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# Teaching Dossier (2014)

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# Approach to Teaching

### Philosophy of Teaching and Learning

I see the role of university teacher as helping students discover knowledge for themselves wherever possible. For example, consider the process of helping a child assemble a puzzle. She picks up a piece and looks over the board. She might put it down, but far from the right position or orientation. My teaching role begins by offering guiding questions or suggestions that help her to manipulate the piece so that she works it into the correct position. Perhaps I would ask a question like, "if the piece is green, where in the picture is green?" After more fumbling, I might think aloud, "I wonder what would happen if you turned it?" From only the most necessary suggestions and her trial and error, my little student discovers how to piece together her puzzle. She prizes the outcome as her own work and has a little more confidence in her abilities. Granted, the university context involves greater content and complexity than this example, but I think the basic approach can still be applied in many circumstances. Whether it is during a lecture, lab, assignment, or other learning opportunity, I think we can find ways to lead students to deduce for themselves how and why things work. Although content delivery is a natural and integral part of the teaching and learning process, my philosophy is that learning is substantially enhanced when teaching also facilitates the student's own discovery of key concepts and their integration. For the student, the **discovery-based learning** experience will be memorable and rewarding, motivate further learning, develop a deeper understanding of the content, and build self-confidence. I also believe that discovery-based teaching and learning encourages students to take charge of their learning. Students that leave their university experience firmly believing they can learn/discover anything they do not know will be more likely to excel in today's changing technology sector workplaces.

Another major belief I hold about teaching and learning is **the importance of helping students connect what they learn into a framework**. This helps them see the bigger picture, provides motivational "Eureka!" moments, and should improve retention. I have come to believe in the use of "story" as a method of connecting points and conveying ideas, such as opened this philosophy. I think people believe they will understand a story and are inclined to reengage lost focus. Also, story details are readily recalled when a list of bullet points may not. So, when class examples or analogies can be put in the context of a story, it stands to make them memorable and may also refresh student interest and focus. For example, when explaining to students how robots may deal with failure, I have given the example of driving home from Prince Edward Island and missing the highway exit to Truro/Halifax. Subsequently, we discuss the ways of overcoming from the failure and methods a robot in a similar adventure might do the same. Also, posing questions of motivation like, "Why would we care about how accurate sensors are?" can get students thinking and prepare them to integrate the answer into their knowledge framework.

Ultimately, I believe that discovery-based teaching and learning supported by an integrative approach to content delivery is an effective way of leading students to a deeper understanding and retention of the subject matter.

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## Teaching Strategies and Evaluation Methods

My approach to teaching is manifested in the way I manage the class atmosphere, evaluation methods, and structure within the different teaching venues available. Having been a sessional instructor for an introductory robotics and game design course in 2012, I have had the opportunity to implement some of these approaches.

From personal experience in the lab not all students are excited about figuring things out for themselves. The **class atmosphere and approachability of the professor** are important so that students not only have a positive class experience but also so that they are confident they can get the support they need to engage the discovery-based learning process. Access to the professor by email, office hours, or in the class or lab is standard practice, which I have offered. Beyond this, I have described my philosophy in the first lecture and described it in the syllabus [E5a] to **set student expectations**. Also, the lab tutorials and mid-class **exercises [E5d] were done in groups** so that students would have one another to share ideas ("two heads are better than one"). In support of a positive atmosphere in the lecture periods, I have tried to keep content delivery enthusiastic and creative, offer friendly conversation with students before and after the class, and **get to know the majority of student's names**. To prove my interest in providing quality lectures, I gave my students a formal opportunity to give me feedback via a photocopied survey [E5c] that I distributed to the class, after which I determined, communicated, and implemented changes to the lectures that followed. Also, in class I sometimes brought up certain public details of my life beyond the classroom. I think that doing this to a limited degree builds rapport with students. Also, getting to know some of these details (e.g., hometown/homeland, summer plans, etc.) about the students lets them know you care, and are thus approachable. Perhaps the most unusual feature of the class I taught that boosted the student's perception of the course was the song I wrote [E5g] and performed in the last lecture, encapsulating some of the most important course content. It was a surprise to the students and very well received.

