) to determine the path we should take to implement faith integration in our engineering curriculum.

Methods

I conducted surveys and interviews with students in the Engineers for a Sustainable World (ESW) club at EMU to first learn about how the students have been experiencing faith and learning in our engineering program. The ESW @ EMU club is a project-orientated club that promotes sustainability around campus and beyond. Some non-engineering students are members of the club in addition to the many engineering students. The reason that I chose this group of students for the study was that they experienced service-orientated learning opportunities through team projects in addition to their regular course work.

The survey and interview questions were listed in Table 1 (a) and (b), respectively. The first eight questions were adapted from Halsmer et al. (2016). The first six questions used a Likert-type scale listed under Question 1. The responses were analyzed using Excel.

Table 1 (a) Survey questions

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|----|---|-------------------|----------|---------|-------|----------------|
| 1. | I have knowledge and understanding of how Christianity and a Biblical worldview relates to engineering. | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
| | | 1 | 2 | 3 | 4 | 5 |
| 2. | I understand the relevancy of Christianity and the Bible to learning engineering, and vice versa. | | | | | |
| 3. | I can use Biblical illustrations and examples to shed light on academic issues in engineering. | | | | | |

4. I can present Biblical truths and principles to address current issues in engineering.
5. I understand how Biblical morality and ethics are important in the study and practice of engineering.
6. I understand how knowledge of engineering is important for serving others, both materially and spiritually.
7. Please provide further details on any of the above statements:
8. What suggestions would you give for improving faith and engineering integration?
9. I gain my knowledge of faith applied in engineering through (circle all that apply)
 - Experience in ESW through service learning
 - Engineering classes
 - Math and sciences classes
 - Humanities classes
 - Church, family, and friends
 - Others (please specify):
10. Would you like to see a course (maybe one credit including assigned reading, in-class discussion, and reflective writing, for example) dedicated to faith and engineering integration? (circle one)

YES	NO
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(b) Interview questions

1. What and how does ESW experience help you grow in faith?
2. How does your faith motivate your learning in engineering?
3. How important is it to you to integrate faith and engineering?
4. What do you like that is happening at EMU in regard to faith and engineering integration?
5. What would you like to see happening at EMU in regard to faith and engineering integration?

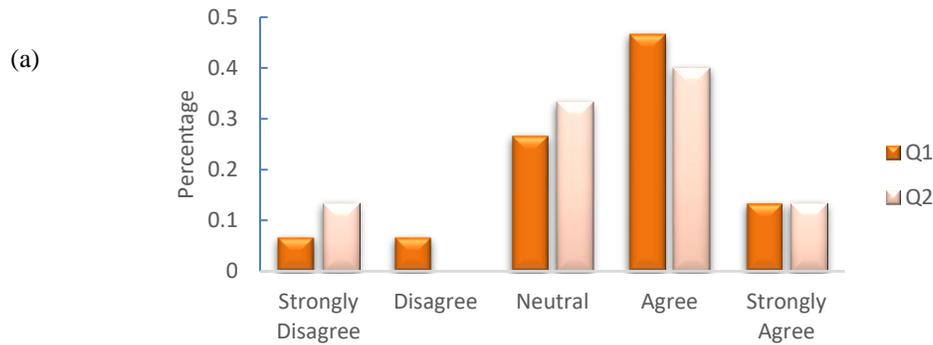
Results

The project is a baseline study, through which I seek to learn about students' perception of the topic of faith-animated learning in engineering. This will help us plan and implement faith integration in our engineering curriculum.

The survey results of the first six rating questions were summarized from responses of fifteen engineering students and shown in Figure 1. I graphed the responses to the first two questions in Figure 1(a), questions 3 and 4 in (b), and questions 5 and 6 in (c). Students felt they somewhat understood the relevancy of Christianity and the Bible to engineering (Figure 1(a)). However, they were less confident about using and presenting Biblical truth in engineering (Figure 1(b)). They were very positive about the importance of Biblical morality and serving others (Figure 1(c)).

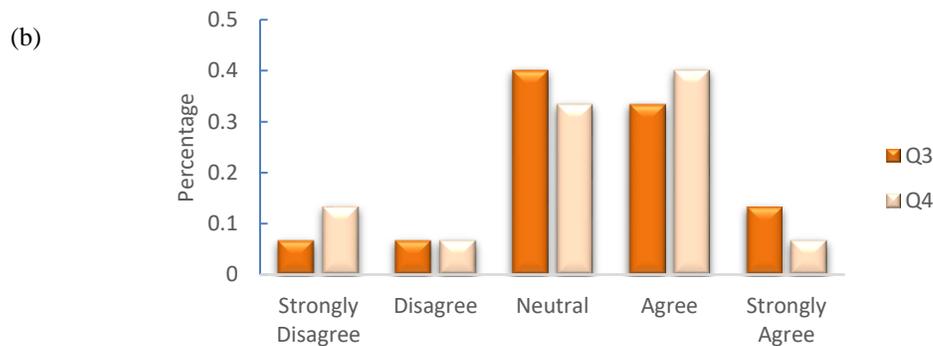
Many students provided further details regarding their responses to the six rating questions. For example, Student 1 said, "I think that anything can be integrated with faith and you should do all that you can with faith as a foundation." Student 2 commented, "I feel like I have a strong moral compass and have some understanding of the relationship between responsible

engineering and faith, but I don't know that I have experienced the faith being emphasized in classes." Student 3 suggested, "I would agree most strongly with the last question about using engineering as a tool to serve others. However, I am not sure that this is best done by viewing the work of engineering through a Christian or faith-based lens. I think the work of helping others through engineering can be carried out in many different ways." Student 4 said, "Stewardship is an important element of Christianity, and it is highly prioritized in ESW."



