Teaching Portfolio

29 June 2015

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University Mission Statement

"At McMaster, our purpose is the discovery, communication, and preservation of knowledge. In our teaching, research, and scholarship, we are committed to creativity, innovation, and excellence. We value **integrity, quality, and teamwork** in everything we do. We inspire **critical thinking**, **personal growth**, and a **passion for learning**. We serve the social, cultural, and economic needs of our community and our society."

University Vision

"To **achieve international distinction for creativity, innovation and excellence**."

Hundreds of people work behind the scenes at the University ensuring that it fulfills all of the mandates set down by the mission and the vision.

1. My teaching philosophy

"If you stop experimenting, you've given up on life — and I really believe that."

This provocative statement slipped out in my statistics class the 4th time I taught the course. It was a moment of passion, and I wanted to grab the students' attention as to why I felt this material was so important. Its full impact didn't resonate with me, until I gave it some deeper reflection a few days later when watching myself in a recording of that class video. I have repeated that quote it my subsequent classes, and it was an opening line in the Coursera massive open online course (MOOC) that I had the honour to teach in the summer of 2014.

When writing this philosophy it is hard to reflect and think what matters as an educator. That unplanned, strong statement, is in hindsight, a perfect way to summarize what I do. **I really do believe in constant improvement, driven by evidence and feedback.**

For example, in the Statistics for Engineering class I'm currently teaching, I am using the Coursera videos to flip and blend the classroom. While I made mistakes in the first weeks, a flurry of anonymous ideas and feedback that students provided via my website quickly made the new approach to the course run much smoother. The pace, focus and timing of deliverables now works with the student's schedules — which I was not aware of prior. I do this in all my courses with mid-semester evaluations. I also keep a class diary, review class video recordings, and make notes for the next year, so I can track my improvements.

Another example was **bringing active learning into my classes**. I know it works. There is ample evidence of it in the scholarly literature on teaching and learning, and I have sat in classes where it has been successfully used by one of my mentors, Dr. Thomas Marlin. I really struggled at first, and still do, to get past the stone-faced wall of silence, and a perceived lack of engagement. I've persisted now for 3 years, tweaking and making changes. Last semester I solicited a large volume of feedback directly from the students, and have some suggestions that I'm trying in my classes now. Students now get a small credit for their written activities in the class, and the engagement level is so much higher.

When doing experiments, whether in the kitchen to perfect a recipe, or in the lab for research, we always have one or more outcomes we want to improve. In the area of statistics we give that outcome a symbol: it's called the "*y*" variable. My biggest challenge as an educator is figuring out what the *y*-variables are.

What are the measures of effective teaching? We have all had that experience of coming away from a class we thought we taught really well. Subsequent questions or test results quickly dispel that thought. Clearly, our self-assessment of a class is a one-sided, very imperfect metric. Students need time and experience for concepts to take root. Assessing this accurately, even ***quantifying*** it is nebulous, and an ongoing challenge for myself. We have to measure and evaluate it somehow, else, how do we know we have improved?

Recently, I've come to realize there is another "*y*" variable; I call it the "*why*" variable, after another very inspirational mentor, Dr. Joseph (Joe) Kim. He has been provocatively asking people on campus: "***why should students come to your class?***". When I prepare my classes it is one of the main questions in my mind. The other two are: "how can I reengage students at this point in the class?" and "why should students care about this material?".

I want students to understand the applicability of what I'm teaching, as it leads them to engage more fully. To this end I clearly explain where the material is used in the future. I have stood in for several professors while they are on sabbatical, so I have taught 8 unique courses in our department. I point out the connections to students, showing that nothing is stand-alone. I'm also fortunate to have 8 years of working experience outside the university and consulting with a variety of industries. I bring in colleagues I have worked with as guest lecturers, and I draw on experiences of McMaster colleagues as well to help demonstrate the applicability of the material.

Once the students see these connections, the career paths that guest speakers have taken, and the applicability of material, then the mental journey to get there is more exciting. This is an important point I learnt from another mentor Dr. John MacGregor. All these strategies help to answer the "*why*" variable.

To conclude my teaching philosophy, I'd like to highlight three areas that I'm particularly passionate about. **First is offering student flexibility in how they learn**. I make all my class resources freely available on my course websites. Full electronic notes, copies of slides, audio and video recordings of the class, examples of source code, and worked solutions to prior assignments and midterms. This gives students from all sorts of backgrounds and abilities, who might have to be out of class for a job interview, or other personal reasons, the resources to still participate. I call this the "*eat-in*" vs "*take-out*" decision. The university environment is perfect for either figuring out, or failing, at managing time. The repercussions here are fairly minor if they misjudge the need for being in class. As much as we would like to think otherwise, students really aren't only at university to patiently and attentively listen to their instructors.

Second, I believe in public access to our knowledge. Aside from the fact that we receive substantial funding from public resources, there's a deeper reason: public peer review. Being in the teaching track, I have always seen it as fairly one-sided that colleagues in the research tenure track have their work peer-reviewed and then published. Not so in the teaching track. If we really believe in how we teach, and what we do every day to influence hundreds of undergraduate minds, then this should be done publicly, and not behind an Avenue password. It has been humbling to have errors pointed out in materials on all my public teaching websites, but I'm always appreciative of it, and it makes my courses better. It is a real pleasure seeing my course and teaching materials being used in other universities and companies around the world now.

Lastly, I am passionate about **collaboration with my peers**. Four effective classroom strategies I have heard about were because of MIIETL (McMaster Institute for Innovation and Excellence in Teaching and Learning). In the Education 750 course I learned about active learning from Dr. Catherine Swanson and Erin Allard. At MIIETL's community of practice (CoP) meetings I learned about collaborative peer learning from Dr. Terry McCurdy, and we now have a fruitful research collaboration, and use it in our classes. I have convinced other colleagues of its utility, and it's been rewarding to see it used widely on campus. I learned about the testing effect, the spacing effect and the feedback effect from Dr. Joseph Kim at his own MIIETL CoP. And lastly Devon Mordell from MIIETL taught me so much about online learning, which was critical to the success of McMaster's first MOOC that she helped launch with me.

As you can see, the connections that MIIETL enables are just incredible — and essential — to all on campus.

I have tried, tested, tweaked and now use all the above ideas in my classes. One of my primary roles as a teaching professor is to transfer the successful strategies to my peers. I see my role is to solicit and listen to feedback from my students, get to know them personally, learn from them to make changes, and keep experimenting to find improvement. And to keep seeking out those two elusive "*y*" and "*why*" variables.

2. Teaching innovations and excellence

2.1 Course design

This section is the longest in this portfolio. It is one, I believe, that is central to my teaching role.

Critical thinking is paramount

Prior to teaching at McMaster University I developed and taught industrial courses. I quickly learned however that the focus of a university course is different. Rather than focusing on direct applications, a strong element of critical thinking is required. In an article in the Globe and Mail with the Dean of Engineering, on 04 November 2014 (http://yint.org/gm-article) I was quoted as saying: "The turnaround in knowledge is very rapid … In order to avoid becoming redundant, engineers need to be able to identify shortcomings in their knowledge and then have the ability to find the resources they need to fill those gaps."

I gained this insight from two sources. First was my direct experience in the workplace, where I saw colleagues terminated because they did not have up-to-date skills. The second was the one and only discussion I had with Dr. Donald Woods before he passed away. He was a prior Teaching Award winner and a mentor to so many of my current mentors here at McMaster University. He pointed out to me that one of the hardest skills to learn is to figure out what you do not know, and then to go find the resources to learn that.

For example, in my Separation Processes course, CHEM ENG 4M03, the course material covers about 12 different separation units, and the equations for each one are relatively straightforward. Most textbooks have the quiz and assignment questions where the students design these systems from scratch. This is disingenuous. Few engineers ever designs these systems from such simplistic equations; actual design is almost always outsourced to an engineering design firm like Hatch, or ABB, and they have computers that do much of the work now.