**There is nowhere as natural a setting for discovery-based teaching as in the laboratory**. Given some basic instructions and demonstration, the students are assigned tasks that require some practice or integration of what they have learned. Working in groups enables students to learn from each other, while the instructor interacts with individual groups to provide focused feedback to enable their progress. I have been both an instructor and teacher's assistant in a lab-based course involving basic robots. Students had to complete a project that required their robot to participate in three events of the Robot Olympics, each with a set of specific rules and aims [E5f]. They were forced to integrate knowledge gained over four previous tutorials, paying careful attention to the event rules. Often, however, groups got stuck. What they thought the programming said the robot should do and what it actually did sometimes disagreed. So**, I would try to ask leading questions to help them discover the problem** for themselves, and leave them to look for a solution. These one-on-one interactions with the instructor, helps facilitate and encourage the process of discovery rather than teaching per se, which I believe will be more memorable than if they simply followed step-by-step instructions.

**In a lecture setting, employing the discovery-based principle requires more creativity.** One strategy I have successfully employed is to give a **mid-class exercise [E5d]** and allow a few minutes for students to

discuss and answer the problem on their own and then in pairs. This gives the students a chance to engage with the material, which I believe is more effective than mere declaration of facts. Problems can be presented creatively, whether through video, step-by-step running through a computer program, or watching a simulation in progress.

**Assignments offer another unique way of implementing this principle**. When the content requires numerical answers, giving **the actual answer and a perhaps some hints** (e.g., the program code should use two arrays and three variables) **provides scaffolding** on which to help them deduce what should be done. In such a case, an assignment solution would be written evidence of the process that led to the answer. Along with additional **"why" and "how" questions**, this approach ideally requires students to assemble a coherent understanding of the subject matter.

## Teaching Goals

One interesting idea in pedagogy I would be interested in experimenting with is "flipping" the classroom. In advance I would prepare an online video lecture. If students could be convinced (or rewarded?) to watch this before coming to class, we could work on problems in class that make use of the material covered in the video lecture. In this way, the students gain the advantage of going over the videoed material and going back over it as much as necessary. The class time is also perhaps better spent with the instructor free to help students discover how to solve problems for themselves. In cases where previewing a video is not viable, clear post-lecture videos that demonstrate how to solve specific types of problems would support student learning in a some of the same ways.

In the course I have taught, I used a course management system (Moodle) to communicate with the class. In addition to this, a certain computer science professor colleague also uses social media (e.g., Facebook) to get feedback from students about where their understanding is weak. This is interesting, since students are readily engaged in social media and may be more inclined to take part in providing feedback when it is only a click away. In this professor's experience, he has not experienced any negative side effects in 2 years and about 200 students of exercising this practice. Accurate student feedback would allow me to help get students out of the ruts sooner in the course of learning.

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# Teaching Contributions

### Winter 2012 - CSCI 1106, *Animated Computing*

In Winter, 2012, I was hired to teach CSCI 1106, Animated Computing. This course has been offered in the Faculty of Computer Science since 2009 and I had been a teaching assistant (TA) in two offerings of the course prior to taking up the instructor role. In 2012, the course involved formal lecture periods (officially 3 per week, 50-minutes each) and two 2-hour lab periods each week. The **course enrollment settled at 86 students** (with about 75 students engaged) who were mostly in their first year of computer science. Some students from other departments and years also joined-in and the class included many international students. Because of the somewhat large enrollment, there were **three lab sections** and a total of **six TAs**. In terms of content, the course was to cover **introductions to robotics and game design**, each represented by a separate module with an associated project. A **summary of the Student Ratings of Instruction [E1] for the course are provided below** and compared with departmental scores for Winter 2012. In short, the ratings suggest that in my first formal teaching experience **I was an effective teacher**, receiving ratings usually on par or higher than the "average" professor teaching the same term in my department.

