

# TEACHING STATEMENT

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## 1. TEACHING PHILOSOPHY

As a Ph.D. student in mathematics, I have taught calculus to life science students and linear algebra to engineering students. Through my teaching, I hope to not only motivate students to learn but to instill in the students the desire and need to learn as well as to perform to the best of their abilities. My teaching is currently guided by the following principles:

### **To Motivate My Students To Learn**

When I think of the mathematics courses from which I retained the most, I recall motivated teachers who were passionate about the course material being taught. Their interest in the material not only encouraged me to want to learn mathematics but showed me that mathematics can be beautiful. I hope to engage my students in the courses I teach and bring mathematics to life for them as it was for me. In order to do this I try to find aspects of the material that interest me and share these with my students. I also encourage my students to share aspects of the material that interest them.

### **To Talk With My Students**

The majority of the mathematics which I have learned has been through conversations with other people. These conversations have taken place during classes and in private meetings with other students and teachers. I believe that these conversations had such a positive impact on me because they gave me a chance to clarify facts and my own confusion. A student's misunderstanding can have serious implications in the learning of the material. For this reason, it is very important that I talk *with* my students rather than *at* them. I hope to encourage my students to ask me questions by demonstrating that I will sincerely listen and attempt to provide answers.

### **To Teach My Students To Think For Themselves In Logical, Creative Ways**

I realize that not all my students will appreciate mathematics as I do. I believe that a university should prepare students to become productive citizens in society. With this in mind, I try to keep the courses I teach interesting by showing that the material is relevant to other fields of study. By linking students' other courses to the material seen in my course I express that an individual never knows when their thoughts will influence the face of a subject. For example, I often tell the story of how Gaussian elimination, a topic seen in an introductory linear algebra course, was described by Gauss who needed the process for studying an asteroid! I hope to instill in my students the pleasure of thinking for themselves in logical, creative ways. In class we examine how to analyze mathematical problems and discuss numerous creative possible methods to solve them. I also challenge my students to further pursue what has been seen in class and give weekly challenge questions.

### **To Improve My Teaching**

I admire the teachers who have taught me difficult courses in an effective manner. I believe that the best way to say thanks to these teachers is to strive to also be an effective teacher. In order to do this I need preparation, practice, and feedback from self-reflection, students, and colleagues. I always work to improve my teaching abilities because I desire that my students get from me the personal best that I can give them (afterall, I do expect my students to perform to the best of their abilities so they should not expect any less from me).

## 2. UNIVERSITY TEACHING EXPERIENCE

The following is a brief description of my experience as a university instructor. All courses were taught at Queen's University.

- **Winters 2003, 2004, and 2005:**

*APSC 174 - Introduction to Linear Algebra for Engineering Students:*

An introduction to matrix algebra, linear algebra, and applications. Topics include linear transformations, systems of linear equations, vectors, dot and cross products, lines and planes, projections, the vector spaces  $\mathbb{R}^n$  and their subspaces, bases, matrix algebra, linear independence, bases and coordinates, orthonormal bases, dimension, rank, determinants, inverses, eigenvectors and eigenvalues, symmetric matrices, and diagonalization with applications.

This is a required course for all first-year engineering students. In the Winter 2005 semester I will teach a section of approximately 100 students. In each of the Winter 2003 and 2004 semesters I taught a section of approximately 100 students (from about 650 total students registered).

2003 Text: *Transform Linear Algebra*, Frank Uhlig. We mainly covered Chapters 1 - 10.

2004 and 2005 Text: *Introduction to Linear Algebra: Course Notes for APSC 174*, S. Cooper, C. Koestler, D. Pollack, Queen's University. We also required *Linear Algebra with Applications*, Second Edition, Otto Bretscher. We mainly covered Chapters 1 - 7.

- **Fall 2001 and Winter 2005:**

*Math 121 - Differential and Integral Calculus:*

An introduction to differentiation and integration of the elementary functions, with applications to physical and social sciences. Topics also include Taylor polynomials and multivariable differential calculus.

