

**Chancellor's Award of Distinction**  
**Dr. Medhat Shehata, PhD, P.Eng., FCSC**  
**Statement of Teaching Philosophy**

Every day, I marvel at my immense good fortune to be immersed in a learning environment. For me, teaching is a pure joy, and my passion for the craft rivals, and often exceeds, my abiding interest in research. This energy and enthusiasm are rooted in something I discovered early in my career: learning begins with relationships. I think of my courses, labs and activities as a partnership with my students, a way of collaborating with them to create an optimal learning experience.

When you connect to your students and see things through their eyes, you become a catalyst for learning. I love to spend time with students, and I make every effort to know each of them. I believe wellbeing is a precursor to excellence, and it is my responsibility as an instructor to understand the challenges each student faces so I can make the learning environment fair, inclusive and equitable. Based on direct experience and input from students, I know that when a student feels respected and comfortable, they are far more willing to engage. Therefore, I go out of my way to know as many of their names as possible, invite them to participate in class discussions, and engage with them individually and in small groups. These personal connections enrich the learning process while students are in my courses or members of my research team, but they are also the basis of my ongoing relationships with former students, which are a constant source of inspiration and education for me.

I pursue excellence in teaching with the same vigour that fuels my research, because my students rely on me to help them achieve their professional goals. I love the challenge of continually improving my curriculum, labs, experiments and teaching tools based on feedback from students and peers, exposure to innovative practices, and ongoing input from industry leaders about the latest technologies and techniques. My curriculum addresses the unique features of engineering education and the demands of my particular area of expertise, and as I design the learning experience, I am guided by a central question: what do these students need to succeed as engineers of the future?

To assess the overall effectiveness of the learning environment and curriculum I create, I keep in contact with former students and industry partners who hire graduates from my courses and research team. Dozens of my former students are now thriving in the construction materials industry and working in cement companies, consulting firms, governmental agencies and construction companies. Across the board, employers and recent graduates report that my students are extremely well prepared and excel in the field.

**Fostering student learning and intellectual growth**

The major techniques and teaching strategies I use, and the methods by which I assess them, can be illustrated within five pedagogical priorities.

**1) Student engagement:** I have found that the best learning happens when I grab students' interest immediately and sustain their attention. I achieve this in two ways: first, I ensure students see the importance of the material under consideration – why it matters to their future careers; second, I convey the relevance of the topic to real-life situations. To fulfill this two-pronged strategy, I begin each class with a video or image that invites students to speculate about the causes or conditions that led to a particular problem in the field. Staring at a deteriorating bridge or a dam that is beginning to crack, my students erupt with possibilities and are gripped by a desire to unravel the mystery. The success of this approach is evident in their engagement in discussions, but it is also apparent in the degree to which their performance on assessments and ability to explain concepts improves when we use this method. Former students also report how much they benefited from this approach and that they regularly remember what they learned in class when faced with a similar issue in the field. Students also benefit from a cement factory field trip I organize every year to strengthen concepts covered in class.

The success of this approach motivated me to develop instructional videos I created myself and to collect hundreds of images from my research, field work and extracurricular experiences with students. Videos are particularly effective, especially to support students' understanding of complicated techniques used in the industry. For example, explaining why concrete designers introduce entrained air into concrete leaves students grasping, whereas showing a video of *how* entrained air protects concrete against the freezing-thawing cycles immediately illustrates the point. Showing a video clip of how entrained air is measured in the lab strengthens the point further. My

commitment to relevance also motivates me to continually upgrade the curriculum and lab equipment to reflect recent advances in the materials we study. Former students often tell me they refer to my course materials whenever they face a technical challenge related to concrete, asphalt or pavement in their careers.

**2) Analytical and creative thinking:** I don't want my students to just "do" engineering – I want them to be innovators and leaders. This objective requires that I foster critical thinking and the ability to see beyond obvious features or existing parameters to underlying principles and possibilities related to a problem. My goal is to prepare them to be a force for change and to reach beyond the status quo rather than accepting what is written in the rulebook or guidelines. I want them to have the confidence to improve on existing methods and strategies so they can move society forward.

In large classes, I foster analytical and divergent thinking by framing sessions as discussions rather than lectures. By offering students sample problems and case studies, I can let their questions, responses and dialogue drive the learning while my role is to push them to refine their thinking. For example, if we have established an understanding of the characteristics that enable a structure to last for many decades, I challenge them to figure out why many structures don't endure. Together, they work toward an understanding of various practical considerations, such as economic constraints, and the fact that there is more than one right answer for how to build a structure. This is the beginning of their ability to design for performance by understanding differences such as marine versus land-based structures or the temperature effects of building in Syria versus Iceland.

I supplement this approach with ongoing informal discussions between classes, in labs and during office hours. These conversations enable us to reach toward understanding together and stimulate the expansion of students' ideas and ability to make connections between complex engineering principles, basic science and the techniques we study. To further enrich their capacity for deep thought, I create assessments that emphasize understanding over memorization and push students to explain the reasons behind their answers on assignments, projects and exams.