| Criteria | Class Rating | Dept. Mean | Dept. Min | Dept. Max |
|---|---|---|---|---|
| Overall, the instructor was an effective teacher. | 4.2 ± 0.870 | 4.0 | 2.2 | 5.0 |
| The instructor conducted the class in such a way that I was stimulated to learn. | 4.0 ± 0.941 | 3.9 | 2.3 | 5.0 |
| The instructor organized the class well. | 4.1 ± 0.830 | 4.1 | 2.3 | 5.0 |
| The instructor communicated clearly during the class. | 4.4 ± 0.765 | 4.1 | 2.5 | 5.0 |
| The instructor showed enthusiasm for the subject matter of the class. | 4.5 ± 0.576 | 4.3 | 3.2 | 5.0 |
| The instructor used fair evaluation methods to determine grades. | 3.9 ±1.097 | 4.2 | 3.0 | 4.9 |
| The instructor provided constructive feedback (considering the class size) | 4.0 ±0.981 | 4.0 | 2.3 | 5.0 |
| The instructor showed genuine concern for my learning | 4.2 ±0.840 | 4.2 | 2.6 | 5.0 |

As part of my job**, I was asked to substantially reshape the nature of the course** to include full-length lectures (see E3 for example slides) and expand the content slightly in the lab periods [E5c]. For the first time, the course would include bi-weekly quizzes [E5e] and a final exam. Because this was my first university-level teaching opportunity, I was **given the opportunity to meet weekly with a teaching mentor** (Alex Brodsky, a previous instructor of the course) long before the course began and as well as during the course. Although I had taken a formal course (CNLT 5000) in developing a university-level

course, this practical mentoring was very helpful. I believe that being able to bounce ideas off this mentor and generally receive feedback gave me insights that may have otherwise taken several teaching terms to learn by trial and error alone. Preparatory work for the course included adding to the lab manual [E5c], preparing a lecture schedule and course syllabus [E5a], developing several powerpoint presentations, and hiring and preparing the 6 TAs for their duties. I also worked together with accessibility services to handle a request to change the location of the class.

**The course itself ran quite smoothly as a whole**. The typical lecture involved a 15-20 minute presentation of content including the motivation for or practical use of that content. The class was then given an exercise where students were asked to first work out a solution on their own, then pair with a neighbour and discuss, and finally share their solutions with the class. Another 15 minute presentation of content would follow and the class would conclude with a summary of the day's content and a brief "teaser" of the content to come in the following class. The introductory and closing remarks were hoped to help students piece together the relevance of the content and how it interrelates. Content was presented on Mondays and Wednesdays. Friday lectures were used to give and discuss quizzes, have special presentations (e.g., Mind Sea Inc.), and because of large lab focus (2 hours Tuesday and Thursday) were sometimes were deliberately cancelled.

### Supervising Students

**I have had the opportunity to supervise others' research.** My PhD supervisor has employed a number of undergraduate students at various points in their program to perform research during mostly the summer months. I have had the role of helping to supervise these students, often during my supervisor's absence. Exceptions to this occurred in summer 2011 and summer 2012, where I played the role of primary day-to-day supervisor of two of these students as they worked on areas of research relevant to my own work. In both cases, this eventually led to working with the students to develop conference-level research articles, one of which was eventually published. The students were:

- Laurent Mattina - exchange student from ENSTA (Military School in France)
- Jacob Kroeker - Dalhousie Computer Science student

As mentioned earlier, **part of my responsibilities as instructor of CSCI 1106 was to hire, prepare, and manage six laboratory TAs**. All six were students, some graduate and some undergraduate. Before labs began I met with them to not only discuss duties, but to also encourage them to use the discovery-based learning approach. After that, I interacted with them on a semi-regular basis, keeping a pulse on how quickly students were completing lab-based tutorials and making progress on their end-of-module projects. Prior to certain labs, I offered some additional theoretical background to the TAs to prepare them for the labs. Due to the threat of labour strikes, I discussed contingency plans with the TAs. For both projects, I clearly identified how many marks would be given for each section of the report. I discovered after the first project, however, that the TAs could use better guidelines to help them mark efficiently and so I provided this for the second project.

