Future directions for undergraduate learning at Queen's.

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Prologue: I'm embarrassed to admit how long I have been rewriting this essay, trying to understand what I really want to say, and fearful of being misinterpreted. It's a bit longer than I meant it to be, but I hope it is organized in a way that makes it easy to digest. This document builds on several years of invaluable discussions with many colleagues and students, too numerous to mention and thank, and many seminars and discussions at the CTL and the ILC. My purpose is to begin the process of turning some of our conclusions (or dreams) into concrete recommendations.

1. *Students as learners*. I believe that almost all of our students want to learn and want to make their university experience count, but their experience ultimately falls short of what it ought to be. Facing a packed curriculum and an uncertain future, marks becomes a big issue and this all gets in the way of real learning, the kind that requires deep reflection and time to play and reinvent the world. We need to find a way to get real learning back into the curriculum.

To be able to learn well and completely, to get mastery and even ownership of a set of ideas and techniques, is a deeply satisfying and energizing experience and drives an increasingly better quality of learning. A student who has arrived at that state is more independent and is easier and more rewarding to teach, and student and teacher can move to a higher level of integrity. I think we can construct such a learning environment at Queen's but it will require changes in attitude, expectations, objectives and strategies from both student and teacher. Experience tells me that this won't be easy to accomplish, but in terms of bringing my colleagues on side, one thing we have working in our favour is the idea that it can save them time and aggravation.

2. *Hard-pressed faculty*. Most of us are far too busy, far too pressed, trying to squeeze too many things in. We need to simplify procedures, let go of some of our concerns.
We are crazy busy. And it's apt to get worse. The university is set to expand and diversify in a number of interesting ways which will almost certainly put more teaching and administrative pressure on us. And at the same time the pressure for research, for multiple grant applications, for program innovation, for interdisciplinary broadening will increase. But with students who are real learners, we can weather these changes well, and enjoy the new challenges they bring. A learner is not nearly so dependent on individual access to faculty.

As things stand these days most of my colleagues would be quite happy never to have to teach a large first-year course. Why is that? It's not because the material is uninteresting or hard to teach. It's because of all the crap, the continual back and forth between us and space allocation and timetabling, finding rooms for all the special needs that arise, finding times when all the sections of the course are free, and the endless anxieties of the students, the possibility that we do something in class that they are not quite ready for, the missed tests and deadlines, the unquenchable student thirst for notes and web support etc. On the whole, my colleagues love teaching and would like nothing more than to be able to simply *teach* the course. It's not the teaching of the material or ideas or problems that takes the time it's the unbelievable number of special circumstances that constantly clamour for attention. I have no doubt (and here's the point) that almost all of this non-academic *stuff* flows not from the student desire to learn but from (understandable) student anxiety. Fundamentally I believe that this anxiety is about lack of control, more specifically about not having enough say over the basic structure of their own learning, and over the way their learning is evaluated.

3. *Hard-pressed students*. **Most of our students feel they are too constrained, too overburdened. They have crazy schedules for lectures, assignments, exams, too little time and space to do any serious learning. They want more time and opportunity to make choice in terms of both what to learn and how to learn it. Whether they know it or not, what they actually need is more control over their lives as learners.**

"This morning I talk for an hour to "Jane," one of our senior engineering students. In the email she sent to me yesterday, she said she was desperate. She is not at the top of the class but is good enough that she can (and does) dream of doing a PhD and becoming an academic. But now she is almost ready to drop out. She is a person who needs to understand what she is doing, who needs to be able to see the big picture, who needs to fit things in to a greater whole. She has been told to be patient and that this will come in graduate school, but she really can't see hanging on another year. It's just too discouraging. She loves her two math courses but they go too fast and she needs time to make sense of everything. And she has four other courses to take. *I keep willing for that moment to come when I understand, but it never comes soon enough. If I had just two courses I would be the happiest person in the world, but I can't afford to do that. Maybe I'm just not cut out to be an engineer.*"