Critical thinking is vital to understand how to manipulate the equations for what they work well at: intensifying or troubleshooting the process. For example, I ask students: now given this existing process, how can you make it use less electrical energy, or how can you create a purer (more valuable) product, or if one part of the machine fails internally, how would you know it? The vast majority of students will answer questions like these in their careers. These are questions that computers do not answer well, if at all. So this is where one can add value to a company, and the risk of being replaced by a computer drops dramatically. With these critical thinking skills you will never be terminated — like the colleague I mentioned prior that had not kept his knowledge up to date — but you must think critically.

Incorporating feedback: course evaluations and mid-semester feedback

Course design is an imperfect process. Every course that I have taught at McMaster, even those where I am just filling in a for a sabbatical, I have scrutinized and restructured where required.

I have no expectation of being perfect, but when planning a course I seek a logical progression from topic to the next. I ask myself what shortcoming is present in the prior topic that is resolved in the one that follows.

I do not get this right every time. I make notes about my lecture right after class, in my class diary, and they are used, together with student evaluations to make changes the following year. As my teaching philosophy states: never stop experimenting. This is not as bad as it sounds — it is a very human endeavour to interact and work

with developing minds — so the principle of not doing harm is critical. After all, we can't get ethics clearance for everything we attempt to vary in our classes.

I begin my course designs with thoughtful review of the prior instructor's course. In one instance I have inherited binders of materials going back to 1974, and in another, I inherited material from the late Dr. Don Woods going back to the 1960's. I pored through these seeking what may have been the rationale for how they structured the course. If the instructor is still close by, as in the case of Dr. Thomas Marlin, it has led to long coffee shop discussions off-campus. These informal meetings are always fascinating — we have to learn from each other to avoid making the same mistakes.

Since we will never get a course design perfect, I have a form on my website where any student can provide anonymous feedback. I tell students about this in the very first class, and it is well used in the first weeks of a course; especially a course that I'm filling in for a sabbatical or have substantially overhauled.

An example of this in my current course, Statistics for Engineering. As mentioned, this year is my first attempt at flipping the classroom. I made several mistakes regarding when videos were available, when quizzes were due, how much work was reasonable to cover in class time, and the duration and number of videos to watch prior to class. I had no point of reference, no model on which to base my course. But many feedback ideas (most provided anonymously on my website) quickly rectified this. The most recent message I received was this one:

> *"I appreciate that you really took our concerns. I have a suggestion, since you have changed the format on the quiz (based on you* [sic] *textbook instead of the video lecture) perhaps maybe our video lecture could incorporate some examples on how to solve some problems? So in a way it we will have more hands on practise? Again, Thank you very very much on taking our concerns."* Anonymous, via the anonymous feedback website, on 16 January 2015.

In every course I have used mid-semester feedback that students supply in October (term 1) or in February (term 2). I tell students those 10 minutes to fill in the form are likely the most impact they can have on shaping their own learning. It puts the student in a metacognitive state, where they are asked how they would teach and improve the class if they were at the front. It indicates that we take teaching and learning seriously, but obviously only if I provide feedback and discuss their suggestions in the next class, and demonstrate real change to them.

Anyone reading the above who has used a thermostat in a house can appreciate the feedback principle. If you adjusted the thermostat, but it took hours (a long delay) before a temperature change was noticed, you would never have a comfortable environment. It would alway be too hot, or too cold. We learn that in engineering, in Process Control, that systems with a long time delay lead to dangerous, potentially unstable operation that is never "on-target". Timeous and complete feedback is one of the biggest improvements we can make to a process, and it very much applies to our classes: we cannot wait months to receive final course evaluations. Failing early and getting rapid feedback gets us on-target faster.

As seen in a later section on Teaching Materials, timely and accurate feedback is the main reason why I provide full solutions to assignments and midterms. It takes an incredible amount of work, but it is essential to help the students master the skills of self-learning. The same principle applies to course design. **So as can be seen from this, the student is very much a partner with me in the course design.**

Align the course with student attributes

An emerging emphasis in engineering accreditation in Canada is on outcomes-based education. I doubt this is a temporary phase from the accreditation agencies. However, whether it is or not is largely immaterial — we have to design our courses in mind with a career path of 40 to 50 years.

This requires developing group work skills , communication skills, problem solving skills and time-management expertise. Running a class where students communicate their answers, working in small active-learning teams, and solving meaningful problems is part of achieving this goal.

Group work as part of the course design

The attributes of group work and communication skills required by the engineering accreditation body is one reason why small-group active learning activities are used in both class, and always in longer tutorials. Students on co-op work terms need to develop these skills while at university, and those not on co-op will need them before graduating. Therefore I use group-based assignments, tutorials, and in class activities in all my courses. It allows me to set more challenging, realistic and open-ended problems, often using computer-based tools. While taking longer to grade, informal reviews with students indicate these exams substantially improve their understanding of the course material.

The first time I taught Engineering Economics and Problem Solving, CHEM ENG 4N04 course I had three dysfunctional groups (out of 20 in the class) in my office in crisis-mode. Since then I have exploited the feedback effect and the process of self-reflection, which engineers are very averse to. Using a custom-written website tool, students provide anonymized feedback to their peers, and they are required to critically reflect on their group's progress that week. This has helped and in the last two years I have had no emergency meetings or crises with student groups in this class

2.2 In-class delivery

If anyone watches my videos on the public course websites, they might be surprised to see that my classes operate much the same as anyone else's on campus, save for two main differences.

Active learning strategies

I aim (though don't always achieve it) to stop lecturing every 15 minutes or so, and have students work on a small problem or have a discussion for a few minutes. This breaks the monotony of the class time, and encourages participation in the class. As mentioned in my teaching philosophy, it is an evolving process as I discover which activities are most suitable for which courses. In my one course last semester I solicited a large volume of feedback directly from the students on how to improve the active learning moments. They were quick to supply me with a list that I'm working on, and hope to implement in future classes; such as calling out groups directly, providing small rewards, and having an electronic forum to answer for those that want to participate but are introverted, or intimidated by the large class.

Guest lectures

I prominently feature guest lectures in all my classes. A frequent guest is Dr. Thomas Marlin, since he is actively interested in teaching and learning despite having retired, and because he has a wealth of industrial and practical knowledge. Other speakers include a generous McMaster alumnus, Robert Kulperger, and a very experienced

water specialist from GE Water, Henk Koops. For my online course I interviewed local citizens, Joy from Made for you by Madeleine bakery, Dr. Soo Chan Carusone who provide a valuable external point of reference for students.

I also invite recently graduated students, as current students appreciate hearing about how they have started their careers. These have included Sean Johnstone, Emily Nichols, and Matthew Galachiuk, and colleagues from campus have included Dr. Thomas Adams, Dr. Lotfi Belkhir, Dr. Joe Kim, Dr. David Latullipe and his student Jeff Cobbledick.

These guest lecturers, whether in-person, or by video, provide a welcome change at the front of the class, and introduce role models from outside of the classroom context.

2.3 Assessment strategies

In my opinion I find it quite unfair to students to base a final grade on one or two major deliverables. This does not provide an accurate assessment of their capabilities. It would be the equivalent of having my teaching assessed by one or two lectures.

Based on discussions with Dr. Joe Kim at his weekly EdCog community meetings in 2013, I learned about the testing effect and the spacing effect. These reduce the stakes and spread them out over multiple assessments. Having the spacing in time, where prior concepts are revisited in subsequent tests, has also been shown to positively impact learning.