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# Professional Development

Over the years, I have engaged in several teaching professional development opportunities

- Completion of **Dalhousie's Certificate of University Teaching and Learning** involved:
  - CNLT 5000, a course instructing how to develop a university-level course as well as some of the basics in teaching practice. The major course project is to develop a course portfolio for a course you might teach in the future. I developed a portfolio for a first year computer programming course and received very positive feedback [E4], particularly for my unique syllabus component.
  - three formal teaching observations/assessments [E3]
  - 20 hours of teaching and learning workshops
- As a graduate student, I **attended Dalhousie's New Academic Staff Orientation** in 2011, which included several teaching-related workshops.
- In one teaching and learning workshop, I **presented a teaching technique** called think-pair-share [E7], which I used in my class.
- Prior to my time at Dalhousie, I also **attended other teaching workshops**:
  - Enhancing Motivation to Learn Among All Students: A Guide to Engaging Instruction for Learners. (2003, University of New Brunswick Center for Teaching and Learning) [E6a]
  - Teaching Assistants Workshop (2003, University of New Brunswick Center for Teaching and Learning) [E6b]

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# Reflections on and Assessment of Teaching

In Fall 2011, I was given the opportunity to guest lecture in a first year programming course, to get my feet wet before teaching the following winter term. **I enjoyed the teaching experience** and those professors observing indicated I had done well. Although this was one of my first university-level lecturing opportunities, I was supported by the numerous smaller scale teaching and public speaking opportunities afforded by earlier volunteer work [E8c,E8a] and a few industrial opportunities [E8b]. In general, the Animated Computing course that followed was a positive and rich learning experience for me, and apparently for my students as well [E1].

Teaching the Animated Computing course had its share of teaching and learning challenges. The course was relatively large, settling at around 85 students, where about 75 were at least semi-engaged. The possibility of students feeling unnoticed in the class existed. However, I tried to get to **know the students by name and by the end I knew 2/3 or more of them**. The larger class size also afforded a larger teaching venue, which stretched upward and back more than it did wide. The venue was also not brightly lit so that students could sit in the back and seem inconspicuous. **Sometimes students would chat and disrupt other students during class**. As my teaching observations note [E3], effectively addressing such situations is one of the areas in which I could improve. Those observing my teaching offered some helpful ideas in this regard and one of the teaching workshops I recently attended has given additional strategies. Although I was pleasantly surprised by the advanced maturity of level of certain students in my class, I did have unpleasant encounters as well. In particular, **one student aggressively argued for additional marks** in quizzes and the final exam. Though difficult, this was a good experience in that it forced me to think through my expectations of students in formal testing. By the end of the term, I feel I was better prepared to handle these situations. Another student (or his parent via email) who initially made things a little uncomfortable was really in need of special accommodations, which I may have helped him discover. By the end of term, he was officially enrolled for such assistance.

My strategy for engaging students during the lecture was to begin with motivational questions to try and get students thinking. A **mid-class exercise gave students the opportunity to engage** with the material. Some engaged, some did not. **Midway through the course, I asked the students to formally evaluate [E5d] their class experience so far.** This provided me with helpful information to tighten up aspects of the lecture presentations, including the mid-class exercise. I learned that some of the exercises were too easy and that some students felt too much time was being spent on it. So, I shortened the time given and in some cases increased the difficulty level. Other feedback from the evaluation led to providing handouts online before class and an attempt at increasing the amount of content in each lecture.

Feedback from teaching observations [E3] made by professors sitting in on my class indicated areas of strength and areas for improvement. Reported areas of strength include

- organization and presentation style,
- communication skills and a good mix of learning strategies,
- enthusiasm, good rapport, and a natural interaction with the class

Reported areas for improvement were:

- to avoid disengaging from the class when presenting demos,
- to engage students earlier in the class with questions and repeat student answers and questions so they can be heard by all
- address class disruptions (chatting) earlier,
- move about the room at a slower pace and cover more area.

