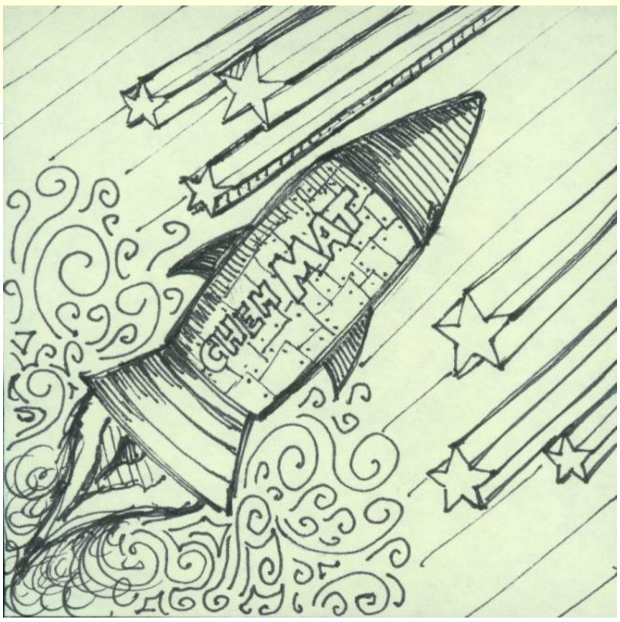
Tertiary Teaching Excellence Awards

2013

Nomination for Associate Professor Bryony James

Department of Chemical and Materials Engineering
Faculty of Engineering
The University of Auckland



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Bryony was without doubt the BEST lecturer I've EVER come across. Her ENTHUSIASM on the topics she presented was infectious, and thanks to her, I now have a keen interest in the field of Materials Engineering. There was always a very comfortable and easy atmosphere in her lectures, and it wasn't often she needed to request silence from the students, since nearly all the time they couldn't help but pay attention. She was always well prepared, and made the lectures even more interesting by giving visual and actual demonstrations. Thank you so much for all your effort. Oh and the fact that you ride a Hayabusa just made you that much more cool!

CHEMMAT121, 2011

Madonna was right - we are living in a Material(s) World

Before beginning my own undergraduate studies, in Mechanical Engineering at the University of Bath, I worked for twelve months for a food process engineering company as a graduate-track engineer. Soon after lectures started I vividly remember a lecturer presenting a complicated mathematical problem that seemed beyond my comprehension and, moreover, *totally unconnected* to the engineering I had seen in practice for the previous year. The lecturer was blithely unconcerned that he had left some of the class behind, feeling frustrated and alienated by their inability to put abstract ideas into the correct context. As a first-year student, my inclination was to blame myself and look elsewhere for instruction. I transferred into another discipline - Materials Science and Engineering - and felt that I had “come home”. Materials Science describes everything the world is made of; metals, plastics and ceramics, are things brittle, hard, tough? I could engage with the subject straight away, because examples and applications of the concepts were within reach all around me.

This memory shapes my own teaching, particularly with my first-year engineering class. My philosophy can be summarised very simply. I aim to infuse students with the enthusiasm for Materials Science and Engineering that I developed as an undergraduate, an enthusiasm that prompts them to look at the world with fresh eyes and ask “Why?” and “How?” particular materials were chosen, used or evolved.

I am determined that none of my students will feel as disenfranchised as I once did. Not everyone will fall in love with my subject, but it won’t be for want of enthusiasm. Not everyone will remember all I teach, but it won’t be for want of clarity. And no-one will be left wondering “where does this stuff fit?”

Building engineers

I started teaching the large first-year materials class in Engineering in 1998, combining my teaching role in Chemical and Materials Engineering (CME) with that of Director of the Research Centre for Surface and Materials Science (RCSMS). Consulting with industry through the RCSMS keeps my engineering experience grounded in real industrial problem solving, and provides examples that I use in courses ranging from large introductory classes to small, advanced electives. Running RCSMS means I have to be up to date on new techniques and practices in materials characterisation, which keeps my lecture material current. The toys and tools used to analyse the structure and composition of materials at the microscopic scale are themselves large and expensive, and talking about them in class always gets students excited.

What I teach…

- CHEMMAT121 “Materials Science” is a compulsory course for all first-year engineering students, with an enrollment of around 700. The course provides a taster for students who have yet to select an engineering discipline, establishes the foundation for students who intend to advance in this area, and gives a necessary background in the engineering of materials for students following other engineering disciplines. Many students express reservations about a compulsory course in a topic they do not cover at school and that they do not connect with their vision of a career in engineering, but by the end of the semester we have many converts.

- CHEMMAT724 “Advanced Materials Characterisation” is an advanced elective taken by fourth-year engineering students, postgraduate students, and students from the Science Faculty, with enrollments varying from 12 to 30.

- Final year students in CME conduct a full-year capstone research project (CHEMMAT751 A&B), and each year I supervise four or five students in this course. This is very different to classroom teaching as my role is one of research mentor and supervisor; teaching research methodology, communication skills and time management, in addition to the specifics of the individual research projects.

- I have been principal supervisor for seven PhD students, and co-supervised four. I have supervised three Masters students.

- In 2006 I worked with Professor Neil Broom to develop and deliver a General Education course, CHEMMAT100G, “Materials of the Modern World”. The University’s General Education programme allows students to broaden their degree by taking one or two courses outside their disciplinary area. CHEMMAT100G introduces non-engineers and non-scientists to the exciting world of materials science.

Activation energy

Enthusiasm is vital in capturing the initial interest of undergraduate students and setting them on the pathway of engagement and effective learning. There is a risk in large classes that students will feel isolated and be reluctant to seek clarification on points they do not understand. Activities are a great way to convey enthusiasm, engage student interest, and encourage interaction and participation. When well prepared, activities in class can illustrate even highly complex concepts.

I find it easy to be enthusiastic in lectures as I am passionate about the subject I teach.

Thank you for making us enjoy this subject by enjoying it yourself!!

CHEMMAT121, 2007

The enthusiasm of Dr Bryony James was probably the most helpful thing in terms of learning. Her teaching gave a solid base for this course and…the interest aroused by Dr James made it easier to follow. This "involved" method of teaching helped retention and deepened understanding.

CHEMMAT121, 2010

Dr James somehow made 8am lectures manageable…You can't teach that.