This is a two semester required course for many arts and science students. Math 121 is intended for students not concentrating on Mathematics or Statistics. In Winter 2005 I will teach the second semester with a section of approximately 140 students. In Fall 2001 I taught the first semester with a section of approximately 370 students (from about 800 total students registered).

Text: *Calculus (Single and Multivariable)*, Third Edition, Hughes-Hallett, Gleason, Mc-Callum, et al. In the Fall 2001 semester we mainly covered Chapters 1 - 7, 10. In the Winter 2005 semester we will mainly cover Chapters 6 - 15.

## 3. UNIVERSITY TEACHING ASSISTANT EXPERIENCE

- **Winter 2001:**

*APSC 172 - Introduction to Differential and Integral Calculus for Engineering Students*, Queen's University. Substitute instructor. Responsible for 6 lectures, 2 tutorials.

- **Fall 2000 and Winter 2001:**

*Math 121 - Differential and Integral Calculus*, Queen's University. Responsible for running weekly tutorials.

- **Fall 1999 and Winter 2000:**

*Math 120 - Differential and Integral Calculus*, Queen's University. Responsible for running weekly tutorials and marking.

- **Winter 1999:**  
*Math 110 - Linear Algebra*, Queen's University. Responsible for running weekly tutorials and marking.
- **Fall 1998:**  
*Math 110 - Calculus 1*, University of Regina. Responsible for running weekly tutorials.
- **Summer 1998:**  
*Math 111 - Calculus 2*, University of Regina. Responsible for running weekly tutorials.
- **Fall 1995 - Winter 1998:**  
*Various calculus and linear algebra courses*, University of Regina. Responsible for weekly marking.

#### 4. CURRICULUM DEVELOPMENT ACTIVITIES

After reviewing student feedback from the Winter 2003 semester, it was decided that course notes should be written for **APSC 174 - Introduction to Linear Algebra for Engineering Students**, Queen's University. I co-authored these notes with C. Koestler and D. Pollack. These notes were introduced in the Winter 2004 semester and revised for the Winter 2005 semester.

#### 5. PROFESSIONAL DEVELOPMENT ACTIVITIES

##### 5.1. Instructional Training.

Since becoming a graduate student, I have tried to take advantage of workshops and courses which focus on instructing at the university level. In particular, in the Winter 2003 semester, I successfully completed the full semester course **SGS 901 - Teaching and Learning in Higher Education** offered by the Instructional Development Centre at Queen's University. In this course students and instructors participated in reading various articles on teaching, small-group work, and seminars. Students were required to give small presentations after which feedback was given. To conclude the course, students were asked to complete a teaching portfolio.

##### 5.2. Instructional Certificates Obtained.

I have participated in the **Program in University Teaching and Learning** organized by the Instructional Development Centre at Queen's University. As a result, in May 2003, I was awarded the following certificates.

- Certificate I: Scholarship
- Certificate II: Practical Experience
- Certificate III: Professional Development

##### 5.3. Educational Leadership Activities.

- TA Mentor/Liaison, Department of Mathematics and Statistics and the Instructional Development Centre, Queen's University, September 2004 - Present.
- Organizer of Marking Session, Teaching Assistant Workshop, Department of Mathematics and Statistics, Queen's University, September 2004.
- Canadian Mathematical Society Student Committee Co-Chair (with Robert Juricevic), July 1, 2002 - June 30, 2004.
- Canadian Mathematical Society Board Member, Student Representative, January 2000 - June 30, 2004.

- Canadian Mathematical Society Student Committee Member, 1998 - June 30, 2004.
- Co-organizer (with Dr. Morris Orzech and Chris Leith) of the Teaching Assistant Workshop, Department of Mathematics, Queen's University, September 2001 and 2002.
- Canadian Mathematical Society Judge at the Canada-Wide Science Fair, Queen's University, May 2001.
- Co-organizer (with Dr. Leo Jonker) of two day-long math camps for elementary-school students, Queen's University, June 2000 and 2001.