In all my courses, I now use at least 5 assessments and the final exam counts for less than half the weight. Near weekly assignments, midterms, small tests spaced in time, projects, and class activities make up the bulk of the grade. And these start right in the first week, setting the tone and the pace of the class. The supporting letter from Sean Mercer makes reference to this: "*His classes often keep you quite busy, but when it comes to tests and exams the concepts have actually been learned and applied enough to know them well. People do well in his classes not because they're easy, but because they actually learn the material and understand the concepts.*"

I recognize this places a greater assessment load on the TAs and myself, but this is mitigated to some extent by using tools such as peer-evaluation and auto-grading of questions using the customized Quest software I wrote. This software creates randomized quizzes containing randomized and customized data for each student. It was designed to exploit the testing effect, feedback effect and spacing effect. Quizzes are automatically graded, and solutions provided right away to students.

I have found that student satisfaction, based on sentiments expressed in course evaluations reiterate Sean's quote above, and spurts of short-term learning for a midterm and final exam are avoided.

Peer-evaluation is a new tool I began using in 2014. Students submit a project, where their names and numbers are removed and the project is circulated to between 3 and 5 blind peer-reviewers, with a detailed grading rubric. A portion of their grade comes from grading their own work, and another portion from my own assessment, with the bulk coming from the average of the peer grading. So far the evidence is consistent with the published literature: student grades are mostly correlated with instructor's grades. The pedagogical objective is that students are provided training wheels (the rubric) to learn to critically evaluate their own work, and the work of others.

2.4 Teaching materials

The development of teaching materials has been an area that is without doubt one of the most creative and the most tangible aspect of teaching. It is one which I personally enjoy the most.

To ensure that the materials have long-lasting value, I publish them all under a permissive Creative Commons License. I believe this is the right thing to do, since we are an institution that depends on public funding, and the materials we develop as educators are for the public good.

As an aside, and elaborated on in my teaching philosophy, my position is that our materials must be open to peer review and public scrutiny. I have no doubt there are errors and inaccuracies in the teaching materials listed below, but the open nature of them has led to many emails related to spelling and grammar errors, factual errors and suggestions for improvement. Like my peers in the research tenure track, I do think the teaching track should be held to a high standard of peer evaluation as well.

Every class that I teach, or have taught, has most of the following materials available:

1. **Recorded video and audio of every class** are posted within 24 hours of the class. Students can stream these on the website and may download them. I know that every class video is downloaded and viewed by at least half the students again. Every single course evaluation has high praise for the video component. Students state they use it to re-review material they maybe didn't comprehend, or didn't pay 100% attention to the first time, or when they were unable to attend the class. I know that I could never maintain full attention for six hours of lecturing per day, so I can't expect that of my students either.

I have received emails from students at other universities that use my lecture materials to study from, as an alternative resource. For example, I received this email:

> *"I wanted to thank you again for allowing me the opportunity to learn from you, and also say how much I appreciate the accessibility of the course materials. I have been downloading the lecture audio and listening to it on my drive to & from work. The worse the traffic is, the more I learn in a day!"*
>
> from Sarah Nichols, unsolicited email, 16 February 2013.

2. **downloadable slides and resources** of every class are posted prior to class. These PDF notes are made available for students to print, and are publicly available. In several of my courses these notes take the place of the course textbook. A recommended textbook is listed for those that would like further insight. Required textbooks in engineering are notoriously expensive, and these free resources provide a more accessible and alternative educational experience.

Generating the illustrations, or finding images and drawings that are suitably licensed for public access can be time consuming. However, it is a skill quickly learned, and with the right software tools great quality drawings can be made.

3. **Downloadable assignments, with full solutions** are made available to students. Flexibility is paramount here. My mindset is always "*what would I have liked to have as an undergraduate student?*". Fortunately I had plenty of poor (but even more fortunately, many excellent) undergraduate professors that I can use to guide that answer. I found it frustrating as a student that I did not have access to solutions, unless I had time to visit the TAs. Providing them materials in the most flexible, unencumbered manner is critical. It also plays into the topic of the feedback effect, described in the prior section on Course Design: timeous and complete feedback is essential for successful self-learning.

4. **Electronic games and quizzes**: are used in more opened-ended assignments and take-home tests. I've had a lot of fun creating customized software tools for my classes. Gamification of the class was a trending activity a few years ago, and in hindsight I realized that the tool I developed in 2010 was harnessing just this: "*As a personal favourite, Kevin developed an on-line algorithm to simulate a business scenario individualized for each student so they could apply their knowledge of experimental design in a competitive, video-game-like environment. To this day that final project sticks out in my head as the most fun (I wanted to keep playing!) I have ever had while completing an evaluation.*" Jake Nease, 9 March 2015.

The 80 students each got a customized simulation, which was unknown to them, and they were asked to optimize it using the tools we had learned about in the course. I used a leaderboard to bring an element of competition. It was fascinating to watch students rise to this challenge.

2.5 Using technology inside, but mostly outside, the classroom

Technology has a special interest for me. I love programming, creating and designing software, and especially having technology assist us. This is yet another reason why I jumped at the opportunity to teach McMaster's first MOOC. So it seems counterintuitive that my classes on campus look remarkably similar to many of my colleagues: just a projector and a board.

Class time is not our only interaction with students. In fact, students spend between 4 to 8 hours per week [based on my mid-semester questionnaire data] outside of class on related course work. They might be re-watching the videos posted on my course websites, listening to audio, downloading the assignment PDF, or working through the full solution posted on the website, or using the quizzing system, called Quest, to confirm their learning.

In my current blended/flipped class I am heavily promoting the use of online forums to interact, which engineering students seem to resist, but it is the mechanism heavily used in online courses. I have also started to grade term projects with peer-evaluation, which was described in the prior section on assessment.

Each of my courses have now moved to fully online assignments and grading, with no paper, and no special software required. Paper assignments are still accepted of course, but less than 5% of students submit that way. Students appreciate getting instantaneous comments and feedback from the TAs, they can submit their work at any time, and do not need to collect or track paper copies. It is also another form of flexibility extended to students, which they appreciate, as per their course evaluation comments.

Other technology resources are described in the prior section on teaching materials: such as the customized quiz system called "Quest", video streams of the class, and gamified simulations.

2.6 Supervision and mentorship for undergraduate students

It has been a real honour to work with many undergraduate students over the years. In small ways, I hope by providing references for students, or attending recruiting events and undergraduate club social mixers that I can assist in the development of their careers. Informal discussions about potential career paths have hopefully led to something beneficial.

I make it a point to **attend most of my course tutorials**. In particular, the Engineering Economics and Problem Solving that is mentioned by Tom Marlin in his letter of support, is one I find the most rewarding. The group work, the countless ah-ha moments, the ability to talk about career options and to answer their questions is incredibly humbling. Students let their guard down in tutorials; their faces express frustration with difficult concepts, and I can overhear great learning moments and peer explanations when I walk around the class. This is not rarely possible during the lecture time.

I was honoured when Dr. Carlos Filipe asked me to fill the **associate chair** (**undergraduate**) **role** in our department. I felt very green at the start providing help to students that were struggling with making a minimum grade point average, or on how to fit courses in so they can graduate on time. These short encounters of a few minutes matter to students who really need that help to navigate the university process.

In early 2014 I had the incredible experience to have a group of students in our Bioengineering program come to me with concerns about the program's structure. I was able to listen to them, solicit feedback from others in my department, and with help of the Associate Dean's office, in particular Maria White, do a bit of creative **shuffling of course sequencing**. This will be implemented over the next 3 years and will lead to a streamlined experience that improves this already excellent program.

Perhaps more quantifiable is the **supervision provided to students in my classes** where a term project is a substantial part of the course grade. Meetings outside of class time, often in excess of 20 hours of total extra time in the week that these meetings are scheduled, are well worth the one-on-one contact with over 100 students. We can quickly identify misconceptions and problems, and guide them on a path towards a successful, and more meaningful project. I have done this for 3 years now, and I cannot see myself ever removing that rewarding, though time-consuming aspect of the courses.