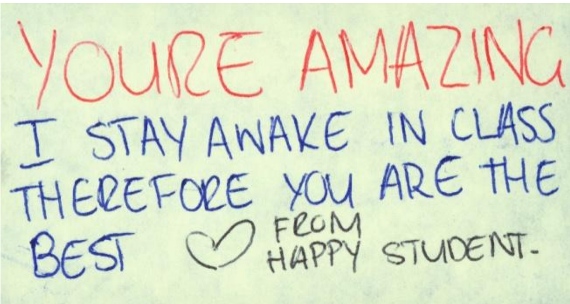
CHEMMAT121, 2007

Bryony was awesome! Made me find something that could be boring really exciting, great enthusiasm.

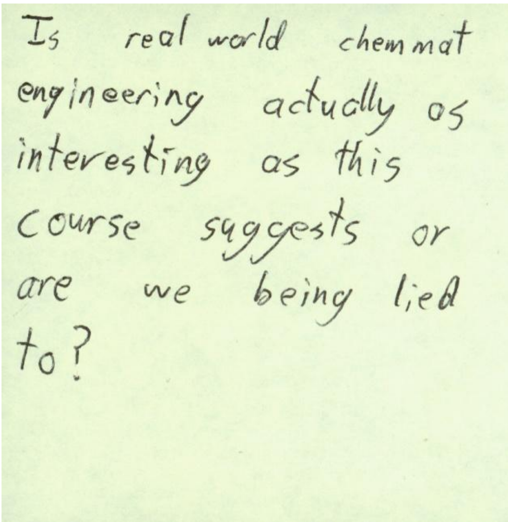
CHEMMAT121, 2011

Bryony was a truly excellent lecturer... she really involved the class and I looked forward to each lecture as I knew it would be engaging and the material would be well explained.

CHEMMAT121, 2011



Typically wry student acknowledgement of enthusiasm.



In 2011 I requested review of my teaching in two courses by Associate-Professor Gerard Rowe, Associate Dean, Teaching and Learning, Faculty of Engineering. Gerard summarised his review of CHEMMAT121 with:

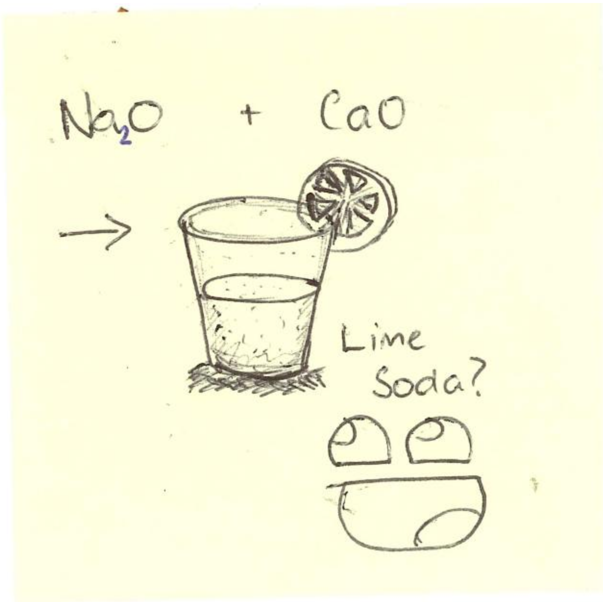
> *An outstandingly good lecturer. Great rapport with a large class. High-energy presentation throughout. It was a pleasure to be able to observe this lecture. As observer, I came away with ideas to improve my own teaching.*
>
> **Peer reviewer, 2011**

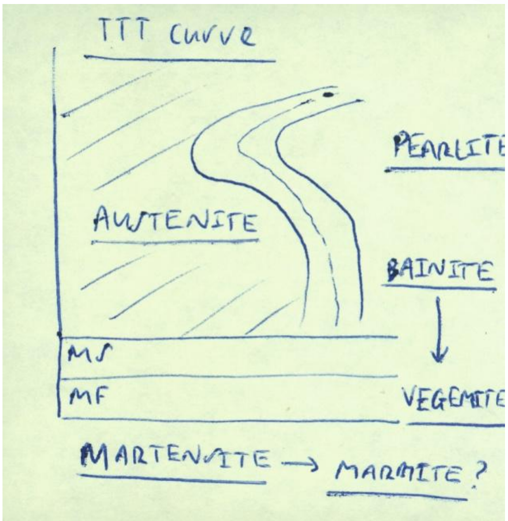
My PhD and Masters students are the engine room of my research activity. Enthusiasm is equally important for PhD students, not to initiate them into a subject, but to stimulate them to become excited, engaged and ethical researchers. I make a point of instructing them on the wider context of science and engineering research. This includes encouraging them to become active members of the University family with participation in the Engineering Postgraduate Society, and events such as the "3 Minute Idol" contest. At the inaugural "Idol" contest my PhD student placed third and I received the award for "Noisiest Supporter"!

A pun on my PhD student's thesis topic- First bite to swallow: The life of a bolus.

Humour is an important part of my teaching style. In 2008 I started encouraging immediate student feedback based on "post-it notes". In the large first-year paper students are issued regularly with a post-it note. Students write questions, and stick these to the doors of the lecture theatre as they leave. This provides an instant overview of concepts that students are finding difficult. It also provides other valuable kinds of feedback and I will describe later in the portfolio how I use this information.

The “post-it note” approach has become a low-tech Facebook, and the quirkiness tends to generate materials-related humour and artwork, as well as thoughtful questions. I am always pleased to see the jokes, which I share with the class. Composing and understanding a good joke requires a thorough grasp of the material and this shows me that effective learning has occurred. Some of the jokes are so corny, or so well executed, that they become unforgettable mnemonics; how to remember that ***cat***ions are positive? They are “pussytive”…





The post-it notes brought some much-appreciated humour and student contribution in a unique way of allowing students to probe for deeper understanding or put forward another way of explaining something.

CHEMMAT121, 2011

FANTASTIC lecturer. Engaged my interest in the subject. Post-its are great - made lectures more interactive and encouraged us to ask questions, where otherwise we would have been too shy/embarrassed to ask directly. Bryony James is always so upbeat and spontaneous! I really appreciate the practical demonstrations.

CHEMMAT121, 2011

This method of communication had a certain charm, for as well as encouraging informal discussions it removed the potential embarrassment which results from asking questions in lectures or being recognisable online. This promoted free and open conversation in the class.