## 6. TEACHING STRATEGIES

I believe that one's teaching style is constantly developing. This natural change is the result of personal growth, experience, and education about teaching and learning. I have been fortunate to teach motivated and capable students who have encouraged me and given me the confidence to experiment with different teaching strategies. The following is a list of a few successful strategies I have experimented with.

### **Mini - Break**

After considering the feedback of my students and reading some articles on teaching, I realized that within a fifty minute class the attention of the students is quite low after twenty minutes or less. In order to re-energize my students I provide a "mini - break". This break takes place about twenty minutes into the class period and lasts anywhere between one and three minutes. During this break I encourage the students to look over the notes they have taken during the first part of the class and to ask any questions they may have to the students sitting around them. I find that the students appreciate the break and that the energy level in the class is increased for the rest of the class period. In addition, the students are also quite surprised and happy to see that their questions are common and that together they can usually find a satisfactory answer without my help.

### **"Pens Down" Examples**

Often my students express that they feel that all they are doing during the class period is transcribing notes from the board. I want my students to actually understand what they are writing down. To give my students the opportunity to see if they understand what has just been written down I will present a "Pens Down Example". These examples are not to be written down by the students. Rather, the class discusses how to go about solving the problem given. These examples vary from basic/standard level to intermediate level. Sometimes, I will use these examples to speak about notation that the students will see in their assignment that week.

### **Interactive Questions And Answers**

After discussing some theory and providing some examples, I will sometimes introduce a related problem. I then ask the students to work in pairs and solve the problem. The students are given between two and three minutes to come up with their solutions. During this time, I will walk around the room and speak with students who aren't working in pairs as well as answer questions. I then ask for volunteers to either write their solution on the board or to tell the entire class what the solution was in their group. I find that this exercise gives myself and the students a chance to gauge how well they are understanding the material. I believe that if a student can explain a solution then there is a better chance that they will retain the information and gain a deeper understanding as to why things work the way they do. I often encourage my students to share their solutions, even if the solution is only partial, by expressing the value in sharing the knowledge they have.

### **Challenge Questions Of The Week**

During the last class period of the week, I remind the students of their suggested readings as well as their assignment. In addition, I provide a "Challenge Question of the Week". These questions vary from the standard extra practice level to the challenging level. Students are

encouraged to attempt these questions, either individually or in groups, to write up their solutions, and to discuss the question with me if they so wish. These questions are not collected and read.

### **Mathematical Games**

At some point in the semester I will try to play mathematical games. These are played in order for students to gauge their understanding of the material in a relaxed atmosphere. The most successful game has been “Switch”. In the game “Switch” I ask the students to pair up and then give them a computational question. For one minute one member of each pair works on the question without speaking to their partner. I then say “Switch” and the students must pass their work to their partner. At this time the partner is either given one minute to finish the question (again without speaking to their partner) or they are asked to mark the work handed to them. Asking the second student in the game to mark the work of their partner allows students to be in the role of the instructor marking an assignment or exam. The idea of “Switch” was suggested to me in a conversation with Dr. Grace Orzech.

### **Mathematician/Quote/Joke Of The Week**

Once a week I will present either a mathematician, quote of a mathematician, or a joke related to the material currently being covered. I think that it is important for students to realize that the field of mathematics has a history. By having mathematicians or quotes of the week I hope to peak the interest of students in the history of mathematics.

### **Physical Candy Examples**

In my experience students often find the concepts of 1-1 and onto mappings quite difficult. I will often toss candy towards the students to emphasize the differences between 1-1 and onto. This technique has proven to be quite successful, wakening up the sometimes sleepy students.

### **The Venice Dictionary**

I have spent four months visiting Italy and love to share my experiences with students. When discussing coordinates and change of bases in introductory linear algebra courses I often set the topic matter up by describing a city made up of many regions (such as Venice). I insist that each regional has its own language or traditions and that in order to communicate with people from these different regions we need language dictionaries (or boats between the islands of Venice). I then go on to equate the dictionary (or boat) with the change of basis matrix. In addition, I also give examples of how it sometimes may be more convenient to be in one region rather than another, although we are still in the same city, and hence we see the motivation for changing coordinates at times.

