

TEACHING STATEMENT

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Teaching is very important to me. I come from a long line of teachers going back three generations and my parents were both public high school teachers. I have taught mathematics at many levels, ranging from classes for functionally illiterate adults to supervision of Ph.D. students. I work hard to tailor my teaching style to the needs of the particular students.

I believe it is vital for the mathematical profession to leave a good impression on its former students. This can best be achieved by meeting the students half way. It is important for teachers to convey their enthusiasm for the subject, but it is equally important that they try to understand the students' interests and needs. I have often had students say that they were never interested in mathematics before my class. It is very rewarding when a student comes to understand why someone would want to spend their whole life doing mathematics. But we must be understanding of the fact that mathematics is a tool rather than a vocation for most of our students. Since 2010, I have taught at least one large service unit every year. In addition, I have taught smaller units for graduate students, mathematics majors and mathematics education students.

In 2013, the University of Canberra started a major project to *modernise first year units*, using a Mastery approach to assessment combined with flipped teaching for on-campus students and online methods for distance learners. Our approach to flipped teaching involved replacing lectures with material that the students are expected to access on-line before weekly face-to-face workshops in which they get help on exercises and assignments. Mathematics, Statistics, and Chemistry were chosen for the trial of this new project. I was appointed as Leader of the project for Mathematics and Statistics, and was on the planning committee for the project. We identified lack of prerequisites as the main cause of student failure in first year. I planned and supervised the design of new units with a greater focus on helping students learn the assumed knowledge via a structured series of on-line modules, supplemented by individual and group tutoring. These modules used Pearson's MyMathLab system for practice exercises and testing. In 2016, I extended the use of MyMathLab to the entire first-year calculus unit, with online exercises and envigilated online tests.

In 2013–14, I was the representative for Mathematics and Statistics on the *Curriculum Planning Committee for Information Sciences*. This committee was in charge of redesign and reaccreditation for all Bachelor and Master level degrees in Information Technology, Software Engineering, and Engineering. The main purpose of the committee was to ensure that our degrees remained competitive in an environment where university courses are increasingly available online. In addition to updating the course material taught, we also had to plan for updating our teaching methods to allow for on-campus and remote students to study the same degrees.

1. SERVICE TEACHING

I taught **Discrete Mathematics** for five years: from 2010 to 2013 and in 2015. This course covers elementary proof up to induction and standard discrete structures, such as functions, graphs, trees, and automata. This is the main mathematics service course for IT and software engineering students. It had a diverse student body, with significant numbers of immigrants (including

refugees), overseas students, and native Australian aboriginals. This course was notorious for its high drop-out and failure rates before I started teaching it. I succeeded in substantially reducing the failure rate and the number of students who have to retake the course. I have significantly redesigned the course and also created new online teaching materials. I have also recorded the lectures, so that the course could be taught using edited “vodcast” versions of the lectures while I was on sabbatical in 2014.

Discrete Mathematics was also taught at the University of Canberra College, for non-English speaking students and students with poor educational backgrounds. I supervised the teachers for this version of the course, and made appropriate changes to the teaching material and assessment. I also co-designed an Advanced Placement version of the course for local high school students in the University of Canberra Accelerate Program.

In 2015, I was put in charge of **Mathematics Methods (calculus)**, the University of Canberra’s largest and most troubled maths service unit, as a result of my success with Discrete Math. This unit is required for most Science and Health students, but has long been plagued by the poor preparation these students get in High School maths. By concentrating on the basic skills and assumed knowledge, I have managed to achieve an exceptional improvement in a short span. For example the Unit Satisfaction score went from 35% in 2015 Semester 1 when I was not involved with the unit, to 73% in 2015 Semester 2 when I was managing the unit with an adjunct lecturer, to 84% in 2016 Semester 1 when I was lecturer. I have also managed to use the online testing system MyMathLab for all the major assessment items, thus significantly decreasing the marking load. This allowed me to free up the staff’s time to provide individual help to students. The tutorials are now 2 hours long with a short assessment in each tutorial. This has led to a great increase in tutorial attendance, which is a major contributor to the improved pass rate. The change was clearly reflected in the student survey comments, such as “The lectures presented very relevant material and Scott was excellent in his explanations. The tutors were also great and made sure everyone understood concepts further in depth.” At the same time I have been converting the unit to flipped teaching, so that this improvement can more easily be sustained when I am no longer teaching the unit.