CME Part 2 student, 2012

Big Bang…then a little theory

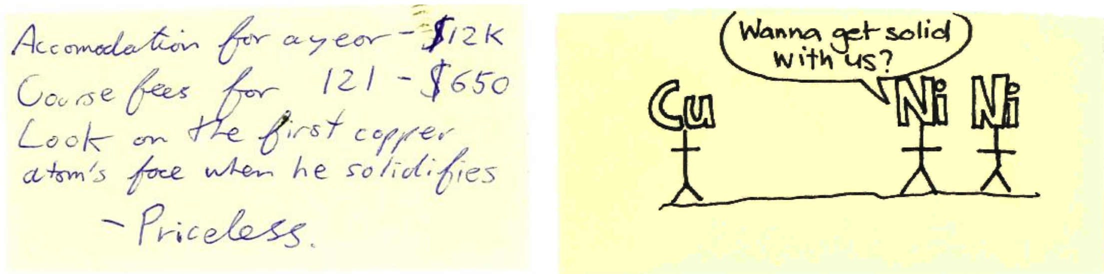
I make frequent use of demonstrations to illustrate physical concepts throughout my lectures. They serve as breaks for the students and can help to reveal the "wow!" factor in materials engineering.

I try to design two demonstrations for every one-hour lecture. Demonstrations can be simple physical models or activities that involve "volunteers" from the class. If I use volunteers I endeavour to learn the names of these students and greet them, subsequently, by name. In a large class this helps to break down the feeling of being a face in the crowd.

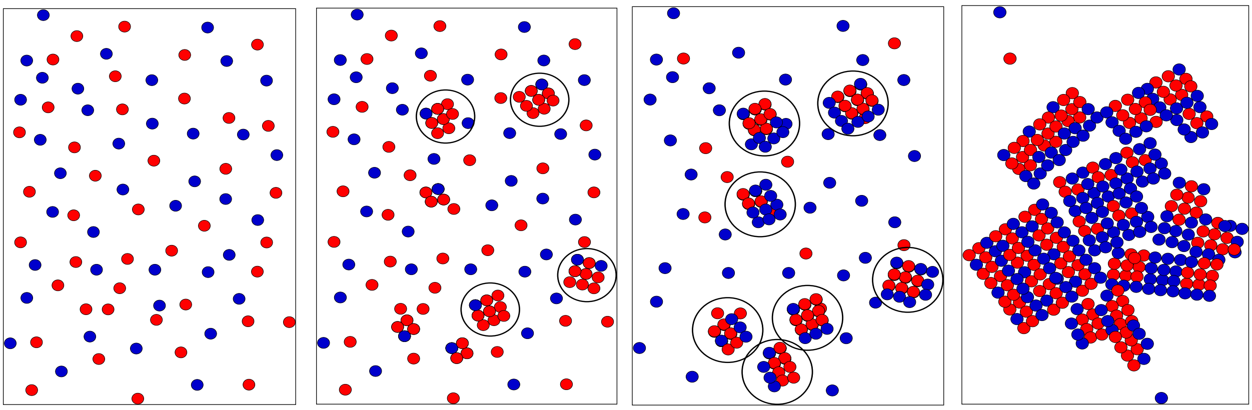
One example that students seem to particularly remember is a demonstration of elastic deformation using a sword, which springs back to its starting shape after "stabbing" someone or something. In class I relate this phenomenon to atomic level deformation using polystyrene balls as atoms on the document camera.

"May your swash never buckle". The elastic deformation of a sword and a model of atoms used to explain it.

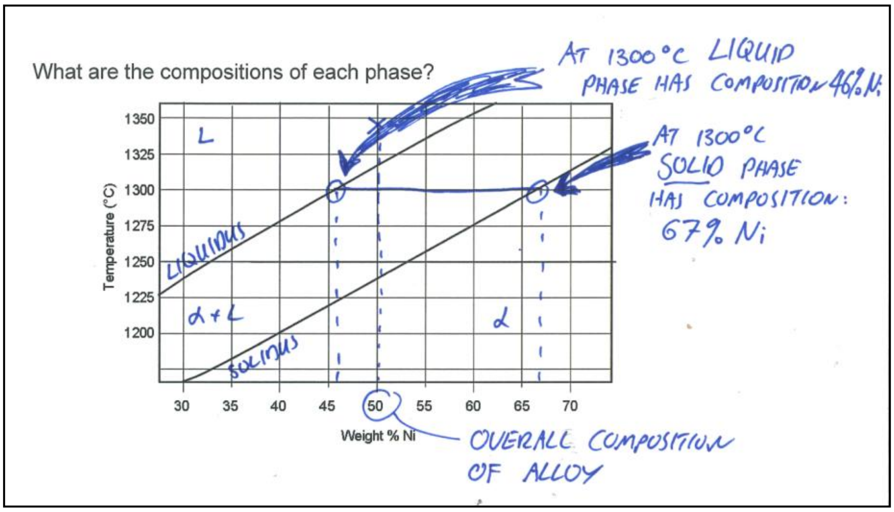
Some demonstrations can involve up to 20 students at once, with 10 female students being nickel atoms and 10 male students being copper atoms to illustrate what happens as an alloy cools. This is one example of using multiple means of delivery to reinforce a very complicated idea. As an alloy cools the proportions of solid and liquid change, but at the same time the *composition* of the liquid and solid are also changing. By asking students to wander round randomly (liquid state) and only stop moving (solidify) when I tap their shoulder I can build up a solid phase with a changing composition and leave behind a liquid phase, also with a changing composition, whilst keeping the overall number of copper and nickel atoms the same. The humour of the demonstration helps people get involved with a very abstract idea, and makes it memorable. To build on the visualisation I also use an animated PowerPoint slide and a mathematical treatment.



Post-it note feedback from the class following the Cu-Ni alloy demonstration.



Stills from an animated slide showing Cu-Ni solidification.



Extract from coursebook showing mathematical/graphical treatment of Cu-Ni solidification.