## 7. MEASURES OF TEACHING EFFECTIVENESS

I believe reflection plays a very important role in the development of a teacher. In order to reflect on my teaching techniques as well as how I view other strategies, I try to speak with many experienced teachers and fellow graduate students in the area of mathematics about their teaching. I have been fortunate to be surrounded by very experienced and deeply committed teachers in the Department of Mathematics and Statistics at Queen’s University.

In order to be an effective teacher, I believe that it is very important to collect and interpret constructive feedback from students. As a TA, I concentrated on feedback from successful mentoring teachers and did not formally collect feedback from students. I did however consider comments submitted from students orally and in emails.

As an instructor, I usually ask my students to fill out a mid-term feedback form part ways through the semester. I always find this data to be quite useful for the second part of the semester and, as a result, find myself experimenting with new techniques which may help my students be successful in the course. In addition, at Queen’s University, each instructor is to have their students complete the **University Survey of Student Assessment of Teaching** (USAT, formally known as QUEST) feedback forms near the end of the semester.

On the USAT evaluation forms students are asked if they strongly disagreed or strongly agreed on a range from 1 to 5, where 1 = “strongly disagree” and 5 = “strongly agree”, with some statements. Each time I read all of the comments on these forms and try to keep these in mind when beginning a new semester’s course. However, much of the USAT feedback forms are on the course and not the instructor. Since I have not yet coordinated any of the courses I have taught, I have had little control over course content and organization. I have had some control over homework and exam questions. Therefore, I need to make careful interpretations of the USAT forms.

Feedback for the Winter 2005 semesters of APSC 174 and Math 121 courses are not yet available. The following is a summary of feedback collected from these courses in the Fall 2001 and Winters 2003, 2004 semesters. Copies of complete USAT Evaluation Reports, along with selected student comments, can be found in the appendices. Copies of student USAT forms are available upon request.

• **Math 121, Queen’s University, Fall 2001:**

My first teaching assignment at the university level was Math 121. This was an introductory course and my section was very large. I found this to be a rewarding challenge. Part ways through the semester I conducted a mid-term feedback form. I found the comments of my students to be very helpful in experimenting with new techniques, such as “Mathematician of the Week”. I soon found that “Challenge of the Week” and the “Switch” game were quite useful and fun for my students. The feedback also gave me practical tips which I could improve on for teaching.

The USAT feedback form was completed by 306 of 370 students. Overall students rated this course quite poorly. However, they did seem to value my teaching efforts more. I was given a 3.6 mean for being an effective teacher, which was only slightly under the departmental mean of 3.9. I was also given a 3.5 mean for presenting material clearly with a departmental mean of 3.9. Overall students seemed to appreciate my teaching, particularly where being approachable and being concerned about whether students learned the material was concerned. Their comments also indicated that my concentrating on improving specific, practical techniques, such as repeating questions before answering and going beyond the course notes for additional examples, as well as my being innovated, enthusiastic, and genuinely interested in the material helped support their learning. Indeed this feedback helped form my Teaching Philosophy. Selected comments can be found in Appendix IV. Below is a partial summary of the USAT Evaluation Report. The complete summary can be found in Appendix I.

Overall, this is an excellent course.	Mean: 3.0	Dept. Mean: 3.7
Overall, this instructor is an effective teacher.	Mean: 3.6	Dept. Mean: 3.9
The instructor showed concern for students.	Mean: 4.3	Dept. Mean: 4.1
The instructor presented material clearly.	Mean: 3.5	Dept. Mean: 3.7
The instructor was available outside class.	Mean: 4.1	Dept. Mean: 4.0
I would recommend this instructor to others.	Mean: 3.4	Dept. Mean: 3.8
The instructor was enthusiastic.	Mean: 4.4	
The instructor seemed interested.	Mean: 4.4	

I have also received unsolicited feedback from Math 121 students on my teaching. In these cases, their comments are overwhelmingly positive. In particular, they express appreciation for time and effort that I put into improving my teaching. Selected unsolicited comments can also be found in Appendix IV. I believe that as a result of the Math 121 feedback I have put great effort into improving my teaching and that this hard work has demonstrated itself in later courses.

