I. Teaching and Learning Philosophy

A. Introduction

To develop a society that is inclusive and respectful, I believe there is no better foundation than a citizenry that is open to differing points of view, with the willingness and ability to judge the merits of those views based on critical analysis. My firm conviction is that this level of tolerance and respect is developed through education – not only by improving content knowledge, but also improving the ability to critically assess what is put forward as the truth. In this regard, I put a high value on the learning process - and critical thinking skills in particular - above the content itself, although of course the content is important as well.

In my opinion, this education is put into effect through a social contract into which the student and teacher enter. Although this contract may be recognized as implicit in the undertaking of a course or degree program, I think it is important for an educator to make this contract as explicit as possible. Thus, the teacher contracts to provide content knowledge and to demonstrate and foster critical thinking skills. Students contract to practice the methods and challenge themselves to synthesize new modes of thinking.

B. Learning Paradigms

Over the course of the years as an educator, I have discovered that there are several overarching principles that guide how I approach design and delivery of learning episodes, and in curriculum design as well. **I believe students learn best theory is put in context**. Just recently I learned that my approaches align well within a Constructivist educational framework. Constructivists believe that learners blend their past and present knowledge acquisition experiences to make new discoveries, often transforming and reshaping information through active observation in contextualized situations appropriate to their discipline. For me, this is Engineering, although what I am most passionate is helping learners make the linkage between theory and models (e.g. math and physics) and practice (engineering application). The main principles that I see as fundamental in the educational process are as follows.

My ultimate role is to empower students to "learn how to learn." As a teacher, I can best do this by providing the example of how to analyze problems critically. I try and vocalize my thought process and encourage students to also do so in small discussion groups. By developing these skills through discussion and practice, students learn how to acquire new knowledge themselves when they approach a new problem. This also gives them the confidence to seek out and research different ways of problem solving and discover what works for them when trying to learn new material.

I actively seek for and incorporate 'eureka' moments to motivate students to want to learn more. Students are often surprised and elated when they are blindly led to important physical phenomenon that can be teased out from theoretical models (e.g. the speed of light). I carefully script the path we take – my blinders have already been removed – but it can lead to moments of real inspiration in the students. For this inspiration to take hold, the cognitive environment for the individual must be ripe: their mind must be open to new ideas, and they must actively discover common links between subject. I capitalize on their existing knowledge to draw analogies with which they can relate, wherein new concepts are introduced by building upon concepts that students have already learned, and then teasing out the new concepts in the context in which they are encountered in practice.

I recognize that in most disciplines, there is a requirement for the student to learn some foundational knowledge. Students must learn the appropriate vocabulary and the necessary tools to succeed in the

discipline they have chosen. For example, in engineering, it is necessary for the student to have a foundation in the language and construct of mathematics before they tackle a problem in physics. My role is to provide the base structure and norms, and the student in turn must become intimately familiar with them. For the student to learn to apply these structures to problems in various fields, I focus on developing their critical thinking and reasoning. Ultimately the student should become more involved and take control of the learning process through collaborative learning. This also helps to promote a sense of self-worth in the student.

The most useful tool in science and engineering is language. I strongly believe that a student must learn how to communicate effectively. Expertly developed critical thinking is good to no one if you can not communicate your ideas effectively to others. I challenge students to explain their reasoning, not only to develop their critical thinking skills, but also to prepare them for the world beyond school where that will be part and parcel of what they do.

I strive to create communities of learners. It is important to foster an environment where - over an extended period - small groups of learners create a trusted community to share in the communal activity of learning. As individuals approach learning a new topic, they bring their own subjective view and interpretation. The community of learners provide feedback and help the individual to iterate on their interpretation, and over time help them discover new ways of tackling new learning tasks.

C. Modes of Teaching

Students of engineering pass through various stages of learning. When students first enter engineering (and university in general), they are entering a new world, though it is built on a foundation of high-school level fundamentals. As they progress through their degree, they must become more familiar with engineering theory and practice and develop the skills and methods to tackle problems critically. Each stage demands a particular teaching style or model.