I co-taught **Business Statistics** at Hong Kong Baptist University in 2012, after helping with the design and administration of the course in Canberra in 2010 and 2011. This is our department’s largest and most financially critical course, with over 600 students each year. I also helped redesign the unit in preparation for converting to a flipped mode of teaching. Teaching in Hong Kong involved students with an often poor grasp of English, and also supervising a foreign tutor.

In 2014 I taught **Engineering Mathematics 2**, which is a service course for Engineers and Software Engineers, covering complex numbers, vectors, and matrices.

The table below gives my scores from the anonymous Unit Satisfaction Surveys at the University of Canberra.

Unit	Year	Level	Unit satisfaction	Good teaching	Overall satisfaction	Student experience	Class size	Response rate
Math Methods	2016	1	84%	80%	83%	80%	175	37%
Discrete Math	2015	1	88%	84%	86%	79%	103	42%
	2013*	1	86%	55%	84%	76%	130	38%
	2012	1	88%	78%	87%	80%	140	43%
	2011	1	77%	75%	81%	77%	120	43%
	2010	1	78%	74%	79%	71%	120	44%
Eng Math 2	2014	1	89%	61%	61%	61%	71	25%

No data is available for Business Statistics because it was taught off campus.

★ I co-taught Discrete Math with a adjunct lecturer in 2013.

I have also taught undergraduate calculus at the University of Chicago. For each of these courses I lectured, gave problem sessions and office hours, developed syllabi, set exams, designed webpages, and assigned grades.

In my first class, **Mathematics 151–3**, most of my students had good backgrounds in high school calculus. I taught *theorems and proof* for the prospective math majors, while not neglecting *calculation and applications* for the other science majors. One student in this class was notably weaker than the others; she came from an inner city high school. But she had a great love for mathematics and, with much help and encouragement, she did well in the class and went on to be a successful math major.

The next year I taught **Mathematics 131–3**, which is a calculus class for students who took little or no calculus in high school. My section of roughly 30 students was split into three tutorial groups run by undergraduates. The tutors, under my supervision, helped the students with their basic skills, such as algebra. I spent a lot of the class time trying to *make the subject interesting* for the students. I did a number of demonstrations in class, such as showing ice break when it is dropped in hot water as an example of a discontinuous function. I motivated the material by giving overviews of more advanced applications. I also taught the students how to do symbolic and numeric integration on a computer.

I also taught a *service course* on multivariable calculus for social scientists, **Mathematics 195–6**. Most of my students were economics majors and I did many applications from that field. Since I could not pretend to be an expert in economics, I taught them the mathematics while encouraging them to teach me more about the economic concepts. This led to many interesting class discussions. We used Matlab, a computer system which is popular with economists.

The table below gives average ratings from anonymous student evaluations while teaching at the University of Chicago. They are on a scale from 1 (worst) to 5 (best).

Course number	151	152	153	131	132	133	195	196
Organization	4.1	3.9	4.3	4.4	4.7	4.6	4.6	4.8
Clarity	3.9	4.0	4.4	4.2	4.1	4.7	4.6	4.5
Interest	3.5	3.6	3.8	3.9	3.7	4.3	4.1	4.4
Positive attitude	4.3	4.1	4.5	4.5	4.5	4.0	4.7	4.9
Accessibility	4.3	4.0	4.7	4.4	4.8	4.8	4.6	4.9

2. SPECIALIST AND GRADUATE TEACHING

I taught **Coding Theory** from 2010 to 2012. This was primarily a graduate level course for students doing a Masters in Software Engineering, although it also had a small number of senior undergraduates and one or two external students from the Department of Defence Research Division each year. The unit had a large contingent of foreign students from China, India, Pakistan, and the Middle East. When I started teaching this unit it was on the verge of being cancelled due to lack of enrolments, so I concentrated on attracting more students: this unit now regularly attracts 30 to 40 students, up from 5 students in 2009.