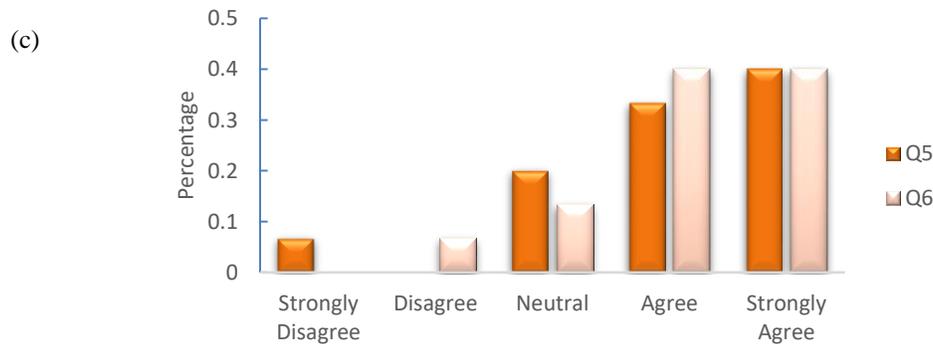
Q1: I have knowledge and understanding of how Christianity and a Biblical worldview relates to engineering.

Q2: I understand the relevancy of Christianity and the Bible to learning engineering, and vice versa.



Q3: I can use Biblical illustrations and examples to shed light on academic issues in engineering

Q4: I can present Biblical truths and principles to address current issues in engineering



Q5: I understand how Biblical morality and ethics are important in the study and practice of engineering

Q6: I understand how knowledge of engineering is important for serving others, both materially and spiritually

Figure 1. Survey responses to the six Likert scale questions.

When students were asked where they had gained their knowledge of faith applied in engineering, the category “Church, family, and friends” scored the highest (13/15) followed by “Experience in ESW through service learning” (9/15), and “Engineering classes” (8/15), then “Humanities classes” (7/15). I was a bit surprised by this result. I thought we had not given ample time and space for the faith and engineering discussions in our engineering curriculum, yet students were able to pick up the information.

Students offered suggestions for improvement of faith and engineering integration. Some of the responses were: “Having more discussions about ethics and faith in our engineering classes”; “Look at more current issues in engineering and analyze how they relate to faith”; “Perhaps by suggesting or requiring other courses here at EMU focused in this area, not only the core Bible credit”; “Maybe a class examining engineering in the Bible, and how the Bible ‘tells’ us to engineer”; “Also with ESW doing service events and talking about faith”.

I certainly saw students desire more learning in this area. Out of the engineering students, eleven of the fifteen wanted to have a suggested 1-credit course dedicated to faith and engineering integration. I also asked the non-engineering major students in the ESW club their opinions on this topic. Eight of the nine students embraced the idea of a new course. They wanted to make sure that other majors would be welcomed in the proposed course. “If such a 1-credit course is in fact offered, it may be beneficial to make it include CS (or even math) as well, as both will encounter similar issues regarding faith and technology.”, one student said.

I also interviewed eleven of the students to further the discussion. I found that students appreciated the community we built around the Engineers for a Sustainable World club. They recognized that the projects they did in the club were beneficial to the environment as well as encouraged stewardship. They all believed that faith and engineering integration was important. They talked about how their faith motivated them to help others, to be diligent, and to have a purpose in life. Some of them felt the calling of studying engineering. Speaking about the future, they all expressed the desire to have more discussions about faith and engineering either in a designated course or embedded in different courses. One student observed that faith meant different things for different people and hoped that would be taken into account in a class discussion.

Discussions

In this study, I learned that an engineering program in a Christian liberal arts university needed to emphasize faith-animated learning intentionally. One of the areas in EMU’s core curriculum is Christian faith with the goal for students to be able to “articulate Christian approaches, explain Anabaptist faith traditions and recognize expressions of these approaches and traditions in contemporary life” (EMU Core Curriculum, 2019). However, the connection between faith and engineering may not naturally happen for students. They, in fact, would like to have more discussions and see real-world examples as one student suggested, “we could get other people’s perspectives and how they integrate their faith into their job.”

Students have recognized community building and service learning in the Engineers for a Sustainable World club. However, we have not intentionally talked about faith while working on

our projects. This club presents a venue where we can have discussions at our club meetings and invite speakers in the field of engineering to talk to the club about their faith journeys.

Ultimately we would like to incorporate faith-animating learning in our curriculum. Our program is new. We have not established a thorough approach as Sikkema and Vander Werff (2015) did, where they had a set of five distinctively Christian guiding principles for engineering that they implemented and evaluated in their civil engineering curriculum. Che (2017) focused on “the development of a system of thinking that related engineering with theology”. Nonetheless, we have decided to have a faith and engineering integration unit in the Engineering Ethics course that we will offer in the next academic year for the first time. We plan to have assigned readings and reflective writings, in-depth in-class discussions, case studies, and invited talks. This is a starting point. We will determine the best practice of and a systematic approach to integrating faith into our engineering curriculum.

In addition, I am continuing the interviews with students who have completed their cross-cultural learning, which is another core requirement at EMU with a goal for students to “develop a critical awareness of themselves and others in local and global contexts” (EMU Core Curriculum, 2019). I want to do a comparative study of their views on faith and engineering before and after the cross-cultural experience. Also, I have been selected into the Lilly Faculty Fellows program engaging the intersections of Christian thought and practice with the academic vocation. This will provide an excellent opportunity to further my learning and to help advance the integration of Christian faith and academic practice at EMU. My hope is to instill faith into students’ learning at EMU and thus better prepare them to serve each other and to serve God.

Acknowledgment

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