> *The experiments carried out in lectures (eg the piano wire) and the demonstrations by 'volunteer' students (eg the copper and nickel demonstration) helped make it easier to understand and remember the materials better.*
>
> ***CHEMMAT121, 2011***

> *Nearly every lecture featured a visual demonstration of the concepts covered in that lecture, which successfully engaged the various learning styles present in a large class. These provided an extremely valuable tactile example and mnemonic of some of the more challenging concepts. By participating in the demonstrations, we could see the real-world applications of what was covered in the notes, reinforcing the material and adding another dimension to our understanding.*
>
> **CME Part 2 student, 2012**

> *Whilst teaching us about stress strain diagrams for materials, she performed a demonstration where she produced a sword and shield and asked for a volunteer to hold and brace the shield….. She then applied the tip of the sword to the shield and applied force until there was a distinct bend in the sword, which was fully elastic and upon unloading the sword straightened to its original form. This was a memorable demonstration of the stiffness and yield strength of a material, and a comparison of the load applied and the subsequent comparison of how a material of lower yield strength would have performed. This also lead into a discussion on toughness and the differences between brittle and ductile materials.*
>
> **Former PhD student, 2012**

> *The animations used were a very, very effective and clear method of illustrating the principles you were explaining.*
>
> **Peer reviewer, 2008**

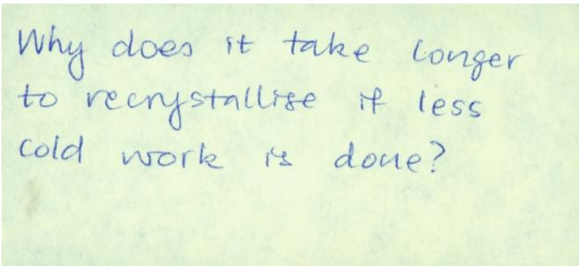
Meshing gears - not gnashing teeth

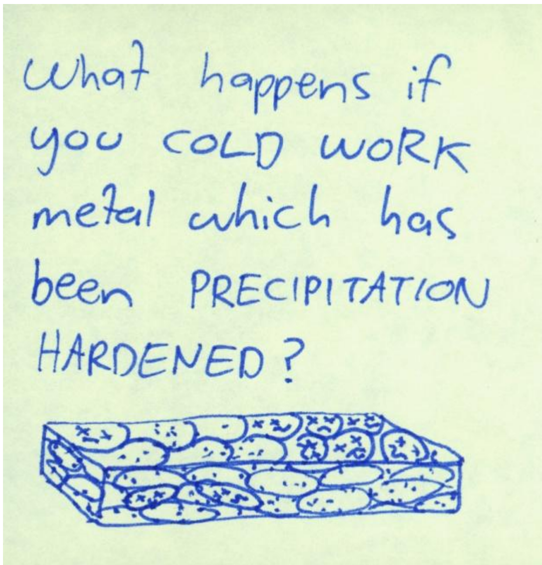
Laying the foundation for later learning requires that the students, who have no background in Materials Engineering from school and varying levels of preparedness in physics and chemistry, develop a sound understanding of materials science concepts. I am determined that in my lectures no-one will be left behind in the way I experienced. An enthusiastic delivery and engaging activities are important for bringing students along with me, but more is required to ensure that students understand key concepts. It is crucial to provide clear explanations, relevant examples and diagnose when students are experiencing difficulty. I explore new technologies to support learning, but I also have great faith in my ability to explain difficult concepts with simple words and demonstrations that resonate with students.

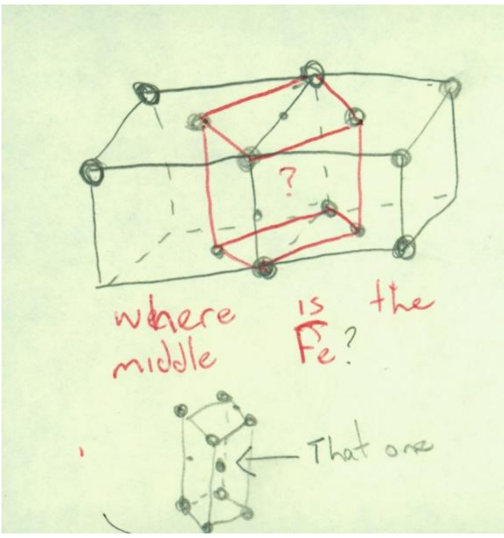
I thoroughly enjoyed Bryony's lectures, and found them interesting and engaging. She not only entertained but also explained the concepts very clearly and in a way that was easy to learn. My only criticism is that we didn't have her for long enough in the semester!

CHEMMAT121, 2007

I assess student learning as each course progresses to better gauge what areas are giving trouble. On-going feedback from students is essential to identifying gaps in understanding and I use several tools for this. The post-it notes are the most visible method for the large classes, with a hundred or so small yellow notes to harvest from the lecture theatre doors on my way out. I address some common questions in the next lecture by putting the post-it notes on the document camera, sometimes specifically addressing the deliberately "silly" ones first to ensure everyone is paying attention. I also assemble the questions into an FAQ online, updated weekly, with the final FAQ indexed and hyperlinked to ease navigation, providing a useful revision tool for the class.







Another valuable tool is the Part One Assistance Centre, manned by senior students who collate first year questions into an on-line forum monitored by all the first year lecturers.

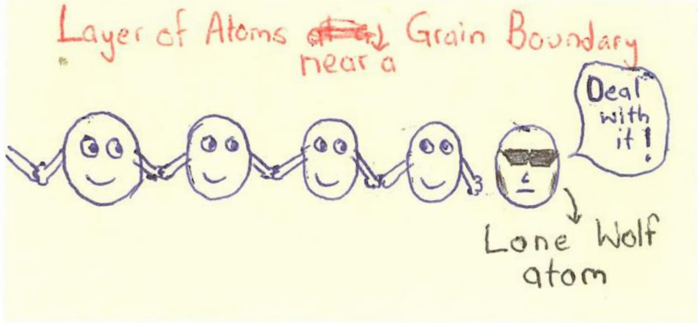
In 2008 as part of an invited peer-review exercise Dr Darrell Patterson identified my tendency toward "teacher talk" in class, not leaving enough opportunity for immediate feedback. I have incorporated this valuable input into my teaching style by more use of quick quizzes and discussion opportunities in smaller classes which have been commented on positively by students. I use results of mid-semester tests to give students feedback during subsequent tutorials, and I offer the students opportunity to reflect on new material by incorporating exercises and quick revision questions into the course book, or by giving the more advanced students reprints of journal articles for discussion the next lecture.

For the first time in 2012 I trialed the Epstein Immediate Feedback Assessment Technique (IF-AT) system. This simple system, based on scratch cards, can be used as summative or formative assessment as the cards reveal not only the correct answer, but the number of attempts taken to get there. I used the cards as formative feedback for students in the week prior to their first test. This exercise was based on a ten question pop quiz, with specific instruction to the students to close their course books but discuss questions with their immediate neighbours. The buzz of active learning in that lecture immediately persuaded me that here was a technique worth pursuing and I will develop this further in 2013.

Tough material needn't be hard

I have always tried to identify those key concepts that challenge many students. I attended a workshop on "Threshold Concepts" in 2011, and realised that this is a well-recognised phenomenon. It is essential to address these stumbling blocks to avoid disenfranchising students at the outset of their engineering careers. To this end I always signpost difficult topics as we come to them in class, saying that not everyone will find the upcoming lectures easy, but that together we'll find a way to ensure understanding.