Jane feels hemmed in, imprisoned by the demands of her courses. It's likely that if she were cleverer, or had a better background (that is, if she were among the top 20% of our students) the program *would* work well for her—she'd be able to master the technical details and still have time over to investigate and play. That kind of open investigation pays huge dividends—the understanding you get of the big picture makes everything is so much better because you are the architect of your own conceptual framework and it's fun too because the design process is always fun. I have no doubt that Jane would (and I hope will) make a superb engineer, and even a fine engineering prof. But for her, that will happen in spite of rather than because of the structure of the curriculum.

In fact many of Jane's fellow students will tell you the same story if you challenge them to look clearly at their lives. Traditionally at the end of our Math and Poetry course, Maggie Berg and I listen to our class of 65 senior students from all different disciplines (including engineering) talk about what's been right and what's been wrong and they are always clear that most of the specialized stuff they learned they never use and never expect to, that they want a wider education with more choice. They want to learn a few things well and learn how to learn. They want time to "get it wrong," to trouble-shoot, to rewrite the important stuff in their own language.

After listening to many students over many years, my view is that what the students need is more opportunity to design their lives as learners, to be architects engaged in key structural decisions. And these decisions need to concern both how they learn and how their learning is evaluated.

4. *The curriculum*. **Too often (especially in introductory science and engineering) our courses are largely focused on the transmission of technical skills. There are two problems with this, first, our students make very little progress towards the crucial task of becoming an independent learner, and secondly, they fail to get a proper sense of the drama, beauty and power of the discipline.**

The guiding philosophy of curriculum design is that our fundamental task is not to teach our students the things they need to know to be engineers or mathematicians or psychologist or historians but to teach them what it means to be an artist. And to do that we need first of all to remember that we are artists ourselves, and we value such qualities as beauty, colour and restraint. Of course we do what we do with knowledge and ideas, using examples, methods, techniques and problems that belong to engineering or mathematics or psychology or history.

Our courses (especially first year) are *comprehensive* and as a result they are too crowded, and often too detailed and too technical. We worry that if we don't teach it they won't learn it and they'll be in trouble next year. As a result our best students do not find their courses particularly engaging or exciting or illuminating and the rest feel anxious and out of control and hope simply to survive. No one complains much but in my view that's because their expectations are so low. We need to return to a focus on what Karen Rudie calls "interesting problem solving." Rather than "cover the curriculum," we need to choose examples that are *formative*, that present an enticing surface which in turn compels the student to go more deeply, to try to penetrate to the centre of the meaning.

When you have a problem on the go, when you are thirsting to get a better understanding, your learning trajectory is quite different. It's less linear and more strategic, it's very selective, fastening on different things, rejecting some and nailing others firmly to the wall. Over time, the mural that takes shape becomes a model that will inform and nurture you for the rest of your life.

How can we effectively move to such a curriculum? This is a huge question; there are deep and subtle difficulties in making progress on this front. Even if we accept an investigative model of learning, suddenly we resist when it comes to cutting material out of our own courses or of another course on which our course depends. In many ways, the problem is that we think in terms of reducing material. We ask: "what can we cut out?" and the answer to that question is almost always: "nothing—everything is important and wonderful." [It's a beautiful subject after all.] We think in terms of pruning the curriculum tree, when we really need to construct a new kind of tree, one with a different organizing structure—less linear and more like a network. Curricula in the humanities are often structured in this way but it is rare in introductory science courses. There's more to be said about how such structures work, but my experience is that, with faith and patience, miracles occur, and five key examples and two small ideas are enough to feed a multitude of topics. [c.f. Caroline Baillie's threshold concepts.]