I had been asked to supervise Heather Van, for her **Inquiry project** in the Engineering and Society Stream, in 2012/2013. She probably did not realize it, but her questions on affordable water treatment lead to interesting reflection and refocusing of one of the courses I'm teaching, Separation Processes, CHEM ENG 4M03. This course is now part of a new Chemical Engineering stream that I was glad to help co-create with Dr. David Latulippe: it is called the Water and Energy Technologies (WET) stream.

I have been honoured to provide **mentorships outside of Chemical Engineering**. I was asked by Dr. Spencer Smith to co-supervise the capstone project for Computer Science 4ZP6 in 2013/2014 [3 students], who designed a free iClicker-equivalent that used only a cellphone or table. Then I was asked again by Dr. Rong Zhang in 2014/2015 to supervise 4 students that developed cell-phone based apps, and are, as of writing this, in vying for their apps to be in the Apple Store and the Google Play Store. These apps will use the real-time GPS data of the Hamilton Street Railway (HSR) bus data to tell how far the bus is from your selected stop, so you can step out of the office, and right onto the bus. At a February conference they had their app critiqued by top experts on User Interface design. I'm excited to see where their greatly improved software app will lead. Here again, this supervision is actually out of scope, but the half hour a week of meeting time is it all it takes, to hopefully valuable mentorship.

> *"Our group has had the pleasure of having Kevin as our supervisor for our Computer Science capstone project. Kevin has gone above and beyond in providing us with the resources required for our project. In working with him, we have learned great project management skills such as having regular meetings and setting reachable goals. These management skills have allowed us to have an extremely successful*

capstone project thus far. Kevin has also been generous enough to send us to a conference so that we could present our project and meet with industry professionals. Kevin has been a great mentor and has done an amazing job with helping guide our project to success."

The 4 students for the 2014/2015 COMP SCI 4ZP6 Capstone project [Ashley General, Noel Brett, Iheatu Wogu and Matthew Halleran], by email, 08 March 2015.

Within Chemical Engineering I have informally supervised the undergraduate work of Filipe Gomes (now back again as a really promising graduate student), Andrew Bovell, Trevor West, and Mustafa Rashid. This has been work with my colleague, Dr. Michael Thompson, on acoustic analysis. Even though this is extra-curricular, I find these collaborations very satisfying, and enjoy assisting where I can bring value.

Or another, is the Chemical Engineering website that I actively maintain, where I regularly tweet and post news articles about events that the department is involved in; including undergraduate students, graduate students and faculty. Many of the graduating students are connected with me on LinkedIn and I follow their career progress and updates with interest.

2.7 Supervision and mentorship for graduate students

Most of my student interactions have been with undergraduate students, but I have taught a graduate level course, CHEM ENG 765, Latent Variable Methods, to a group of 15 students. Each student had a different course project, which was mentored.

A critical impact I have on graduate students is through their role of being a teaching assistant. This is described in the later section 4.1, where I demonstrate they are part of the collaborative team to deliver a course.

The rest of my interactions with graduate students have been self-initiated, or requested by graduate students based on their supervisor's or someone else's encouragement. As a teaching professor, strictly speaking, I do not typically have graduate students to supervise. But in a university where great pride is placed on research intensity, and the positive effects that has on teaching, I **feel it is important to be actively involved in research applications that my colleagues are engaged in.**

As an example: in the past few months I have had the real pleasure of seeing how Salomon Gabriel, a student of Dr. Philip Koshy, has accelerated the work on his thesis by applying the tools from Design of Experiments. Salomon initiated a first meeting to ask if I could show him how to design his experiments. Unfortunately I was extremely busy getting started with the semester, but I was able to point him to the Coursera course, which though it had finished its official run, is still currently open to anyone to enrol and watch the videos, and try the quizzes. He self-studied the material, and a few weeks later he was back in my office, and our discussion began right where the videos left off. It was the first time I practically saw the time-saving ability of the online courses, where a motivated student can learn without my interaction. Salomon's testimonial here reaffirms this:

"As a graduate student in Mechanical Engineering I needed to optimize a process using design of Experiments (DOE). Kevin Dunn taught me the basics of DOE using clear and effective explanations and was available to answer every question I had as I progressed. A long and daunting investigation turned into a logical, manageable and efficient series of experiments. Furthermore, I had a sound and defensible reason for taking each step and making the changes I did. The work we did together forms one of the core components of my thesis and Kevin's collaboration was invaluable."

Salomon Gabriel, by email, 08 March 2015.

I have also been asked to serve on the **supervisory committee of a current PhD student**, Muddasir Rashid, who incidentally was one of my students in his undergraduate career, and it has been incredible to watch him grow into a talented postgraduate student.

One final piece of supervision I enjoyed a few years ago was a Masters of Engineering Design student, Tiffany D'Souza. Tiffany and I had a series of intensive meetings over the summer about her project which she was implementing together with PepsiCo's Quaker division, in Peterborough, Ontario. I would advise Tiffany, she would run the experiments and report back. We had multiple conference calls with her supervisor, and the work led to such success that she was immediately hired, and subsequently promoted based on implementing those experimental techniques. Tiffany now works in the parent company, PepsiCo, in Toronto.

> *"As a 2010 undergraduate and 2011 Graduate from McMaster University, I have had the privilege of being a student of Kevin's in both my undergraduate and graduate year. In this time, I learned valuable statistical methods and practices from his 4C03-Statistics for Engineers course and developed the ability to link academic theories to real-world applications through his guidance as supervisor of my Masters of Engineering Design project.*
>
> *Kevin's leadership and mentorship, was a critical contribution to the success of my project and for that I am extremely grateful to him. The savings obtained for PepsiCo Foods Canada lead to various role opportunities afforded to me as a result of this achievement.*
>
> *Till today, I continue to leverage the many skills Kevin has taught me. These are beneficial skills that continue to serve me well as I develop my professional career. They include but are not limited to statistical methods, leadership, problem solving, effective communication and teamwork skills.*
>
> *Kevin has clearly demonstrated his commitment and passion for teaching and has gone above and beyond to provide quality education for the students of McMaster."*
>
> Tiffany D'Souza, by email, 09 March 2015.

3. Accessibility and contributions to a broader audience

3.1 Coursera's massive open online course

Beginning in February 2014, events began to line up and I was given the opportunity to teach McMaster's first massive open online course (MOOC). Deadlines were approaching for the provincial government's Ontario Online Initiative and I submitted a grant application. I wanted to explore what online learning could do. (I'm passionate about technology, but selective about where I use it in class, as described earlier).

The Dean of Engineering was also connected with the Coursera CEO, Daphne Koller, and he wrote an email to her and I was "nominated" to teach the MOOC, Experimentation for Improvement. By all accounts it was very successful as evidenced by the quotes below (all the feedback is publicly available in the online forums https://class.coursera.org/experiments-001/forum/, but 3 quotes are reproduced here):

> *"I have three engineering degrees and although I've taken statistics, have never taken another course like this one. Is there the possibility of future courses, even if they are Chemical Engineering courses, being*

taught by Professor Dunn? Excellent presentation style and I'll certainly look for McMaster courses in the future." Edward Dooley

"Thanks for this excellent course. I am doing exeriments [sic] *for almost 30 years now, but I didn't know this theory. Unbelievable! I realize now how unorganized and how unstructured my experiments have been. And equally important: It was an eye opener for me that also experiments in my personal life can be set up this way. Thank you so much."* Dick Harberts

"It is my favorite Coursera course right now. I'm enrolled with 20+s Courses. High praise from me when it's competing with courses in line with my profession.

The knowledge I gained is so practical that I even get to apply it everyday. It's great!", A. R. N. Santos.

The MOOC was a great opportunity to bring together two aspects in my teaching philosophy: I got to teach about experiments and improvement (*what can be better than teaching that?*), and it was a chance to collaborate with my peers in MIIETL, learning about video, audio and animation production, course development, instructional design and online pedagogy. I continue to promote and talk about these experiences (see below). The project was costly, both financially and in the time invested, but well worth it. However, to make that investment pay dividends for many years, we must share what we learned from the process, so others know what is involved in teaching an online course.