• **APSC 174, Queen’s University, Winter 2003:**

On the mid-term feedback form, students indicated that they found me to be very approachable and interested in the course material. It was also indicated that I noticed and clarified points of confusion. The lowest scores that I received was on the matter of effectively using examples to get across key points and explaining material in a clear manner. This was the first time I was teaching linear algebra and I found myself struggling to find good examples. After the feedback I made a great effort by talking to experienced instructors to collect good examples for the future. I was also told that I was trying to put too much material into one lecture. I really appreciated the constructive criticism that that my students provided through this mid-term feedback form and, in response, I experimented with new techniques, such as the “Mini-Break” and “Pens Down Examples”, in the last half of this course. The students reacted well to these new techniques.

The USAT feedback forms were completed by 91 of 112 students. Overall, students again indicated that I was very approachable. My scores regarding teaching effectiveness improved from the mid-term feedback. I was given a 4.1 mean for being an effective teacher which was above the departmental mean of 3.7. In the comments section of the USAT feedback forms, the comments of many students indicated appreciation of my efforts, particularly where my lecture notes and outside class appointments were concerned. Selected comments can be found in Appendix IV. Below is a partial summary of the USAT Evaluation Report. The complete summary can be found in Appendix II.

Overall, this is an excellent course.	Mean: 3.3	Dept. Mean: 3.6
Overall, this instructor is effective.	Mean: 4.1	Dept. Mean: 3.7
The instructor showed concern for students.	Mean: 4.3	Dept. Mean: 4.0
The instructor presented material clearly.	Mean: 3.8	Dept. Mean: 3.5
The instructor was available outside class.	Mean: 4.1	Dept. Mean: 4.0
I would recommend this instructor to others.	Mean: 4.1	Dept. Mean: 3.7

**APSC 174, Queen’s University, Winter 2004:**

The feedback I received when teaching APSC 174 in the Winter 2004 semester is very similar to that when I taught it in the Winter 2003 semester. Comments from students in this course expressed that they benefited from my “Physical Candy Examples” when trying to understand the concepts of 1-1 and onto. Please see Appendix III for the USAT Evaluation Report and Appendix IV for student comments.

**Appendix I:  
USAT Evaluation Report for Math 121  
Queen's University  
Fall 2001**

**Appendix II:  
USAT Evaluation Report for APSC 174  
Queen's University  
Winter 2003**

**Appendix III:  
USAT Evaluation Report for APSC 174  
Queen's University  
Winter 2004**

**Appendix IV:**  
**Selected Comments from Math 121 and APSC 174 Students**  
**Queen's University**  
**Fall 2001, Winter 2003, Winter 2004**