Now let me address the question of large lectures. I have argued with anyone who would listen that the next academic building Queen's builds must contain a state-of-the-art lecture hall that will house the first-year engineering class (say 700). In a lifetime of learning, the best lectures I have been to have been large. And I have not wanted to talk or discuss after or during those lectures, but to think first, to come to terms with a small upheaval in my conceptual universe. A good lecture for me is a presentation of one or two or three works of art, juxtaposed, explored together, especially when there are harmonies and contradictions, possibilities and paradoxes. And of course beauty, always beauty. Our students deserve such lectures, and we can produce them if we make them large and few.

A good lecture is a treat, but a learner neither wants nor needs too many of these. Perhaps two per week per course. For the rest of the week, a learner need lots of time and space, open, yet structured in ways that I will return to.

Let me return to Jane, and to the idea that if she were smarter her difficulties would disappear. Many of our colleagues will protest that there is an inherent difficulty in mounting a curriculum that will challenge our very best students and gives enough time and space for the middle-of-the-road students to flourish. I believe that this need not be the case, that a curriculum designed on the principle that what you need are a few key examples of the highest quality can serve all our students. Our very best students will simply do different (and often surprising) things with these examples; they will carry them to higher levels of abstraction, will see more connections, and will use them to break conceptual barriers. Rather than sit and watch us do that, they'd rather do it themselves. And when they want details, they will come and ask.

A good curriculum can work well for every true learner.

5. *Engagement.* **There is considerable emphasis on the need to engage our students, and rightly so. But we need to look critically at the key ingredients of engagement.**
For a learner the key ingredient of engagement is the problem or the quest. It has to be something that reaches out and grabs her and this has mostly to do with the quality of the problem. Said another way, *engagement has much more to do with the quality of the material then the quality of the pedagogy.* Actually I haven't even said *that* right, because when you come right down to it, pedagogy is really almost all about the quality of the material. At least that's how it is for a learner. So the bottom line is actually this: *engagement is critically dependent on the quality of the material.*

There is an idea around that to foster engagement we need to encourage our students to interact with one another, talk to one another, bounce ideas around. Absolutely—this often promotes or reinforces engagement. But too often I have seen students being asked to take 10 minutes of valuable class time to "talk to their neighbour" when they are ready neither to talk nor to listen. When a learner is struggling to master an idea it can be most annoying to be asked to discuss it or to be forced to listen to someone else. One needs to have gotten to a certain point of internal consolidation before one is ready (and even anxious) for that kind of sharing. And for heaven's sakes, when a learner *is* ready to discuss an idea, she will simply do so provided she has the time and the opportunity. And that's where we come in. I've talked above about time, but there is perhaps more to say about opportunity.

6. *Academic community.* **Our students yearn to have a better or fuller sense of academic community, more opportunity (and encouragement) to interact with one another in a significant intellectual (and moral) forum.** There are many ways we can try to facilitate this. The best of these is simply to deliver lectures that get them fired up, reacting, questioning and arguing with one another. More formally, give them some good investigations to work on in groups, or challenge them to fill in some of the spaces we leave open in our class work. I have had good success in senior courses with final exams to be done as group projects together with the requirement that an essay be written by each group describing in some detail how the group worked together, and where the strengths and weaknesses lay.

But it's just as important that we facilitate a climate of interaction, and there are a number of good strategies for this. One of these is to construct inviting spaces with the right atmosphere. Lounge spaces adjacent to work tables, open concept design, coffee and snack bars. Another is to involve senior undergraduates more in our teaching function, as informal or even formal tutors. We've done some of that in the Math&Stats Dept.

7. *Assessment.* **Our current practice of setting time-limited high stakes exams at the end of every course causes considerable stress, sends the wrong message in terms of what's important, and wastes time and energy. Certainly the students need lots of high quality feedback, but the "system" can and should function with far less certification, particularly in the first couple of years.** I have suggested that much of the anxiety experienced by many of our students comes from the fact that they feel they are held hostage by a system that does not work for them, e.g. the balance between content and process is wrong for them. My focus so far has been on the character of the learning process, but an equally significant part of their experience concerns the manner in which their learning is evaluated and I turn to that now.