Sharing our experiences is critical to enhancing teaching and learning at an institutional level. I have subsequently spoken about the MOOC experience at various meetings: the President's retreat (27 August 2014), with Dr. Dustin Garrick who plans to work on a potential MOOC (25 August 2014), the Dean of Engineering advisory board (17 October 2014), at a Teaching with Technology presentation on MOOCs (22 October 2014), and at a MIIETL workshop (11 November 2014). I have a paper now accepted for the Canadian Engineering Education Association conference in May 2015 ("*The challenges of launching a MOOC and reusing that material in a blended campus class: things you might not have known about online and blended learning*"), and a potential talk at MIIETL's Learning Technologies Symposium later this summer.

3.2 Open education resources

I fully believe in public access to the knowledge that we teach in universities. It was one of the main reasons why I accepted to teach the MOOC, Experimentation for Improvement, and why I was happy to win one of the Ontario Online Initiative grants for my Statistics course. It all means that the broader public will gain access to these materials in more convenient formats — free of any charge — other than their time spent.

All my course slides, assignments and solutions, tests, exams, and so forth, as described in section 2.4 on Teaching Materials, are available from my website: http://learnche.mcmaster.ca. Students know they can come here for all materials, and there is no need to sign into Avenue. To ensure its ongoing value, students know they can return to the site, even after graduating.

Also included on the website is my self-published, but externally edited, course textbook: "*Process Improvement using Data*". It has been substantially revised and updated in 2010, 2011, 2012, 2013, 2014, 2015. The impact of this resource is described by these two quotes, unsolicited, from users outside McMaster:

"Just to let you know, we will be using your book in ABB http://www.abb.com/ *as part of our continual improvement competence development."*

Alex D'Anci, ABB (a large Swiss multinational firm), by email on 02 February 2015

"I am using this book and its processes to design experiments to improve our products."

Gary Bohnenberger, an engineer with over 40 years of experience at UCI-FRAM AutoBrands, 23 July 2014.

The resources for my Statistics course are now used by at least two other instructors that I am aware of (people do not need to ask permission though, so other users may exist).

1. Dr. Andy Hrymak, the Dean of Engineering, at Western University, London, uses the slides, assignment questions, Process Improvement using Data textbook, and tests and exams in his course. We have collaborated since 2011, and the feedback, errors and questions I get from him and his students have lead to numerous improvements. This is an example of peer-review for teaching professors.
2. Dr. Tim Dietrich, Senior Improvement Advisor, Performance and Improvement Office at Hamilton Health Sciences has used the same resources for teaching MATERIALS 3J03 in 2013 and 2014. He has also enhanced the material for his Materials Engineering students.

It is hard work to source materials that are licensed for appropriate copyright usage, or to create your own illustrations and resources, for sure. The benefit and reward of doing so however, has been the pleasure seeing these course materials used in other universities and companies around the world.

4. Developing the teaching team

4.1 Teaching assistants

In my role as an undergraduate instructor I am also a **mentor for my teaching assistants**. It is too easy for them to become highly paid grading machines; I strongly feel we can do more with their expertise and skills. Every TA I have worked with is given the freedom and autonomy to take the assignment, quiz, midterm or exam question allocated to them, and with minimal guidance to create the grading rubric and sometimes the solutions. They are responsible to the students for how they grade. To help guide them I meet with them weekly to establish progress in the courses, hear about any consistent problems they have noticed and to provide any assistance. They are potential future educators, and it is important to provide them with these opportunities.

Many of my TAs have taught classes for me. I let them borrow my video camera so they can practice and I coach them through what will likely be one of the most stressful occasions. (I vividly remember my first lecture.) I attend the class without interrupting, and then provide feedback, as well as a video copy of the class afterwards for them to reflect and deconstruct on what succeeded, and what did not. I feel this is an important skill for building their resumes, and allows them to more fully understand the nature of what university teaching is about.

4.2 Communities of practice

MIIETL has established many Communities of Practice (CoP) across campus. In writing this portfolio I was surprised to realize how almost all techniques I regularly use in my classes evolved from these community meetings.

I learned about **collaborative peer learning** from Dr. Terry McCurdy (a prior teaching award winner) in early 2013 at a Teaching with Technology CoP event. The successes of that meeting are still propagating, as described in section 6 below. The topic of online learning also is covered in this community, lead by Devon Mordell from MIIETL and Dr. McCurdy.

Dr. Joe Kim runs a weekly CoP called "The EdCog Reading Group" that I have unfortunately been unable to attend the past year due to timetable clashes. However, in prior years, I learned a phenomenal amount about the area of **psychology and cognition as it relates to learning**. I now regularly use the feedback, testing and spacing effect in my classes and take it into consideration when I design and plan courses.

The other community that I am involved in is the Teaching Professors community, where we engage in discussion about the role of the teaching professor on campus.

4.3 Working with new and current faculty members

One of the strongest points in my teaching philosophy is the collaboration and learning with peers. The most effective classroom strategies I know about were not gleaned by reading about them, but by learning from others and listening to their experiences. As described above, the MIIETL CoPs have been very influential.

I make it a point to return the favour and speak at the community meetings myself, and to always take the opportunity to speak with colleagues, especially new one. To avoid redundancy I describe these activities in a later section 6.1 "Peer collaboration and development with colleagues".

5. Statement of educational leadership philosophy

My role at McMaster University is in the teaching track, and so it is with that mindset that I frame the discussion. However, I believe that what I have written below would also be applicable if I were a tenure-track professor.

One of the main reasons I was excited to take on the role of a teaching professor at McMaster University was to help shape and set a high standard for this newly created position. From discussions with others as I just joined the university, I gathered that the teaching track could become an "us *vs* them" dichotomy between those teaching and those in the tenure track. I will hasten to add that this was not borne out in the Faculty of Engineering. Discussions with other teaching professors across campus make me realize how separated some teaching professors are from their colleagues. It should never be that way. We have much to share with, and learn from each other.

I believe teaching track professors must provide educational leadership, and they must provide that in the same level-playing field as their research (tenure-track) colleagues. By that I mean, it requires openness as to how we go about teaching (the equivalent of peer-review), and being willing to work collaboratively with our colleagues.

In fact, **collaboration must be cross-disciplinary** in educational research and cross-disciplinarity should be a primary feature of the teaching track. Cross-discipline research should be the norm, and it should be easy for teaching track research to engage with colleagues in other faculties — more so than any other areas of research on campus — since everyone across campus is engaged in teaching.

I will be the first to admit that Scholarship on Teaching and Learning (SoTL) is difficult. I still struggle to understand some of the jargon rooted in the fields of social science, psychology and cognition [but Dr. Joe Kim's weekly meetings to discuss journal articles have been helping with that]. I also still struggle to see the relevance and applicability of some research on occasion, since it is outside my context of learning approaches which are used in other faculties. But I was fortunate that my former chair, Dr. Shiping Zhu, kept urging me to publish and communicate what I have been doing. Now I strive to modify the ideas and approaches I hear and learn about, to make them work more readily in the areas of science and engineering.

So I have come to see one of the roles of the teaching-track professor as being an explorer and **experimenter**: we must try, fail, fix and improve on pedagogical ideas that help our students' learning. We must share those insights with our colleagues to improve teaching beyond our own practice, and beyond our own departments.

In the next section, below, I present some initial evidence how I have applied the above philosophies of cross-disciplinarity and experimentation. I hope to demonstrate how I have converted that into concrete actions.

6. Impact of educational leadership

6.1 Peer collaboration and development with colleagues

One of the most rewarding aspects of working at McMaster University has been the enthusiastic colleagues I get to work with every day. I say this regularly to anyone that asks me how I like working at McMaster.