I designed the unit **Mathematical Perspectives** and taught it in 2012, 2013, 2014 and 2016. This is the capstone unit in the Major in Mathematics for Secondary Education, and it is designed

to help future teachers integrate their mathematical studies and put them in a wider historical and social context. This unit had been taught for many years by adjuncts who used their own teaching materials, so I had to design the unit from scratch. I concentrated on the development of geometry, and the practical questions and philosophical ideas that drove this development from ancient Greece, to the medieval Arabs, and up until the modern day. I also worked hard to tailor the course to the needs of the particular students: for example, I covered ancient Chinese mathematics one year because I had a Korean student who was interested in the topic, and he did a final project drawing on original sources that had been translated into Korean but not into English that actually corrected an error made in our textbook.

In 2015–16, I taught **Mathematical Structures**, a level 2 unit that introduces abstract algebra for Maths Majors. Given the nature of our students, I emphasised computational methods and applications to cryptography. However, the better students excelled at the proofs. This unit covers enough number theory to teach RSA cryptosystems, and the basics of groups, rings and finite fields.

In 2014, I taught **Linear Algebra**, a second year unit for mathematics majors.

Unit	Year	Level	Unit satisfaction	Good teaching	Overall satisfaction	Student experience	Class size	Response rate
Math Structures	2016	2	93%	93%	93%	93%	27	52%
	2015	2	100%	75%	89%	78%	22	41%
Math Perspectives	2015	3	100%	100%	100%	100%	12	42%
	2014	3	100%	50%	100%	100%	9	22%
	2013	3	80%	80%	80%	80%	13	38%
	2012*	3	60%	60%	20%	40%	8	63%
Linear Algebra	2014	2	71%	57%	43%	57%	14	50%
Coding Theory	2012	PG	80%	80%	80%	80%	17	59%
	2011	PG	100%	100%	100%	100%	26	46%
	2010	PG	100%	100%	100%	75%	26	46%

* I was replaced by an adjunct for the last two weeks of Math Perspectives in 2012 due to urgent surgery.

3. SUPERVISION AND OTHER RELEVANT EXPERIENCE

I have supervised a number of research students in algebra and combinatorics, and their applications. The University of Canberra has little funding available for graduate study, but I have attracted the most fee-paying students in my department. I currently have two PhD students at the University of Canberra who have successfully completed their thesis: one on algebraic statistics and the other on mathematical economics. In 2016, they nominated me for a Vice-Chancellors Excellence Award in PhD Supervision, and I was a finalist for this award across the whole university.

As part of my ongoing research with Professor Lisa Carbone, I have also successfully co-supervised a Ph.D. project, an M.Sc. project and an undergraduate research project at Rutgers University. At the Technische Universiteit Eindhoven, one of my main duties was to supervise research students along with Prof. Arjeh Cohen. I have cosupervised three successful Ph.D. theses and I currently have two more students near completion. I have also supervised three Masters project, and a number of undergraduate research projects. I believe that it very important to take into consideration the skills and goals of the student I am supervising. Strong students who wish to

pursue an academic career should be treated as colleagues and given as much freedom as they can handle. I have had several students whose goal was to work in the IT industry after graduation, and for them it was appropriate to give very close guidance on the mathematical aspects of the project.

While I was at the University of Chicago, I worked as a *volunteer teacher* for functionally illiterate adults who are preparing for their high school equivalency exams. This involves teaching arithmetic and algebra to people with a variety of backgrounds and levels of motivation. I also planned and taught a “Math fun” program on symmetry and geometry for kindergarten, first and second grade students at an inner city school.

Although the University of Chicago had a very traditional calculus program when I was working there, I think that there is much to be gained from more modern teaching methods. I have incorporated some techniques from Flipped teaching and On-line assessment into my own teaching. Several of my courses have involved a *computer* component. I find this very useful, as it allows me to cover more difficult concepts and applications, without overloading my students with hand calculations. I have always used a class webpage to give students easy access to information about the class. I have also successfully given my students group projects and essays.