One particular strategy I use that fosters analytical thinking relates to how I present the current state of knowledge about concrete and asphalt. Rather than saying, "this is what we use and this is how it is being done," I point out unresolved issues in the profession and indicate how current or future research might address them. This approach tends to ignite curiosity in students and often prompts undergraduates to approach me to supervise their 4th year projects (prior to 2011 when a 4<sup>th</sup> year thesis-based project was part of the curriculum), join my summer research assistantship, or pursue graduate studies under my supervision. Related to research, I strongly encourage my students to disseminate their findings in refereed technical journals or conference proceedings to sharpen their thinking and accelerate their careers. As an example, three of my 4<sup>th</sup> year students and I produced and presented a peer-reviewed conference paper in 2008 introducing a new idea pertaining to construction sustainability. The paper was later selected as one of a few for consideration as a journal paper in a leading international journal: *Cement and Concrete Composites*. It was then published (2009) and has since received a high number of citations. Nine years after they graduated, the students who authored this paper are now a Postdoctoral Fellow, an owner of a renovation company and a materials engineer at a leading construction materials firm in Canada.

A final approach I use is to foster analytical thinking is to expose students to existing techniques for testing materials, which I am familiar with as a result of my membership in both the Canadian and American standards bodies in my field. Once students have applied the test, I point out possible modifications that could improve on current methods, which invariably stimulates students to consider alternatives. Specific evidence of the success of this approach is that three of my former students are serving on the Concrete Materials Committee of the Canadian Standards Association, a testimony to the strong technical background they acquired during their undergraduate studies.

**3) The role of engineers in society:** Preparing students to be future engineers is not just an overarching theme, it is a consistent focus in the learning environment. Throughout my courses, I look for opportunities to encourage students to see past the misconception that engineering is exclusively about machines, structures or technology. I want them to understand that engineers enhance the social, economic and technical fabric of our world and can improve the wellbeing and livelihood of individuals and communities. I want my students to always consider the human element of their work. I encourage them to remember that the structures they design, build and repair are someone's home, workplace or transport route. It is also a priority for me that I guide my students to be ethical decision makers – engineers who do the right thing. If they discover something wrong with a structure, no matter

who caused the problem, it is their duty to work toward a solution. And if they make a mistake, they must let people know so that it can be rectified, never hesitating to seek advice from others who have expertise beyond their own. Being an engineer is a significant responsibility, and I do all I can to ensure my students are in the right frame of mind to take it on.

**4) Dual emphasis on technical mastery and soft skills:** Technical mastery will always be an unwavering priority in engineering education, but there is a paradigm shift underway toward supporting students in developing a diverse set of competencies so they can effectively communicate, collaborate, empathize and relate. This shift is widely evident, such as in the focus of the Canadian Engineering Change Lab, which I participate in on behalf of FEAS, and in the move by The Canadian Engineering Accreditation Board (CEAB) to expand its graduate attributes assessment to include qualities not previously core to an engineering education, such as teamwork, communication, impact of engineering on society and the environment, and lifelong learning.

In response to this transformation, FEAS is adopting a cutting-edge framework for learning called the All-in Approach to Education, which is a central focus of my new role as Interim Inaugural Associate Dean, Teaching and Outreach. I am excited about this role, and this change across our profession, because fostering capabilities has always been a fundamental element of my pedagogy. From the collaborative learning environment of my classes to group work in labs, research collaborations and extracurricular activities, I am intentional about creating opportunities for students to practice key leadership skills. As but one example, I regularly push students to explain the rationale behind a conclusion or solution, because their careers will require them to communicate complex ideas to both engineering and non-engineering colleagues. At first, students find discussions and assessments challenging, because they are initially uncomfortable explaining their thinking or communicating complex concepts. But as the courses progress, their comfort and skills grow.

**5) Student competitions:** Given the applied nature of engineering, I have always been an advocate for immersive experiences in which students apply their knowledge to real-life problems. One of the most powerful ways to do so, which also attends to the four pedagogical priorities listed above, is student design competitions. Over the years, I have advised many teams in national and international concrete competitions, such as the American Concrete Institute's Pervious Concrete, Construction and Concrete Bowling Ball Competitions and the National Concrete Canoe Competition. Students join a team of peers to tackle challenges that often go beyond what they have learned in class. These challenges pose basic questions: How can you make concrete with such a high resistance to abrasion that you can make a concrete toboggan that will not crack or fracture? How can you design concrete that is lightweight enough to build a concrete canoe that will float? Can you design pervious concrete that will maximize the strength of the material?

Working together to conquer these challenges gives students enormous confidence and leads them to attain a clarity about the concepts that cannot be achieved without applied experience. Teams I have advised have been very successful in these competitions, and my former students report that these applied and integrated experiences were superb preparation for their careers.

### **My work with colleagues at FEAS, across Ryerson and beyond the institution**

Early in my career, my passion for teaching was channelled primarily into my own instructional practices. But as I grew more experienced, I was drawn to a wider context where I could engage with colleagues in a shared exploration of innovative teaching and learning. In time, leadership became a central focus of my career, and I moved through a series of increasingly broad responsibilities from Associate Chair of Civil Engineering to FEAS Teaching Chair, Interim Associate Dean, Undergraduate Programs and Student Affairs and my newest role, Inaugural Interim Associate Dean, Teaching and Outreach.

My activities as an educational leader are motivated by the same drive that fuels me as an instructor: to achieve teaching excellence. My various roles have confirmed for me that multidisciplinary collaborations are as essential for progress in teaching as they are with research, as has been evident to me in a wide range of partnerships with remarkable educators: my colleagues across FEAS, the team at the Learning and Teaching Office, members of some of Ryerson University's most important curricular policy and program oversight committees, and external academic bodies such as with the Professional Engineers of Ontario or the cutting-edge Canadian Engineering Change Lab. Every one of these experiences has been energizing and inspiring to me, and I am excited to continue to offer my expertise to our collective effort to create an ideal learning environment for the students in our care.