Assessment serves two roles, *feedback* which goes to the student and *certification* which goes to the community and *in many cases these two functions interfere with one another.* Though the students always need good, timely feedback, the community does not need as much formal certification as we currently impose. My view is that for the first two years virtually all our assessment should be solely for student feedback. This would have two enormous consequences. First of all it would hugely simplify our lives and the lives of our administrative staff (if you don't believe me, try to run a midterm evening test for a large multi-sectioned course). When certification is not the objective, students can simply be sent home with tests and exams and issues of "cheating" and collaboration and timetabling disappear. And it would make our teaching simpler, easier to manage, *and more honest and faithful to the subject.* And secondly, and even more importantly, it would *dramatically change the learning experience of the student.* For first-year students, simply being faced with the situation of having only feedback assessment would force them to confront the question of why they are here, and what they are supposed to be doing. Those who managed (under our active guidance) to find a positive response to this question would be more likely to adopt long-term learning strategies, and would take more time to consolidate and trouble-shoot the myriad uncertainties they encounter in building their conceptual view of the subject. In summary such a change would send a significant message about the nature of learning and what it means to be a student.

Thus the learning experience could be freer and more enjoyable for both teacher and student. I am convinced that, with the right guidance, encouragement and even inspiration, most of our students would respond to this *and would be changed.*

Let me say one more key thing about feedback to the student. With little improvement in faculty-student ratios in sight, my colleagues are increasingly wondering how we can manage to provide enough of this. In fact, I believe that learners do not need as much of this as might appear. Students who have read good literature, who have seen and understood good arguments, good presentations, good expositions (these are big qualifications and one that , already have a pretty good idea of the quality of their own work. They are much better able to judge the quality of their own work than we give them credit for. In a system in which all assessment is certification, this observation is much less likely to be apparent both to us and to them! We can and should encourage more self-reliance in our students.

By the way I would intend that marks from feedback assessment (esp technical tests) be recorded by the instructor and used, quite possibly in future years to inform and guide the student's program and progress.

The second type of assessment, certification, should be mainly confined to the senior years, and should ideally take place between professor and student who know something about one another. Furthermore, it should be done under conditions that allow the students to do their best work, with enough time, proper space, and access to resources and to professors where appropriate. A striking and astonishing fact that *most of what I currently mark is not of high enough quality to be worth marking.* Let the destruction of *Jock Hardy* signal the end of one assessment era and open the way to another, a new system that will be kinder to our students *and to us*.

8. *Student and faculty expectations.* Expectations are a huge component of behaviour. So often, one behaves as one is expected to behave; one rises to meet the expected challenge. In many crucial ways, we do not ask enough of our students and they don't ask enough of us.
How do we encourage our students to be learners? A big part of this is about *expectations.* University is not for everyone. Or to be more precise, not everyone who comes is *ready* for university. It is crucial that we make clear at the very beginning our expectations of our students. This is something that should happen in our advertising strategies and our admissions policies, and I return to those aspects below. But even after the students come in the door, the expectations they are greeted with can have a huge effect on their learning strategies and experience. We need to make a big deal of this right at their very arrival. In a talk at the Fields Institute recently, Miroslav Lovric from McMaster talked about the nature and significance of certain "rites of passage." A good example is marriage. The solemnity of the ceremony reflects the fact that this new state heralds a profound life change, with new privileges and new expectations and responsibilities. Of course there is great joy and dancing as well but even this is suffused with the gravity of the transformation. Entering university also signals a profound change in the life of the student, in her expectations, her responsibilities and her opportunities. *She simply cannot behave like a high school student any more.* This is also a significant a rite of passage but we do not treat it as such. Our "academic" orientation is hardly academic but is really more socio-cultural and lacks challenge and gravity. And our curriculum (all aspects, content, homework, tests) especially in that crucial first year, is far too much like a heavy duty high school curriculum. No wonder they have the wrong expectations.