It has been a symbiotic relationship with colleagues. I hear about their frustrations and I suggest what I might do. I hear about their successes and use them in my classes as well. These have occurred through countless hallway discussions, and the occasional formal meeting. Below are some examples of this.

In December 2013 I joined my colleagues Dr. Emily Cranston, Dr. Thomas Adams, and Dr. David Latulippe where we discussed teaching strategies and approaches in Chemical Engineering. I learned a lot about their frustrations in dealing with classroom management issues. We regularly bounce ideas off each other: I cannot stress enough, the difference it makes working with colleagues who are equally passionate about their teaching, and their research. For example, Tom Adams, was telling me one day how he used Avenue pre-class quizzes. He probably didn't realize this, but he was describing the testing effect, which I had also just heard about from Dr. Joe Kim; both of these gave me the impetus to use pre-quizzes in my own classes.

Collaborative learning successes

The most rewarding impact to date has been the work with Dr. Terry McCurdy in the School of Nursing. We have been working on collaborative testing, which is a form of peer-learning right after a midterm or test. Students are at their most receptive to review the materials, since they have just been studied and quizzed on it, and now they are obtaining non-threatening peer feedback. Notice how this uses so many proven psychological and cognitive tools: the testing effect, the feedback effect, and the evidence that peer-learning does work.

When I first heard about collaborative testing though, I tried it in my Process Control (CHEM ENG 3P04) course. I made several mistakes adapting the technique, as it was published originally for Science undergraduates using multiple choice questions. We use long-form questions and some open-ended questions. After 4 iterations and variations I felt I was ready to share this with my colleagues. This demonstrates how teaching professors might explore and experiment with pedagogical tools.

I have convinced two colleagues in my department to use it: Dr. Kim Jones, in her CHEM ENG 3BK3, Bio-reaction Engineering, used it successfully in 2014, and Dr. Thomas Adams, in his CHEM ENG 3E04 course has used it 3 times, very successfully in 2014. From their successes, we will hopefully see more research and validation of this tool. After hearing my presentation Dr. Joe Kim has used it in over 100 IntroPsych (PSYCH 1X0) tutorials, showing that: "*students perceived collaborative quizzes as more beneficial to their learning than individual quizzes*" (quote by email, 05 March 2015).

Dr. Emil Sekerinski heard about this tool at a MIIETL Community of Practice talk that Dr. McCurdy and I gave on 26 January 2015, where about 10 instructors from across campus were present. Dr. Sekerinski is now using it in his COMP SCI 1MD3 course. I am in progress setting up collaborations with Computing and Software (Emil Sekerinski) and with Psychology (Joe Kim and Andrew LoGiudice) to help understand their usage, and analyze their data.

Dr. Terry McCurdy and myself are continuing our collaboration on this research, and have recently extended the technique to adding immediate feedback. We have been presenting about this topic at four educational conferences during the summer of 2015, including a 1-hour workshop at the Canadian Engineering Education Association conference in May 2015.

6.2 Dissemination, influence and reputation outside McMaster University

The enhanced visibility outside of the McMaster community, thanks to the development and implementation of the Coursera MOOC has been referred to as"*reaching out internationally and providing learning opportunities for people that do not have access to a University.*" by my Department Chair, Dr. Carlos Filipe. The course has been completed by thousands of students, and it will be improved on, based on participant feedback, and offered in an "On-Demand" format for students to start and complete at their own pace.

I had a slow start with research on teaching and learning, being immersed with courses I had not taught before, and first establishing a teaching vision for myself. I believe that I am in a position now to start contributing to the scholarly literature.

To that end I have presented a paper at the Canadian Engineering Education Association conference in May 2015 on the MOOC course, and the subsequent use of the material in my blended and flipped classroom. That paper discusses "*The challenges of launching a MOOC and reusing that material in a blended campus class: things you might not have known about online and blended learning*" and is available here: http://yint.org/flipped-mooc/

I have a second paper that was accepted at the same conference on midterms and tests where I allowed students to write them for an "unlimited" time period. Using data collected over 3 years I have correlated it with their performance and the paper discusses: "*The positive benefits from the observation that test and exam duration is uncorrelated with student grade performance*". Please see http://yint.org/unlimited

I have presented with Dr. McCurdy at iCEER (International Conference on Engineering Education and Research) in August 2014. We have presented about this work on campus to many others, and we have been accepted for several conferences coming up this summer, including a workshop on collaborative testing at the Canadian Engineering Education Association conference.

The visibility that my self-published textbook has received, and its adoption now in two other university-level courses speaks to some outward visibility of the work done here at McMaster University.

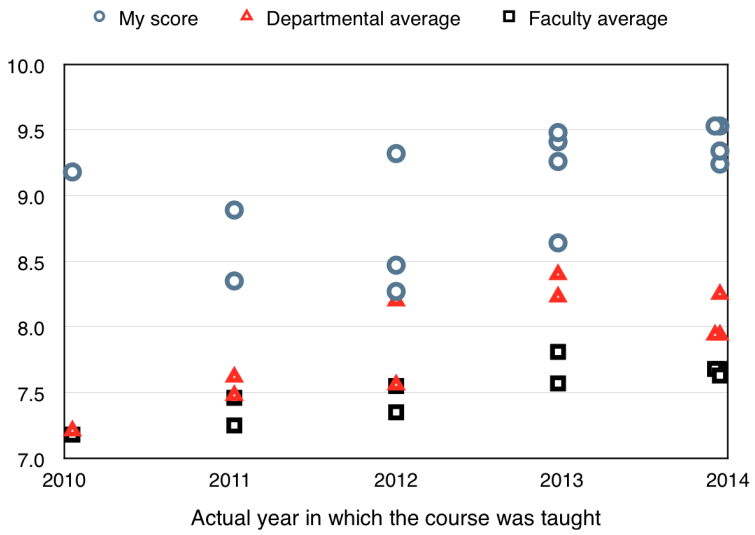
I have been a reviewer for the journal Chemical Engineering Education. I will continue with ways to disseminate my experiences and research with colleagues both on campus, and off-campus.

7. Evaluation of teaching effectiveness

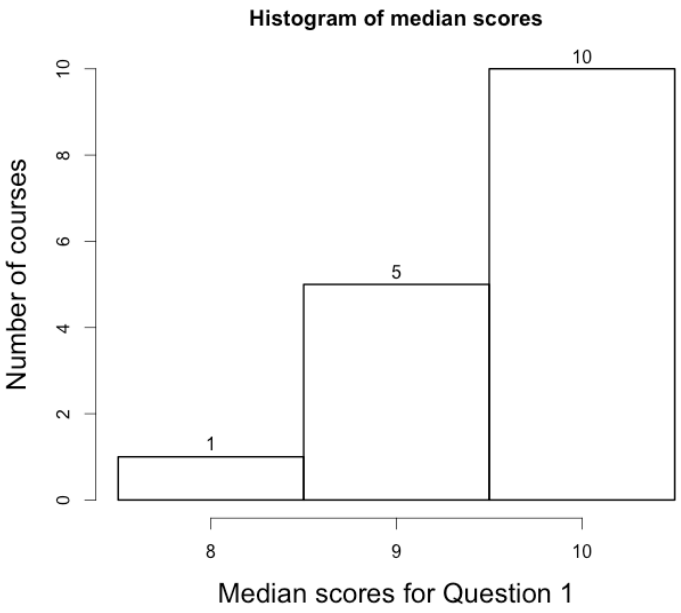
I have steered away from providing evaluation quotes, since these are easy to take out of context. All my course evaluations are however, available from this link. In the same spirit of openness that I have with my course materials, I share these at this link

