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The philosophy of teaching engineering is based on the engineering profession's practices, standards and ethics.

Engineering is a professional discipline that is built solidly on two foundations: professionalism and ethics. Practitioners and students of the profession have to embrace the values of the profession, such as sound judgment, leadership and high standards. Engineering educators have to impress upon students that their future careers are not simply putting skills into action, but ultimately protecting the public and working toward the greater good of society.

According to the facilitator's guide to a not-yet-released ethics and professionalism video for engineering students and recent graduates, engineers-to-be have to approach an "Arch of Professionalism"—and pass through when they are fully trained.¹ The Arch of Professionalism essentially is made up of the pillars of professional practice and ethical conduct (Figure 1).

The building blocks of professional practice include skilled practice, continued study and knowledge. Ethical conduct is founded on personal integrity and values according to the Code of Ethics.

Engineering educators should make a conscious effort to cultivate most of the elements that constitute the Arch of Professionalism in a young engineer's character development within the formative study years on the university campus. The seven characteristics of professionalism are:

Making the grade

An engineering education is not just about learning the skills of engineering practice—it's also about upholding the professional engineer's Code of Ethics. Professor Laxman Amaratunga, P.Eng., C.Eng., of the Laurentian University School of Engineering says the challenge for engineering educators is to strike a balance between teaching the tools of the trade and establishing a strong ethical foundation upon which students can build a career.

- ◆ advanced specialized knowledge;
- ◆ intensive study and preparation;
- ◆ continued professional development;
- ◆ high standards;
- ◆ good judgment;
- ◆ ethical conduct; and
- ◆ duty to protect the public interest.

The pillars of the arch must co-exist; professional excellence can only be achieved with ethical conduct. PEO's Code of Ethics identifies a number of characteristics that professional engineers must observe at all times.⁵

Duty first and foremost

Engineering educators should emphasize that an engineer's foremost duty is to protect the interest of the public and the society at large. From the dawn of the Industrial Revolution, the interests of society have changed over time, according to changing needs and expectations. It is important for engineers to identify and respond to the needs of society.

With the oil crisis in the early '70s, engineers were driven by the need for lowering energy consumption and maximizing energy conservation. Most of

their efforts were extremely successful. Others, such as power generation by increased coal-burning utilities, reduced costs but had a negative impact on the environment, directly contributing to the greenhouse gas emissions.

Today's society is enjoying one of the highest standards of living in human history. Its main interests are good health, safety and security, while promoting a cleaner environment. There is a need to develop and harness the natural resources of our planet in a sustainable manner.

Whether we are training electrical engineers for power generation or process engineers to manufacture products from natural resources, today's engineering educators believe in the philosophy of greener and cleaner engineering for the environment. Engineering educators must stress the goal of producing end products profitably and efficiently in an environmentally-sustainable manner with minimum or zero discharge of waste. Elsewhere, a first year course was developed that introduced students to the theory and practice of preventive engineering.²

Early intervention

The Canadian Engineering Accreditation Board should be commended for its recent efforts to recommend the neces-

sity of exposing engineering students to professionalism and ethics, starting in their first year. Similar to the benefits of early childhood education for young children, instilling the values of good professionalism and ethics in first-year university will enable engineering educators to apply the lessons learned in later courses.³ Recently, another Canadian university engineering educator said that, "changes for a better future start at the undergraduate level."²

Keeping current

In the discussion of any teaching philosophy, it is worthwhile to address the issue of incorporating modern, computer-aided tools in the teaching and learning process. Today, engineering educators have come a long way from the use of slide rulers and manual drafting and design. It is extremely important to use the luxury of current and rapidly developing multi-media devices and computer software for today's engineering education. These accessories have made the teaching and learning process simple, effective and efficient. However, a good engineering educator should never deviate from the fundamental engineering principles of applied science and mathematics. Solving engineering problems using a calculator or computer software without a basic understanding of fundamentals is like a monkey with its hands on a keyboard.

Quality educators

In addition to their academic knowledge, many engineering educators bring real-life, industry-specific knowledge and experience to the classroom. This is an extremely important component in the teacher-student equation, helping to keep materials and methodologies current.⁴

As well, research activities beyond the responsibilities of teaching and curriculum development are a tremendous asset for educators and their students. In the role of researcher, the educator may supervise the research of graduate students, thereby contributing to the training of highly qualified personnel for the workforce. Research keeps educators

abreast of new knowledge and allows them to explore new frontiers. In turn, students benefit in the classroom.

Above all, quality educators should make a concerted effort to relate to students and show compassion and understanding in their teaching. The use of humour can also help to deliver messages effectively. ♦

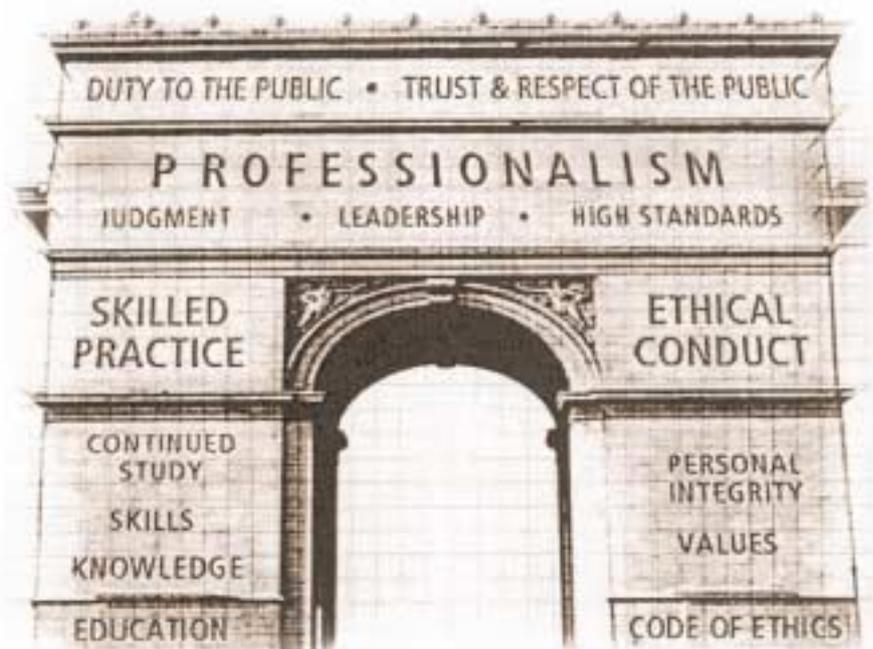
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This Viewpoint is based on a lecture delivered by Professor Amaratunga at the Teaching Excellence Award ceremony held at Laurentian University, March 25, 2003. He is the first engineering professor to win this prestigious award.

References:

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2. Vanderburg, Willem H., P.Eng. "Preventive Engineering for a Better Tomorrow," *Engineering Dimensions* Toronto: Professional Engineers Ontario, March/April 2003, pp. 18-19.
3. Ridler, Jim, P.Eng. "Ethics Education-Building Block for Professional Excellence," *Engineering Dimensions* Toronto: Professional Engineers Ontario, March /April 2003, pp. 24-25.
4. James, Michael. "Laurentian's 'Dr. Lucky' Teacher of the Year," *Northern Life*, April 4, 2003, pages 1 and 6.
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Figure 1. The Arch of Professionalism



Passing through the Arch of Professionalism is a metaphor for taking on the responsibilities and standards of a professional engineer.