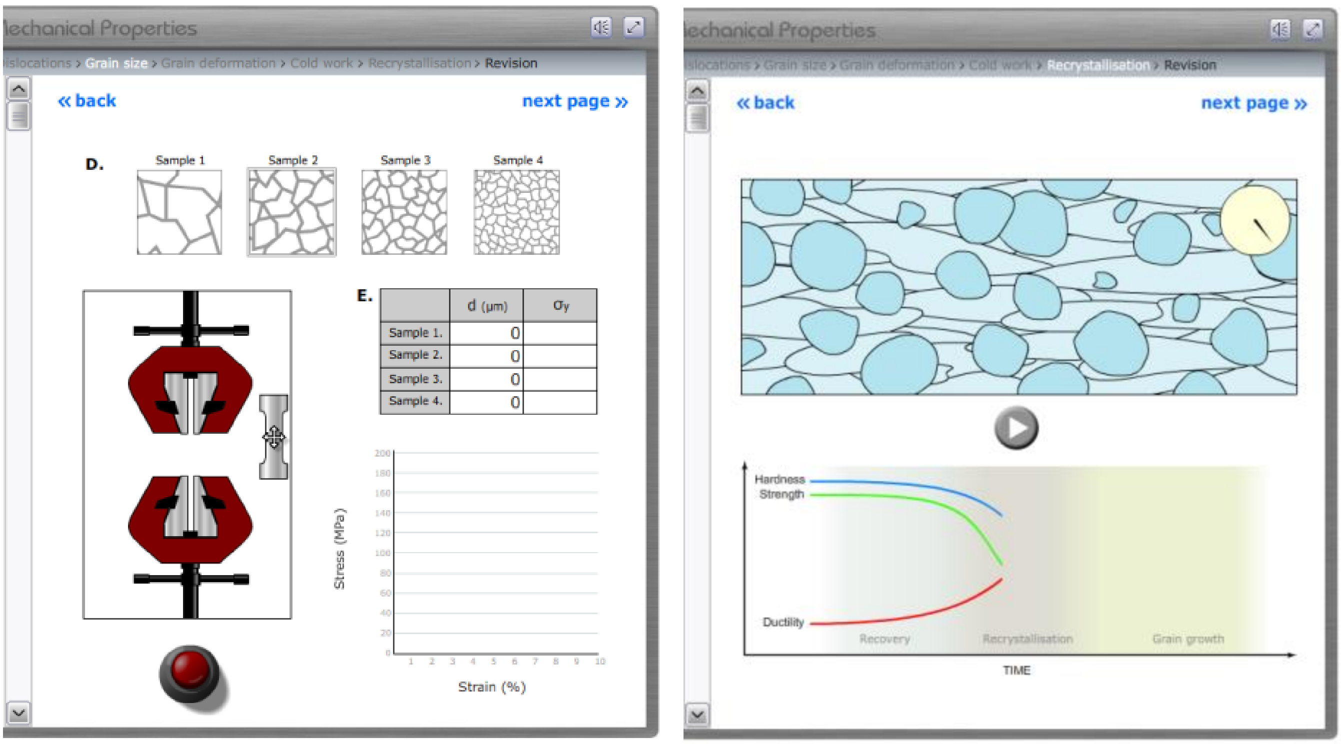
"Crystallography" is a topic that can alienate students as it seems very abstract and disconnected from "real" engineering. I start by asking who is good at computer games, especially "first person shooters". From there I can make the point that some people can take a 2D image and think of the 3D implications easily, and some people find this very challenging - whether you are imagining atoms or aliens.



Her enthusiasm for the subject, her manner of calm teaching when areas looked complex and the numerous demonstrations to solidify ideas with practical applications.

CHEMMAT121, 2011

Other concepts that are recognised as difficult in introductory Materials Science are “Phase Diagrams” and the concepts relating microstructure to mechanical properties. These topics, in particular, are often identified[1] as threshold concepts due to the need to visualise atomic-scale transformations. I have developed specific teaching innovations about these topics, in the form of two computer-based learning resources, on “Phase Diagrams” and “Microstructure and Mechanical Properties”. These use animations and interactive experiments to aid students in the visualisation of core concepts.



Screen grabs from “Microstructure and Mechanical Properties” showing a virtual tensile test (L) and an animated “recrystallization”.

[1] Bailie *et al* 2012 “Engineering Thresholds: an Approach to Curriculum Renewal” Retrieved from ecm.uwa.edu.au/engineeringthresholds

Feedback solicited by questionnaire shows both computer programmes have been very well received:

> *A wonderful tool for helping understanding of phase diagrams.*
>
> *I liked how there were test questions and when you got it wrong it took you back to the notes.*
>
> **Student focus group comments on Phase Diagram programme, 2005**

> *Really liked the graphs/animations and revision problems.*
>
> *I liked the way that we can do the virtual experiments, as it shows us realistically what is happening.*
>
> **Student focus group comments on Microstructure and Mechanical programme, 2005**

> *The most helpful component in the course was the following topics ~ Structure and Deformation, Microstructures and Mechanical Properties, Phase diagrams and ceramics all of them taught by Dr. Bryony James. She made the first five topics so easy for me (someone who hasn't done year 12 and year 13 chemistry NCEA) in the sense that the way she presented the material and that FAQ's part.*
>
> **CHEMMAT121, 2009**

Food for thought

I rely on the idea of *context* to guide my teaching and course design. My experience as a student convinces me that greater engagement, underpinning conceptual understanding, is far more likely when students can see the relevance of their learning all around them, and project it forward to their own vision of an engineering career.

I select examples from my research (in food structure and properties) and consulting career (in materials characterisation) to illustrate concepts at every level of teaching. For example, in the first-year course when I teach the properties and uses of ceramics and glasses (a class of material with applications from whiteware to space travel), I use sugar, which can exist in both a crystalline and amorphous solid state, as an analogy for silica (the building block of many ceramics). I prepare a sheet of sugar glass the evening before and use it to illustrate glassy properties (transparency, brittleness), whilst talking about toffee apples, contrasting this with the lack of transparency of the same material in its crystalline form. In this way the students can directly see the result of an invisible atomic level structure.

Relating chemmat to my interests was really great. It helped me understand what things actually mean and how they achieve it as such.