For most of the core engineering knowledge, my role is to help them acquire and master this core knowledge and set of constructs. Then I must give them opportunity to apply this core knowledge to problems that increase in variety and complexity as they progress to more applied courses.

By actively pointing out common themes in different subject areas, I encourage students to see the bigger picture. There are so many examples in engineering and science that can be used to show how common ideas are shared between topics and methods they previously may have seen as separate. I find that these are powerful tools in the Constructivist mindset to show that they can just build upon what they have learned before. In this pursuit, it is the method rather than the content that I stress, by drawing on analogies with which the students can relate – e.g. the flow of water in a pipe and the flow of electrons in a circuit.

I create opportunities for students to actively engage with problem solving and critical thinking. It is vitally important that students get ample opportunity to practice their problem-solving skills. It is not enough for them watch someone else solve a problem; rather I strive to get them to solve problems but with help through scaffolded questions, peer-help, TA help, etc. Throughout this process, the students must be challenged to establish the link between theory and practice and develop sophisticated reasoning. Working in learning communities is a great way for them to build their critical thinking skills by having to defend their arguments with their peer to come to a communal answer to a difficult problem.

I believe students must engage with Engineering as a profession. Students in engineering are learning to be professionals while still at school. The teacher/student relationship in this role is one of mentor and apprentice. In this respect, we must lead by example and maintain a high level of integrity, responsibility, and accountability. In their profession, they will be expected to analyze problems and propose solutions, as well as defending their choices for solutions. As such, I put them in learning situations where they can practice these skills by defending their argumentation and becoming aware of their cognitive processes when developing their solutions.

I believe in developing Engineers to work as part of a multidisciplinary team. How often will graduate engineers be asked to solve a problem by themselves in the world of work, without anyone asking for aid or seeking alternative viewpoints? With this goal in mind, I think it is important for students to include a variety of humanities courses in their curriculum. Not only will this provide a well-rounded education, but they will also learn to communicate more effectively and keep an open mind to differing viewpoints. In this way, they will become a more effective member of the team and develop a higher sense of self-worth in the process.

D. Methods

I think there are some general guidelines that I try to adhere to in my duties as an educator:

I must be organized and punctual - I know that I felt much better as a student when I received a clear course outline at the beginning of the course, outlining goals and objectives, as well as a clear marking scheme. In terms of student evaluation, I think it is important as a matter of respect to mark and return tests and assignments promptly. If you do not, you can be sure that your classes will continue to be interrupted by questions of, "So..when are we going to get that mark back...?"

I must be an enthusiastic practitioner as an educator – I strive to key in to why I love a subject so much and convey that feeling to the students, as I think that feeling can be contagious. That is why I try and leverage eureka moments, as those can open doors of insight that keep students curious. Sometimes this curiosity needs development, so I also always make myself available for questions (within the limits of practicality).

I emphasize problem solving and critical thinking skills - Since this is one of my main tenets, the form of my student evaluations (i.e. assignments, exams, etc.) stresses these constructs. The evaluations emphasize how they got the answer rather than the answer itself. Moreover, it is essential to stress that students must provide clear and logical reasoning for why they came up with the answer they did. In this way, they must demonstrate their communication abilities as well. The laboratories and tutorial periods are the venues in which these skills are honed, and so it is there that I constantly question students and push them to draw links. Finding analogies to relate to what they already know is key to this.

I pay attention to control the environment - As an educator I recognize that we can control the environment in which learning takes place. It is critical that I provide a forum where students are encouraged to speak and think freely, and where alternative ideas can be discussed openly. I set the example of the concept of respecting the views of others by actively encouraging discussions on learning processes and differing approaches to problems. Students that hinder this atmosphere must be taken aside and reminded of the conduct expected of them. With foundational knowledge gleaned in classroom time, and a healthy atmosphere where proposed ideas and solutions are considered and assessed, the

result is a well-informed student that can think on their feet, and has a positive sense of self-worth because they have "learned how to learn."