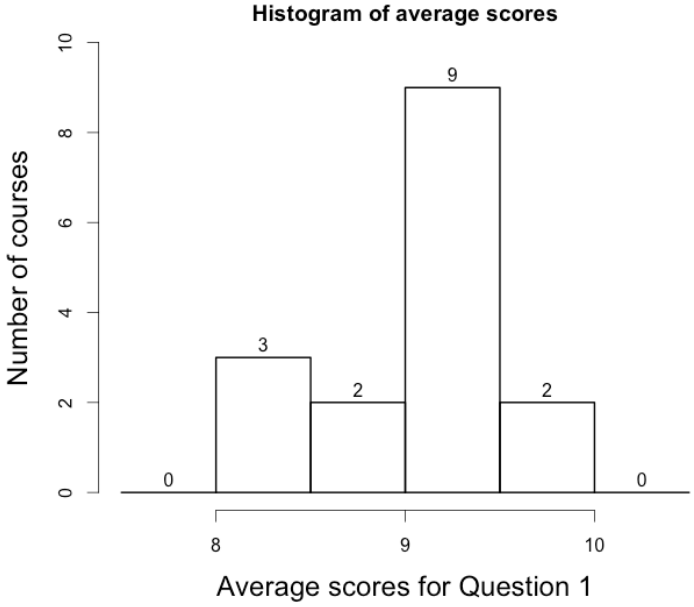
http://yint.org/evaluations/

It might be easier however to see the visual trends over time, particularly for the summative question 1: "Overall for this course, what is your opinion of the effectiveness of the instructor?" on a scale of 1 to 10.



Histograms of the median and the average results from 16 undergraduate courses are shown below





8. Curriculum vitae

1. Name:

Kevin George DUNN

2. Business address

Department of Chemical Engineering
McMaster University
Hamilton, ON, L8S 4L7

3. Educational background

Masters degree in Chemical Engineering, McMaster University, August 2002.
Undergraduate degree in Chemical Engineering, University of Cape Town, 1999.

4. Current status at McMaster University

Assistant Professor, Department of Chemical Engineering
3 year contract from 1 July 2012 and expires 30 June 2015.
3 year contract renewed for July 2015.
Associate Chair (Undergraduate), 1 July 2013 to 30 June 2015.

5. Professional organizations

Professional Engineer (Ontario)

6. Employment history

Process Engineer, GlaxoSmithKline, Mississauga, full-time, 1 year contract, July 2011 to June 2012.
Sessional Instructor, McMaster University, Department of Chemical Engineering, 2010 to 2012.
President, ConnectMV Inc., Hamilton. October 2008 to present.
Co-founder and Project Leader, ProSensus, Hamilton. June 2006 to Sept 2008
Research Engineer, McMaster University, Hamilton.
Full time: September 2002 to May 2006 (and also incubating ProSensus, Inc.)
Part time: March 2009 to March 2010

7. Scholarly and professional activities

a. editorial boards	None
b. grant and personnel committees	None
c. executive positions	Track co-chair, Canadian Engineering Education Association conference, May 2015
d. journal referee	Chemical Engineering Education
e. external grant reviews	None

8. Areas of interest

- Research on effective teaching methods and technologies
- Data analysis, particular experimental design and analysis
- Real-time data processing and analysis
- Latent variable methods
- Consulting with industrial companies on topics related to the above.

9. Honours

President's Award for Outstanding Contributions to Teaching and Learning, June 2015.

10. Courses taught

ChE 4C3/6C3	Statistics for engineering	Winter 2010	Median Q1 score: 9
ChE 3E4	Process model formulation and solution	Fall 2010	9
ChE 4C3/6C3	Statistics for engineering	Winter 2011	9
ChE 765	Latent variable methods for engineering	Fall 2011	10
ChE 4C3/6C3	Statistics for engineering	Winter 2012	10
ChE 4M3	Separation processes	Fall 2012	8
ChE 4N4	Engineering economics and problem solving	Fall 2012	9
ChE 4C3/6C3	Statistics for engineering	Winter 2013	10
ChE 3K4	Introduction to reactor design	Winter 2013	9
ChE 4M3	Separation processes	Fall 2013	10
ChE 4N4	Engineering economics and problem solving	Fall 2013	10
ChE 4C3/6C3	Statistics for engineering	Winter 2014	10
ChE 3P4	Process control	Winter 2014	10
Coursera MOOC	Experimentation for improvement	Summer 2014	NA
ChE 4M3	Separation processes	Fall 2014	10
ChE 4N4	Engineering economics and problem solving	Fall 2014	10
ChE 4G3	Optimization for chemical engineers	Winter 2015	10
ChE 4C3/6C3	Statistics for engineering	Winter 2015	10
Coursera MOOC	Experimentation for improvement	Summer 2015	NA

11. Contributions to teaching practice

a. pedagogic innovation

- Automated testing and quiz system so students have frequent opportunities to review class material and self-test their knowledge. Questions are randomly generated and the quizzes are automatically graded. Uses the testing effect, feedback effect and spacing effect simultaneously.
- Use of completely electronic assignments, electronic grading by TA's to create a paperless workflow for assignments and project reports.
- Web-based system for anonymous comments and feedback from students to improve course delivery during the semester, rather than wait for evaluations.
- First introduced collaborative testing into the faculty in Winter 2014, with preliminary reviews indicating good success. Ongoing research as to its effectiveness is continuing with collaborators on campus, and at other universities. At least two other colleagues in chemical engineering are using this, and influenced the decisions of many more on campus to start the same.

b. leadership in delivery of educational programs

- Completed Education 750, a graduate course offered by the McMaster Institute for Innovation & Excellence in Teaching & Learning (MIIETL). The techniques learned in the course have improved my teaching at McMaster University.
- Introduced and lead the development of McMaster's first massive open online course (MOOC) in July to August 2014. Regular comments from participants on the MOOC forums indicate that this has been one of the best MOOCs they have taken, when compared to other online courses on Coursera, edX, and Udacity.
- The video material from the MOOC is being extended with OOI (Ontario Online Initiative) funding to take ChE 4C3 to an online/blended course in Winter 2015.

c. course/curriculum development

Revised course delivery to more explicitly use active learning during class time in all courses. This was based on compelling evidence from the Education 750 course. All courses I teach now try to engage the students more fully in class time.

d. development/evaluation of educational materials and programs

Course slides and self-authored course textbook (Process Improvement using Data) for 4C03/6C03 are used at Western University graduate course on Statistics (Dr. Hrymak) in 2011 to 2014. These course slides

were also used by Tim Dietrich, to teach MATLS 3J03 Statistical Methods for Materials Engineers. This textbook was also used in the MOOC and positively received by the students.

12. Supervisorships

a. master None

b. doctoral None

c. post-doctoral/fellowship None

d. clinical/professional None

e. supervisory committees PhD supervisory committee: Mudassir Rashid, 2013 till present

f. other

Zhuyuan Zhang	Assist with experimental design	Summer/Fall 2013
Robin Ng	Assist with experimental design	Summer/Fall 2013
Andrew Bovell	Summer project with Dr. Michael Thompson	Summer 2013
Felipe Pedro Gomes	Summer project with Dr. Michael Thompson	Summer 2013
Hadi Muhammad	Capstone COMP SCI 4ZP6 project: Quiz app	2013/14 academic
Wenbo Liu	Capstone COMP SCI 4ZP6 project: Quiz app	2013/14 academic
Justin Kan	Capstone COMP SCI 4ZP6 project: Quiz app	2013/14 academic
Mustafa Rashid	Summer project with Dr. Michael Thompson	Summer 2014
Trevor West	Summer project with Dr. Michael Thompson	Summer 2014
Salomon Gabriel	Assist with experimental design (Mech Eng)	2014/2015
Ashley General	Capstone COMP SCI 4ZP6 project: HSR bus app	2014/15 academic
Matthew Halleran	Capstone COMP SCI 4ZP6 project: HSR bus app	2014/15 academic
Iheatu Wogu	Capstone COMP SCI 4ZP6 project: HSR bus app	2014/15 academic
Noel Brett	Capstone COMP SCI 4ZP6 project: HSR bus app	2014/15 academic

13. Lifetime research funding

$20,000 startup funding from the Engineering Dean for conferences and travel, *etc*.