CHEMMAT121, 2010

Being engaged, the excellent explanations (with emphasis clearly stated on important points and concepts) and vivid practical demonstrations in real-life of the concepts we learn on the atomic scale. Excellent visual representation of coursebook/coursework and ideas/concepts/graphs. Thanks Bryony.

CHEMMAT 121, 2011

I design courses to incorporate repetition and a gradual increase in complexity, and by using food materials to illustrate numerous concepts I give the students an opportunity to reconsider abstract concepts every time they eat a lolly or potato chip.

In developing the General Education paper CHEMMAT100G Professor Broom and I had to consider a very different student background and design the course appropriately while presenting some challenging fundamental science. For this class it was even more important to develop demonstrations, examples and exercises that firmly grounded the concepts in common, real-world phenomena.

Designing for crystal clarity

I want my lectures to be spontaneous and engaging, to share my enthusiasm for my subject with students. Ironically, the only way to achieve this is *thorough* preparation. Through careful preparation of course design and delivery I can allow for the different levels of understanding students bring to their studies, and find ways to present difficult content to ensure that every student has the opportunity to engage and understand. Reflecting on my teaching, and using feedback from students and peers allows me to constantly refine my technique.

Preparation

Preparation is critical to ensuring that the various modes of delivery I employ reinforce each other. My learning style is visual and active and for the most part I am teaching engineers, who have a reputation for also being visual and active learners. Recognising this for the stereotype it is, I make a conscious effort to accommodate a variety of learning styles by using animations, videos and physical demonstrations that allow me to present the same concept in different ways. My organisation includes designing and preparing visual aids that are clear and capture the salient points of the concepts. Ahead of time I run through every lecture, every time, out loud, with demonstrations, to optimise timing and delivery.

Clearly, a very well rehearsed presentation.

Peer reviewer, 2008

> *Very organised. Highly proficient use of the e-lectern. During the lecture used document camera, presenter cam (for demos), guest computer for animations. Excellent use of models on document camera.*
>
> **Peer reviewer, 2011**

Students need to know what they should expect of a course, and what is expected of them. When I design learning objectives I identify the key concepts that the students need to absorb and those that I recognise might be particularly challenging. I review these objectives in class when appropriate to emphasise context for the students.

> *Good review of learning objectives with discussion of short and long term relevance (eg next 3 years, Yr4 project, Postgrad project, 10 years time).*
>
> **Peer reviewer, 2011**

> *You provided excellent signposting of what had been done before in your lectures and what will be covered in future lectures.*
>
> **Peer reviewer, 2008**

As I am the first lecturer (of three) in the CHEMMAT121 course I take time to explain the rationale of the course and how the class will see each lecturer bring their own style and background to the lectures. With a large body of new material it is important that the students are able to make the links between concepts, and the course is designed with deliberate cross-referencing between lectures and between lecturers. I also take the time to explain the differing assessment types in the course.

The imperative of providing fast feedback to a large class dictates the style of mid-term assessment in CHEMMAT121, where we use two multi-choice tests. The final exam is a combination of short answers, diagrams and calculations. I explain that the questions will rely on their understanding of concepts, not simply memorising formula. To encourage practice, I design exercises at the end of each section that can be used for self-assessment.

> *She is creative in the style of questions she sets, knows intuitively what is an appropriate level to pitch those questions.*
>
> **Peer reviewer, 2008**

Teaching is a team sport and I work closely with colleagues to ensure that each aspect of a course reinforces the others. I am course co-ordinator for CHEMMAT724 and take a very hands-on approach to ensure that we are all emphasising the complementary nature of the techniques we teach. I designed the main laboratory-based aspects of this course so that the students have to weave together my lecture material and that of my co-lecturers.

I see in Bryony a strong and passionate commitment to her teaching not only with respect to the students but also to the team of fellow academics she teaches with.

Peer reviewer, 2008

Reflection, feedback and refinement

I believe that it is crucial to critically reflect on what has gone well, or otherwise, in each lecture, and each course. Immediately after each lecture I annotate my notes to improve delivery the following year. At the end of each week I reflect on the topics covered and how best to assess student learning, be it in an exam question or a quick quiz the following week.

Student feedback from course and teaching evaluations has, over time, allowed me to refine and improve my teaching techniques. When I first taught in CHEMMAT121, in 1998, student surveys indicated that I went too fast through the material. It was clear that by using PowerPoint, and adding text to each slide, I substantially mis-timed the delivery. I immediately altered my teaching delivery for large courses and now use the high-tech version of "chalk and talk" – writing onto templates on the document camera. This paces my delivery to a level where a diverse cohort of students can keep up, and allows a narrative around problem solving to be gradually built up.

The filling-in of the various compositions diagrams resulted in a very very complex picture, but it was all taken at a very gentle pace without any rushing or cramming.

Peer reviewer, 2008

Having to fill in gaps in the course books throughout lectures was helpful to me because it kept me actively listening. The frequent use of diagram drawing as well as text to explain and illustrate a concept really helped me to understand. ...My favourite part one paper! Bryony is an amazing lecturer!!

CHEMMAT121, 2010

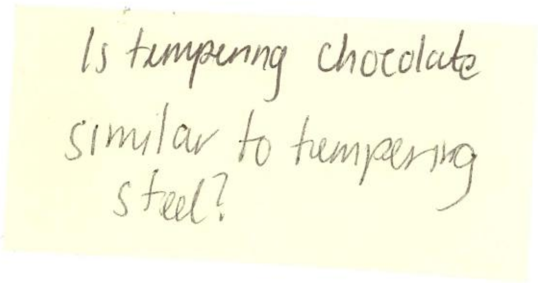
As well as inviting peer review of lectures I strive to improve my teaching by attending relevant workshops. Most recently I attended a course on Teaching Diversity. The outcome of this course was immediate as I had not previously considered lecture recording as a tool for teaching diversity. I realised that this simple tool addresses issues of access across a broad range of learners, and I started recording all my lectures in 2011. It is clear from student access statistics, and emailed questions, that students use the recordings as a revision and practice tool, and I have subsequently become quite evangelical about the merits of lecture recording.

