Abstract - Worldview is defined as the conceptions, explicit and implicit, of an individual on the limits and workings of his or her world. Research in science education has shown that students’ worldviews can affect their ability to learn science. We will extend this research to engineering education. In addition to this, we hope to determine if there is a disconnect between the worldview of the established engineering education community and the students entering the community that hinders the ability to recruit and retain students in an era of declining enrollments. To address these questions, we will first review existing worldview theories to find components that appear to be relevant to the study of engineering. Secondly, using both quantitative and qualitative methods, we will explore the relevant worldview components of four cohorts of students at a medium-sized Midwestern public university: first-year declared engineering students, first-year non-engineering students, senior engineering students, and senior non-engineering students. Results from both these activities will be presented.

Index Terms – Worldview, Recruitment, Retention.

INTRODUCTION

Worldview is defined as the conceptions, explicit and implicit, of a society or an individual on the limits and workings of its world [1], and the focus of our work in progress is if, why and how this concept affects engineering education. Specifically, the goal of this research project is to increase the understanding of the interaction of worldview and engineering education in order to improve the practice of engineering education and the recruitment and retention of students. We have begun our study with the initial research questions:

1. Are there worldviews that are more compatible with the study of engineering and if so, which ones?
2. What are the worldviews held by students and do they vary by major or class standing?

At this early stage of our work, we have mostly raised questions that we believe encourage its continuation. We have first reviewed existing worldview theories to find components that appear to be relevant to the study of engineering. From this we have developed the general features of a worldview model to use in our investigation. Before the conference, we plan on developing means to assess worldview and apply these with a pilot group of students. In addition to this we will identify appropriate real-world questions and worthy applications (student recruitment, pedagogy, et cetera).

BACKGROUND

Worldview has its origins in the field philosophy and is derived from the German word Weltanschauung first used by Kant as a sense of the world [2]. The concept has been applied to psychology, sociology, anthropology, theology and recently to K-12 science education. As expected with its use in so many diverse fields, there are various definitions and theoretical models of worldview, none of which have universal acceptance. Space constraints prevent a presentation of the breadth and depth of worldview theories developed but some examples can be found in the references [3-8].

Research in the area of worldview has revealed several findings with the first being that some worldviews are more compatible with learning science than others [9,10]. It was also found that students can modify their worldviews [11] and can accommodate multiple worldviews [12], and that some academically able students avoid science-related careers because of incompatible worldviews [13].

THEORY

We propose to use the following basic precepts of worldview in our work:

- While worldview is influenced by the culture of a person, we interpret it as being unique to the person.
- Persons’ worldviews will control what they perceive as possible, what they devote their attention to, and what explanations of perceptions are plausible.
- Worldviews are precognitive with no claim of being based on rational or even scientific principles and have no claim on universality.
- While worldviews are deeply held, they may change through a person’s life.

We have also decided to take a pragmatic approach in developing the worldview theory we will use. Similar to the models typically used by engineers, we want to choose the simplest model that will give results with adequate accuracy. We recognize that our model is not necessarily unique and that there are other perfectly valid models. That said, our model has the following categories borrowing heavily from Kearney [9] but making accommodations to be able to incorporate other theories:
Categories: How does a person divide the world into different entities and how sharp are the boundaries between these boundaries? The actual categories will depend on the particular worldview but could include distinctions such as self/non-self, human/non-human, animate/inanimate, and spiritual/material.

Relationships: How do the different categories interact with each other? This would include power issues such as if man is subordinate, superior or equal to the world, and communication issues such as valid ways of getting information about the world.

Causality: What is the nature of changes? This would include causes – what can effect change, values – what change should occur, and ends – what changes will occur.

Time and Space: How are consistency and change organized? This would include both orientation – what is the reference time or place, magnitude – what is a “long” time or distance, and in particular for time, path – is it linear, circular or random.

ASSESSMENT

Since there is not a single theory of worldview, we were not able to find a single universally accepted means of measuring worldview. We plan on developing both quantitative and qualitative instruments to measure worldview and test them with a pilot group of four cohorts of students at a medium-sized Midwestern public university: first-year declared engineering students, first-year non-engineering students, senior engineering students, and senior non-engineering students. Results from both these activities will be presented.

APPLICATIONS

At this time we can only speculate as to what we might find concerning the importance of worldview to the successful study of engineering. At the most basic level one would assume that certain worldviews or portion of worldviews would be helpful or harmful in this endeavor. Consider a hypothetical international engineering student having a non-Western worldview. Horton [14] speculates that worldview in traditional societies holds that there are no coincidences, i.e., that everything has a cause. If true, this belief might hinder the ability of such a student to understand random processes and their role in engineering design. Instructional materials and techniques that recognize and address these differences could be designed and adopted to help such students.

While students’ initial worldviews may hinder their ability to become engineers and technologists, in science education it has been shown that they can compensate for this by modifying their initial worldviews [11] or accommodating aspects of the different worldview along side their current views [12]. For example, many engineers who profess to a religious faith would say that words do not have the ability to control nature at work but would say that their prayers mattered at their place of worship.

One other level of application of worldview to the study of engineering would be the effect of differences in worldview in the educational environment. Is it beneficial for students to have a worldview similar to that of their instructors or text or even their cohorts? The aspects critical here could be those obviously related to engineering or they could be non-related.

Besterfield-Sacre et al found that students who left engineering in good standing had significantly lower positive “perception of the work engineers do and for the engineering profession” and did not “enjoy math and science courses” as much as other students [15]. While there could be many factors that could contribute to this, we hope to determine if there is a disconnect between the worldview of the established engineering education community and the students entering the community that hinders the ability to recruit and retain students in an era of declining enrollments.

REFERENCES