$45,000 Ontario Online Initiative (OOI) funding to convert ChE 4C3 to an online course.

$ 5,000 Co-collaborator on Forward with Integrity grant (Deeper Learning, Increased Student Satisfaction and Metacognitive Gains Through Collaborative Testing with Immediate Feedback)

14. Lifetime publications

a. *Peer reviewed*

- F.P.C. Gomes, A. Bovell, G.P. Balamurugan, M.R. Thompson, K.G. Dunn "Evaluating the influence of contacting fluids on polyethylene using acoustic emissions analysis*", Polymer Testing*, **39**, 61–69, 2014.
- Svante Wold, Nouna Kettaneh-Wold, John F. MacGregor, Kevin G. Dunn, "Batch process modeling and MSPC (Multivariate Statistical Process Control)". *Comprehensive Chemometrics*, In: Brown S, Tauler R, Walczak R (eds.), **2**, 163-197, Oxford: Elsevier, 2009.
- Jay Liu, Manish H. Bharati, Kevin G. Dunn and John F. MacGregor, "Automatic masking in multivariate image analysis using support vector machines", *Chemometrics and Intelligent Laboratory systems*, **79**, 42-54, 2005.

b. *Not peer reviewed*

Kevin G. Dunn, *Process Improvement using Data*, 2015, self-published textbook used for teaching 4C3/6C3 in 2010, revised every year, up to and including 2015. Freely downloaded from http://learnche.org/pid

c. *Accepted for publication*

d. *Submitted for publication*

e. *Unpublished documents*

15. Presentations at meetings

Kevin Dunn, MIIETL's Learning with Technology Symposium, 2013: Google Docs talk

Kevin Dunn and Terry McCurdy, MIIETL's Learning with Technology Symposium, 12 May 2014: Collaborative Testing to Enhance Student Learning.

Minha Ha, Maria Massi, John Preston, Kevin Dunn, Professional development: "Assessment workshop", 29 July 2014.
Kevin Dunn and Terry McCurdy, Collaborative Testing as a Way to Enhance Student Learning, paper presented at iCEER 2014, 26 August 2014.
President's Retreat on Teaching and Learning, 27 August 2014. Presented about MOOCs
Kevin Dunn, presentation to the Dean of Engineering Advisory Board, 17 October 2014
Kevin Dunn, Teaching with Technology presentation on MOOCs, 22 October 2014
Kevin Dunn, MOOC Workshop, MIIETL, 11 November 2014
Terry McCurdy and Kevin Dunn, MIIETL, Teaching with Technology talk on Collaborative Learning on 19 November 2014
Terry McCurdy and Kevin Dunn, MIIETL Community of Practice: 1st year teaching; sharing experiences on collaborative testing; about 10 instructors across campus; 26 Jan 2015.
Kevin Dunn and Terry McCurdy, Collaborative Testing: Two-stage testing in the campus classroom. A 1-hour workshop, with examples, 31 May 2015, *http://yint.org/collab*
Kevin Dunn, The challenges of launching a MOOC and reusing that material in a blended campus class: things you might not have known about online and blended learning" 02 June 2015, *http://yint.org/flipped-mooc*
Kevin Dunn, The positive benefits from the observation that test and exam duration is uncorrelated with student grade performance, 03 June 2015, *http://yint.org/unlimited*

16. Patents, inventions and copyrights

17. Administrative responsibilities

- Undergraduate Curriculum Committee, Engineering
- Associate Chair, Undergraduate, Department of Chemical Engineering
- Chemical Engineering Undergraduate Recruiting Committee
- Graduate Attributes Software Committee
- Engineering Representative to McMaster University's Undergraduate Council
    - Chair of the Certificates Committee
    - IQAP committee to review program quality
- Search Committee for Director, Engineering 1
- Selection/search committee for Associate Dean, Academic

18. Other responsibilities

- CLL Community of Practice member: Pedagogy (EdCog)
- CLL Community of Practice member: Teaching professors
- CLL Community of Practice member: Teaching with technology

9. Concluding statement

I still remember my first week after being hired permanently as a Teaching Professor in July 2012, and climbing the Mills Library stairs to the 5th floor to find where the Center for Leadership in Learning (CLL) was located. I wanted to speak with someone there to answer the question: "what resources are here to help?". I was immediately directed to many helpful people, tools and books.

Fast-forward almost 3 years, where it is now called MIIETL, McMaster Institute for Innovation and Excellence in Teaching and Learning. The "excellence" label is certainly not out of place.

One of MIIETL's many communities of practice (CoP) that I joined was called Teaching with Technology. It was at one of their meetings that I met Dr. Terry McCurdy, and we started what is still an ongoing and fruitful collaboration on collaborative learning. As was described earlier in this document, that tool has been successfully used by many other colleagues on campus.

I also heard about Dr. Joe Kim at these meetings, and was inspired by his work on the testing effect, the feedback effect and the spacing effect. These are tools that I now regularly use in my classes, and use to plan my courses. He provocatively asks the question: "why should students come to your class?", and I still strive to answer that when preparing each class. It was my pleasure, in-turn, to inform Joe about collaborative testing, and then to hear how he has applied it to his large first year Psychology tutorial classes. We are planning to collaborate on this, and perhaps other topics, in the summer of 2015 with one of his students.

MIIETL's Dr. Catherine Swanson and Erin Allard graciously allowed me to take Education 750 back in January 2013, which is a course that is actually intended for graduate students. It was here that I learned about active learning and online learning. The former is something I have applied now to all my classes, and it is backed up in the scholarly literature as something that has a high probability of success. The latter sparked a real interest that together with the trend of MOOCs, and the Ontario Online Initiative (OOI), led me to take on the task of teaching McMaster's first MOOC, but only on condition that MIIETL be there with me.

And were they ever! The summer of 2014 was unforgettable: not only for sleepless nights, but seeing the dedication of MIIETL's Devon Mordell (who is beyond outstanding at what she does) and Zafar Syed, and so many others in their digital media, sound, and lighting crew. They made me look good, and they elevated the course beyond anything I could have imagined eleven months prior to that, when I was sitting in the Education 750 classes. Of course the high-level support of Dr. Ishwar Puri and Dr. Arshad Ahmad was also vital. It was all so fortuitously timed.

In summary, all these improvements to my teaching have grown out of MIIETL — it is the common connection to everything I have achieved so far. For that I wish to thank the leadership of the university, and I am certain they will continue the excellent work they do.

Of course, none of this would be possible if I did not have the amazing support of two outstanding department chairs: Dr. Shiping Zhu, and currently Dr. Carlos Filipe. I have had support at every turn, and with every request for funding, flexibility and planning. I can't thank them enough for creating a departmental culture in Chemical Engineering that makes me want to come to work every day, and to be the best I can possibly be.

McMaster University's vision is that: "*In our teaching, research, and scholarship, we are committed to creativity, innovation, and excellence*". Innovative strategies of pushing the bounds with online learning, and then bringing that to bear in the face-to-face classroom, having gamified class exercises was novel and creative back in 2010.

"*We value integrity, quality, and teamwork in everything we do.*" is something exemplified in the collaborative work with my colleague, Dr. Terry McCurdy in the School of Nursing, and others on campus. High-quality teaching, and being "integral" (in the meaning of Forward with Integrity) and in the sense of addressing the complete class and targeting all manner of learners, is critical to my teaching approach.

"*We inspire critical thinking, personal growth, and a passion for learning.*" is something I instil in my students in every class: don't take equations and concepts for granted. Extend them beyond the page and do something that will give you skills so you will never be without employment. Many of the quotes from former students represent that sentiment.

Assembling this portfolio has been a fascinating process of self-reflection and witnessing the fortuitous connections that have been established at McMaster University. I am still not convinced I know what the "*y*" variables are in education, but bringing this document together over the past two weeks, makes me think I just may be in the right neighbourhood.