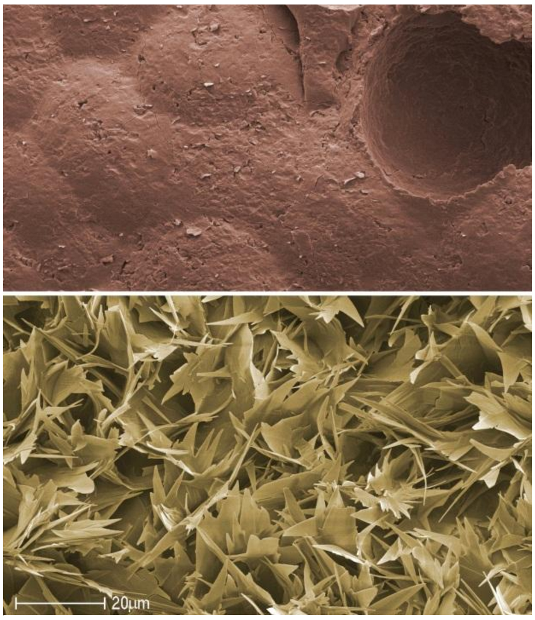
Looking deeper

As a researcher and teacher I am able to use my research, as I have described, to provide examples to contextualize abstract concepts. Importantly, research-based teaching helps students understand how 'real-world' problems are approached and solved. Integrating my research with my teaching provides a broad range of opportunities and challenges for advanced students.

In the capstone research project (in the final year of engineering undergraduate study) I ensure the projects my students adopt are aligned to my research so that they feel part of a research team, whilst also emphasising each student's ownership of their project. Since my research is in food microstructure, coupled with materials characterisation, projects are frequently linked to the microstructure of foods and how that affects their behavior. These are popular projects with the students as they are on topics that you can discuss over dinner. In 2012 one of my students had a project linking chocolate structure to quality which was featured on National Radio's "Our Changing World" programme.[2]

As mentioned, I incorporate examples from my research into teaching at first-year level onwards. In the higher-level course "Advanced Materials Characterisation" I rely most on examples from my materials characterisation research and consulting to ensure the more typical aspects of, for example, Scanning Electron Microscopy (SEM) can be seen in the context of a practicing engineer. Then I draw on aspects of my research in food microstructure to illustrate the atypical, and more challenging aspects, of advanced modes of SEM such as cryo- or Environmental SEM. Chocolate is a magical material for challenging the techniques of materials characterisation and the students' grasp of structure-property relationships!





Cryo-SEM image of fresh chocolate (top) and poorly stored "bloomed" chocolate.

Good use of examples from research/industrial consulting to establish relevance of lecture material.

Peer reviewer, 2011

As this course is taught to a combined cohort of final-year honours students and post-graduates the course delivery and assessment method needs to match the increasing sophistication and advanced understanding of the students. For part of

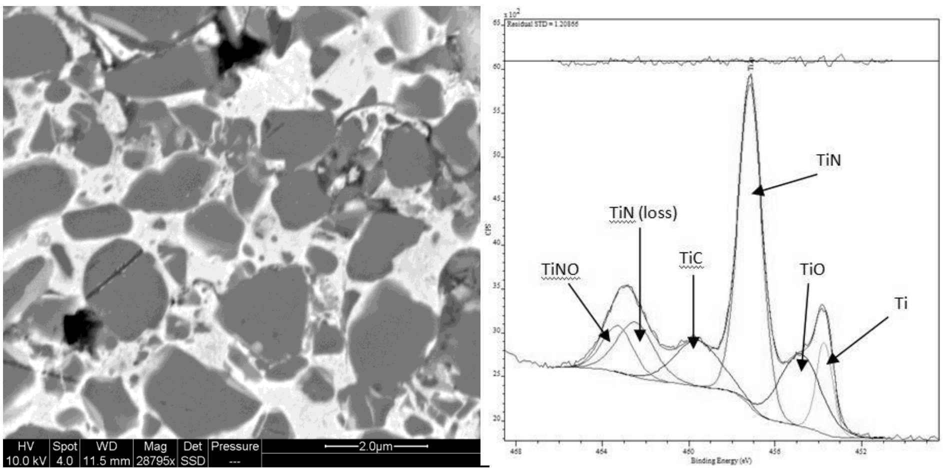
[2] Ruth Beran (Producer/presenter) (20th December 2012) "Our Changing World - Snap of Chocolate" New Zealand. National Radio.

the course assessment I have designed a lab and theory-based assignment that the students write up in the form of a journal article. The aim is to reinforce the idea that materials characterisation requires a multi-technique approach, so the students are required to analyse a sample using two or three of the techniques covered in the course. The sample in question is often drawn from my own or my colleagues' research. This has resulted in some excellent pieces of work from the class with a real distillation of knowledge that is subsequently probed in the final exam. In 2011 I added a peer review section to this assignment, where each student was a "blind reviewer" for one other. The value of this was apparent in the quality of the reviews and was repeated and refined in 2012.

This exercise directly supports the learning outcomes of the course:

- select suitable analysis techniques for a variety of solid material samples
- understand the complementary nature of the analysis techniques and articulate why one or other technique might be suitable for a specific sample
- understand, and critically consider the value of, papers presenting other researchers' materials characterisation activity.

The final exam for this paper allocates at least twenty-five percent of the marks to a critique of other people's use of the analysis techniques learnt in the course, based on published papers or my own consulting work. In 2011 the exam referenced a sample that was an urgent consulting job for RCSMS just a few months prior.



A set of titanium-based coatings (related to my work in that area) provided a challenging analysis problem in 2011.

Another aspect of preparing students to look deeper is the teaching done within the Research Centre for Surface and Materials Science (RCSMS), where I and two professional staff instruct individuals and small groups on the tools and techniques of the Centre and the theory behind the techniques. RCSMS assists up to 100 undergraduate and postgraduate researchers each year of which approximately one third are new users and require specific instruction. This is labour intensive, but very high-quality instruction with a direct impact on the research success of the students involved.

A new initiative, funded by a Vice Chancellor's grant in 2009, has allowed me to develop short courses specific to individual analytical techniques used in RCSMS. The courses incorporate theory and practical sessions and are tailored to the student cohort. For example, the first course ran in 2010, based on the technique of Atomic Force Microscopy and was attended by 17 postgraduate and postdoctoral researchers from the Faculties of Science and Engineering. The four-day course had guest lecturers and in-class practical sessions. A major contributor to the success of the course was that students were encouraged to bring their own samples to the classes to discuss specific analysis issues related to their projects. This placed the technique in context and gave immediate relevance to the material. Another aspect of this initiative was to develop remote access Scanning Electron Microscopy, allowing lecturers to run the SEM, in real time, from the lecture theatre over the internet.

I have twice been invited to the University of Tokushima, Japan, as a visiting lecturer in their "Double Degree" programme where I reprise the theoretical aspects of RCSMS teaching for a postgraduate engineering cohort. Even though the language of instruction is English there were still some communication hurdles that I tackled by careful design of pictographic and animated PowerPoint slides.