**I agree with the feedback provided by the observers** and on the improvement side, the suggestions made are duly noted. In the student ratings of instruction (SRI), the positive written feedback [E2] often made was that **I was approachable and enthusiastic** about the subject matter. Despite this, there were some students who expressed [E2] some boredom over the slow pace or small amount of the course content. In response, the introductory nature and the role of this elective course being an outreach to students from other departments, is at least partly responsible for this outcome. Having received some sense of this from the midstream evaluation, I tried to offer more challenging examples and additional content in class. In the numerical aspect of the SRI [E1], the students rated my teaching as being on par or perhaps slightly better than the "average teacher" in the computer science department (4.2 rating of overall teaching effectiveness compared to the 4.0 departmental mean) for Winter 2012. Although this is a nice place to start a teaching career from, I realize that there is always room for improvement. All but one of the ratings provided were at or above the departmental mean. The lower rating was in regard to fairness of testing. Although I think that testing was normal in most regards, **I could see that in the robotics project, evaluation of the touch wrestling task [E5f] was not the best measure of student work**. Student's robots "wrestled" one another and the most effective entries got the best grades. However, the degree of chance that factored into the results was a bit disenchanting. Instead, the students could have been given a standard opponent to be graded against and yet a competition between student entries could still have been held for the sole purpose of having fun.

In reflection, I have learned quite a lot about teaching from experience, observations, professional development opportunities, and the students themselves. Future improvements will involve putting into practice the suggestions already made, soliciting similar forms of feedback in the future, and attending additional teaching workshops. Overall, **I have received lots of interesting tips and I have yet to test some of them**. The key, though will be to try new things and be willing to make mistakes, which conveniently aligns with the discovery-based philosophy discussed herein, except that this time, I become the student.

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# Guide to Understanding the Supporting Evidence

The following documents are provided in support of my teaching contributions and abilities. At the head of each document, an overlaid note that corresponds with the evidence referencing notation used below will be embedded in blue text. The supporting evidence, if not supplied below, may be requested by email.

E1 - Student Ratings of Instruction for CSCI 1106. Included only first four pages, which are the only pages containing course-specific results.

E2 - Written comments relevant to my teaching from CSCI 1106 student evaluations.

E3 - Three peer observations/assessments of my teaching and associated reflections - In each observation, a professor sat in on one of my classes and completed an assessment form. The observers were selective in the areas they commented because of time-constraints. Each observation includes a pre-observation form, the official assessment form, a one-page reflection, and the corresponding lecture slides.

- E3a - Teaching Assessment performed on January 16, 2012, by Dr. Alex Brodsky
- E3b - Teaching Assessment performed on February 15, 2012, by Dr. Chris Watts
- E3c - Teaching Assessment performed on March 21, 2012, by Dr. Alex Brodsky

E4 - Instructor feedback on a course portfolio I designed as student in CNLT 5000, a course which trains students in teaching practice and the development of a university level course. I chose to design an introductory computer science programming course, which bore many similarities to the course I eventually taught. The course portfolio encompassed a number of elements including teaching philosophy, course outline, syllabus, concept map, methods of evaluation, dealing with expected challenges, and self-reflection.

E5 - Sample of materials developed for CSCI 1106

- E5a - Course Syllabus - largely my own work but borrowed some of the structure and plagiarism formalities from previous syllabi
- E5b - Mid-class exercises - slides used describing questions or problems students would work alone and afterward in pairs during class to solve
- E5c - Two laboratory tutorials - These are the two tutorials that I have developed for the course on my own.
- E5d - Midstream Evaluation - Developed on my own and distributed shortly after completion of the first module (half) of the course.
- E5e - Two quizzes - Developed on my own.
- E5f - Robot Olympics project description - based on an earlier framework of previous project descriptions, but replaced two of the three Olympic events

E5g - "Keep Characterization in Mind". Song written for final review class prior to final exam based on course content.

E6 - Teaching Workshop Certificates - Workshops attended at the University of New Brunswick prior to finishing my Master's degree.

E6a - Enhancing Motivation to Learn Among All Students: A Guide to Engaging Instruction for Learners.

E6b - Teaching assistant's workshop

E7 - Letter indicating contribution to presentation in teaching workshop

E8 - Excerpts from letters of reference reflecting teaching ability - In applications for assistant professor (prepared in 2004) and a scholarship (2011), I acquired several letters of reference. These speak to my teaching abilities. The relevant parts of the letters are highlighted.

E8a - Letter of reference written by Dr. Maryhelen Stevenson, my Masters' supervisor

E8b - Letter of reference written by Tim McCarthy, supervisor in industry (CARIS)

E8c - Letter of reference written by P. Marc Smith, CIBC Bank Manager and fellow parishioner