So far this is about our expectations of our students; the crucial other side of the coin is our students' expectation of us. They can expect to be taught and they can expect to be assessed in an imaginative, understanding, human manner. They can expect us to give them, not knowledge as much as focus, as knowledge is everywhere now in a confusion of excess, but what they need to learn is how to attend to the key issues, to the central techniques and methods, to the ideas of deep and enduring value. And finally they can expect us to get to know them and their work and their capacities well enough that we can give them valuable feedback as learners and give the world an honest, encouraging assessment of their potential. I want to point out that in both cases, teaching and assessment, our current practices are in many ways at variance with these expectations. The good news is that a lot of this variance is created by current practices, of both teaching and assessment, that take time, both ours and theirs, but have minimal effectiveness. We can let those practices go.

9. *Admissions.* Of the students we admit, a few are not nearly ready for the university experience; they are too far removed from being learners and shouldn't be here. Most of the rest are not quite ready but could become so, with the right regime, in their first year. In addition, there are many students who we do not admit because they graduated from high school with marks substantially below the Queen's "bar" but who *are* already learners, who are independent risk-takers, with wide, passionate interests, and who have refused or for a variety of reasons have been unable to play the marks game. They need us—they need some real "schooling"—and we need them. We need to find a way to get them to Queen's.
First let's consider the many students who come and are not quite ready. I believe that a strong well-advertised statement of clear expectations, and the right curriculum philosophy will make a huge difference here. I believe that most of our students will respond by putting substantial resources (with our assistance) into the task of becoming learners. Of course, some will get discouraged and will go elsewhere or will decide that they are not quite ready for university. Those that we lose in this way will be more than balanced by other very good students (some from other countries) who will hear about our philosophy of teaching and learning and will seek us out. Secondly there are those students who are more than ready but would not (at present) be admitted. The problem is to identify such students and there are some interesting strategies for that which make use of teachers and alumni. In fact I know many teachers and alumni who would respond quite enthusiastically to an innovative admissions policy and would

be happy to work with us, making contacts, interviewing students etc. [I know—there are problems of fairness here…]

Much is made of the fact that Queen's has the best students of any Canadian university. But that's only a half truth. We have more than our share of the students in the high 80's and low 90's. But in science and engineering at any rate, I'm not convinced that we have even our fair share of the very best students. I have a feeling that Toronto and Waterloo outpace us substantially in that category. I believe that the changes I have suggested above will serve powerfully to attract the very best students. I believe that we should structure our courses and our lectures to be more attractive to students who are similar to the way *we* were when we were young.

By the way, it needs to be emphasized, and I have made this point above, that a curriculum that pays close attention to the capacities of our best students can also work wonderfully for our second-best students. A work of art, whether Picasso, Rembrandt, Mozart or the Beatles, can be experienced joyfully and deeply by many different students in many different ways. One way we can help this to happen is to think carefully and imaginatively about the goals of our curriculum and the objectives of our assessment of our students' learning.

10. Summary of Recommendations.
1. Reduce the sheer weight of our courses, especially in first and second year, not by pruning but by restructuring. The litmus test is to take into the classroom only what we ourselves find of enduring value. It needs to be observed that where we find the human world to be dysfunctional, this is not due to a shortage of technical skills.

2. Move to a high energy first-year experience with a focus on investigation and learning while still insisting on mastery of a manageable package of technical skills.

3. Make clear to our students and to the world our expectations that our students be learners. *And trust out students to respond.*

4. Design a learning environment for our students that has both the time and the space for informal interaction, that fosters the growth of an imaginative academic community.

5. Substantially reduce or eliminate certification assessment in the first two years. Students are ultimately motivated, not by marks but by the experience of creating a work of art that belongs to them and that is perceived to have significant value.

6. Revamp our admissions policies and procedures to give us a better chance of getting the students for whom this philosophy of education is right.