> *Beautiful figures and animations help me to understand.*
>
> **Student response, Tokushima University, 2008**

There is a vital teaching component in PhD supervision especially in the early years. Guidance on what to focus on is essential because new research questions are uncovered as a project proceeds. An essential part of the supervisor's role is modeling behavior that encourages rigorous scientific method and ethical standards, as well as sharing in the highs and lows that are an unavoidable part of the research process. My own PhD supervisor encouraged me to present at international conferences, and to be first author on our jointly authored papers, and I have maintained these traditions with my own students.

> *Bryony provided very important guidance in the co-supervision of my PhD. She encouraged a very pragmatic approach and focus on key objectives. This helped to maintain my focus on sets of experiments and analysis to building a cohesive thesis without getting lost down rabbit holes that although interesting, were unlikely to contribute materially to my thesis, meanwhile, encouraging me to discern which rabbit holes were more likely to contribute to my research and following those instead.*
>
> **Former PhD student, 2012**

Evaluations of teaching and courses

Faculty surveys of courses and teaching are conducted annually except in years when University based surveys are conducted. The questions asked and scoring methods have varied over the years.

Summary of student feedback

Faculty surveys

CHEMMAT 121 (scores/10)		
	Lecturer	**Course**
1999	7.08	7.72
2000	7.40	7.54
2001	8.42	8.78
2002	8.57	7.91
2003	8.51	
2004	8.45	
2005	8.48	7.87
2006	8.08	7.92
2007	8.44	7.71
2009	n/a	7.41
2010	n/a	7.72
CHEMMAT 724 (scores/10)		
	Lecturer	**Course**
2009	n/a	8.33
2010	n/a	7.85
2012	n/a	8.01

University-conducted student evaluations of courses

	2011 CHEMMAT 724	2011 CHEMMAT 121	2008 CHEMMAT 121
Responses/enrolled	11/16	187/589	370/609
Statement	% who Agree + Strongly Agree with the Statement		
I found the course intellectually stimulating	81.8	89.0	79.1
Assessments supported the aims of the course	100	84.5	Not asked
The course resources and materials helped me learn/ +The course materials helped me to learn	90.9	87.8	77.0+
Overall, I was satisfied with the quality of this course	81.8	90.6	81.0

University-conducted student evaluations of teaching

	2011 CHEMMAT 724	2011 CHEMMAT 121	2008 CHEMMAT 121
Responses/enrolled	11/16	213/589	361/609
Statement	% who Agree + Strongly Agree with the Statement		
The lecturer was well prepared for the lectures	100	98.1	95.0
The objectives of the lectures were clearly explained	100	94.2	65.7
The lecturer used educational technologies (e.g., e-lectern, CECIL, audio-visual clips) in ways that supported my learning	90.9	95.2	n/a
The lecturer stimulated my engagement in the learning process	81.8	94.7	n/a
Overall, the lecturer was an effective teacher	100	97.1	91.7

Leadership in teaching

I have welcomed the opportunity to take a leadership role in the teaching life of the Faculty. I have mentored junior colleagues and offered feedback on lectures. I am the Departmental representative on the Faculty Committee for the Professional Conduct of Students and assist my colleagues in instances of student misconduct.

In 2011 I was delighted to be asked to chair the Faculty Teaching and Learning Quality (TLQ) committee as I believe this is a vital committee in supporting and developing excellent teaching within the Faculty. I have worked with the committee to develop a new web page collecting TLQ related materials. As Chair I am also the Faculty representative on the University's TLQ Committee and was part of a sub-committee establishing guidelines for assessment of group work within the University. As group work is an essential component of all engineering disciplines I am interested to help establish best practice in this area. I was also asked to be a representative of that committee on the Governance Board of the Centre for Learning and Research in Higher Education.

In August 2011 I was nominated to represent the Faculty at the New Zealand Engineering Education Leaders Forum. The aim of the forum is to act as a medium for the dissemination of key findings and knowledge from engineering education projects and initiatives.

Teaching outreach

I am frequently asked to work with the University's Schools Partnership Office to support their recruitment efforts.

My activities have included:

- talks to the scholarship group at Macleans College
- invited speaker at "Arts and Minds" conference for schools careers advisors, 2010
- invited to give "lecture" at Junior Campus Day, 2011.

At Faculty level I frequently give talks at Courses and Careers Day, Engenuity Day (activity day for female high school students) and Engineer Her Future evenings.

My personal crusade is to get kids inspired about science, technology and engineering and I have organised numerous visits of school groups, and the museum's kids club (Dinomites) to the Scanning Electron Microscope (SEM) where we examine a variety of samples. These never fail to fire the imagination.

In 2011 I initiated a new aspect of this outreach by teaming up with the science teachers of Tamaki College. I am hugely excited about this as Tamaki College is a low-decile school but with very passionate teachers. I visited the school in 2011 to participate in their careers day where the students could "speed date a scientist". In

September 2012 I ran an afternoon session for all the science teachers on the SEM where we were able to determine which curriculum modules I can best support.

In 2012 I also supported two groups of pupils with their Science Fair projects, including laboratory-based sessions on the SEM. If even one of these students catches the science bug as a result of this I will be well pleased.

> *Bryony has presented at our junior careers days, sharing her passion for her work and the opportunities in her area of research. She has volunteered her time and expertise to support a group of students that were carrying out their own research as part of the Auckland Science Fair. This was the first experience of a tertiary environment for most of these students. The students also valued the interactions with a scientist and enjoyed the novel learning experience.*
>
> **Secondary teacher, 2012**

> *Thank you for helping us with our science project we really appreciate the support you gave us. It was really fun and interesting using the electron microscopes and experiencing new Things. We ended up getting highly commended at the end of the science fair. Thank you again!*
>
> **Email from College students, 2012.**

Summary

I have one of the best jobs in the world. I get to teach a subject I love to bright students. I conduct research on chocolate, cheese and wine and have the opportunity to bring all of those examples to my classes. My Research Centre hosts tools that are unique in New Zealand and I can share them, not just with undergraduates and postgraduates, but with school children and science teachers. My aim is to teach in a way that is inclusive and engaging, grounded in context, and allows students to understand the world through the lens of Materials Science and Engineering.

Publications

B.J.James, E.Ramsay "A CD-Rom based teaching resource in support of a foundation materials science course" *Journal of Materials Education*, 29, n3-4, 317-324 (2007).