**Math 121 - Differential and Integral Calculus, Fall 2001****USAT Forms:**

- “Susan did an excellent job. She is the best math prof I have had at Queen’s. She shows actual interest in the subject matter and a genuine concern for the students. Queen’s needs more profs like her.”
- “Susan Cooper is a very effective and understandable professor, who I believe is an asset to the Queen’s staff.”
- “I enjoyed very much how Susan would go beyond the courseware notes, giving us more examples to help us get a better understanding and more practice.”
- “Susan Cooper is a very good instructor. She gave lots of examples throughout the material, even beyond those done in courseware notes. She wanted to make math fun for the students and not just work through the course material. She attempted to encourage students not only in the area of math but in life. Susan Cooper is an excellent teacher.”
- “You’ve made a great improvement from the beginning of the course, keep up providing us with extra examples to reiterate points made in the courseware, the way you’ve started to repeat questions that have been asked and try to make sure everyone understands the answer to those questions is also awesome! You really have taken our suggestions from the beginning of the year seriously, and the improvement in your communication with us reflects that! Thanks!”
- “Prof is enthusiastic and creative.”
- “Cooper was very good at helping students on an individual and class basis and trying to explain concepts in a different way if the material was not understood.”
- “She also tried to make the class a little more interesting with “Quotes and Mathematicians of the Week.”
- “The teacher was interested and motivated and always tried to stimulate class participation.”
- “The instructor is very enthusiastic about the class and ready to teach us anytime we were ready to ask questions. She seemed to stand out from the list of profs that I have in showing genuine care to teach the students. She goes through the basic steps to incorporate everyone who don’t understand that topic and even goes through the complex steps to challenge the able minded. She especially gives us examples from outside the work notes. This is a great plus!”

**Unsolicited Email Comments:**

- “I think you are doing a great job. You make math interesting!!”
- “It has been a great pleasure being in your class, . . .”
- “I am really enjoying your class, I like your attitude and the way you teach it.”
- “Thanks again for your time, and I just want to say that it’s awesome how cheerfully you teach math.”
- “If you wonder you are doing great job. You are a good teacher.”
- “I just wanted to thank you for all your help throughout the semester. You put in so much extra time and energy and I really appreciated it.”
- “Hi Susan! I don’t know if you remember me, but I’m the girl who came to your office almost in tears and seriously considering dropping math 121. You were very encouraging and gave me some good advice that lead me to persist for a couple more weeks. Well, guess what? I have an 83% in the course, which is way better than a bunch of my friends who took calculus in high school (3 of whom failed the Dec exam). If it weren’t for you I would probably have dropped the course and had to take it either in the summer or next year. THANK YOU!!”

**APSC 174 - Introduction to Linear Algebra for Engineering Students, 2003****Mid-term Feedback Forms:**

- “[Ms.] Cooper is very approachable, and very easy to talk to. She is genuinely interested not only in the material, but also how the students are doing.”
- “I like Dr. Cooper’s energy as she always teaches with a smile.”
- “[The] instructor is very helpful when asked for clarification outside of class.”
- “[The] teacher is great, very nice, very approachable.”
- “I am really enjoying this course, keep up the great notes, they help very much.”
- “I appreciate how Susan Cooper really does try to teach us.”

**USAT Forms:**

- “[The instructor] presented material clearly with use of examples.”
- “The material was presented in a manner that is easily understood.”
- “The instructor’s board notes were thorough and clear.”
- “Ms. Cooper made herself available for out of class appointments. She is always extremely helpful.”
- “Miss. Cooper taught the course well, she was the main reason I did well in this course.”
- “Susan Cooper’s notes were very well prepared and helpful.”

**APSC 174 - Introduction to Linear Algebra for Engineering Students, 2004****USAT Forms:**

- “I thought that Professor Cooper was fantastic at simplifying difficult concepts.”
- “[I liked] the examples which included food and other interesting things to keep us interested.”
- “The teacher was excellent and very concerned for the students’ needs.”
- “The material was presented in a very clear and organized manner. The teacher showed genuine care for the students and it was clear that she enjoyed teaching the course.”
- “Professor Cooper is an excellent instructor! I really enjoyed attending her classes. She is extremely helpful, and makes sure that everyone understands the material. She is always available for outside discussion.”
- “Susan Cooper is a really good prof! [A]lways open to suggestions, very friendly and approachable, explains concepts at our level, “office hours” are great. Prof. Cooper will answer any questions, no matter how “basic”; neat writing - very helpful! She is good humoured and always in a good mood.”
- “Susan Cooper is very clear and thorough. I find that normally she explains things in a way that makes it a lot more understandable.
- “I liked how the instructor was easy to follow and made good additional notes which exaggerated on the course notes.”
- “This was my favourite class. Prof. Cooper was really great with giving help outside of class.”