Showing You’re Working

A school based project making connections between school mathematics and the workplace

Hi my name is Garrod Musto, I am a Fellow of the IMA, and Head of Mathematics at Kingswood, a Secondary school in Bath.
Aims of the presentation

Background
Forming the concept, creating the project
Incorporating the project into maths awareness week
Assessing pupils’ perception
(Un)Expected outcomes?
Next Steps and wider developments?

In the next ten or so minutes I will try to describe a school based project which aims to strengthen links with industry and with former students, but also as a by-product it has provided a number of significant benefits for the current students involved too.

I hope to give you a little information regarding my interest in this area, click how the initial idea germinated into a potential concept, and also how the concept then developed into a viable project. click

However, to give the project a context I wanted to give the students a balanced view of the importance and relevance of mathematics to their lives, with the workplace being just one aspect of this. click Therefore, I embedded the launch of the project in a planned Maths week during the first week of March last year.

I also want to briefly mention my attempt to quantify how student perceptions of Mathematics might have changed, click then examine the outcomes of the project before click finally examining what will be the way forward for “Showing You’re Working”
Background

1994 – 1996 collated data for a research paper detailing the mathematical needs of Industry

2001 M.Phil: Using sporting contexts to enhance motivation

14 years of teaching, attempting to answer the perennial question:
“Sir, when will I ever need to use this when I leave school?”

From Highbury to Lansdown Road

“Maths Works” Conference 2006

After graduating and securing a Maths teaching post at Kingswood in 1994 I maintained links with Exeter’s School of Education as a research fellow, click and during that time I spent a summer vacation visiting a range of businesses and industries conducting interviews for a research project examining the mathematical needs of industry. click

My interest in teaching maths and making connections with every day life took a different turn between 1999 and 2001 when I completed an M.Phil which focused on how sporting contexts can be used to increase motivation in the maths classroom. Click

With this in mind I find it especially frustrating when, as a teacher of mathematics, I have heard the often muttered phrase many times, and despite many attempts to justify an answer there is always a pervading feeling that little impression is actually made on disaffected students because in discussion they perceive me as an authority figure with little or no empathy for their situation and so, sadly, my response has little impact on them.

However, there are some people who can make that all-important impact on the students, and last Autumn I was lucky enough to host a superb talk click by Paul Shepherd for sixth form students on stadium design which made a great impression on the students present – so much so that recently a few students referred to it in a Physics lesson when discussing resonant frequencies.

The final inspiration was seeing the range of fantastic speakers at click last year’s “Maths works” conference. I came away buzzing with enthusiasm to create a work-related project which could reach out to the students who are most disaffected by the whole mathematical experience in schools, although the challenge was how do you package the information so that the students relate to it, and deliver the material in an engaging way?
The timing of the conference was rather fortuitous as the Autumn half term provided a brief interlude in which I was able to jot a few ideas down and think more formally about how I could structure the project involving both target audiences whom I felt are naturally linked to schools, ie. parents and former students.

I decided to initially concentrate energies on contacting former students, and I was lucky enough to have access to e-mail addresses of a number of our ex pupils, so click a circular was sent asking them to respond if they would be prepared to take part.

Approx 5% of ex-students responded click and these were sent a list of generic questions. These included:

Please describe your current or former career

Please give a short explanation of how you use (have used) mathematics in your professional life.

Has mathematics helped you to resolve a problem in your workplace/environment?

Yes/No

If Yes please give a brief explanation with an example that you think the students would find thought provoking/interesting.

To give students an idea of how important Mathematics is/was to your job please complete the sentences below.

I need Mathematics every day to……

the ex pupils answered the questions and returned them by e-mail. In addition several former pupils said that they would be happy to return to Kingswood to chat to the students about their experiences click. Finally the development of a potential parent and pupil project - a collaboration to create a show and tell activity giving details of how their parent uses maths in the workplace.
Making the project meaningful

A poster competition

The launch of the booklet during “Maths week”

Mathematical talks

The launch was initiated by a poster campaign to match up the profession with the statement, “I need maths to….”

As I stated earlier I felt strongly that students should see industry and workplace links as important, but not the sole raison d’etre with respect to the relevance of the curriculum *click*, therefore the launch of the project was one of several aspects of a mathematical awareness week held in March.

Three former students also returned to Kingswood that week and gave a diverse series of talks on fields such as how mathematical modelling helped describe the Kings Cross Station tragedy, and how maths helped enhance the Outside Broadcast recording of the American Rock band Foo Fighters live in Hyde Park – which te students thought was very cool. This was an excellent opportunity for students to see that the “fictional booklet” contained the experiences of real people, and it gave the project an immediacy which has had a lasting effect on pupil perception of the relevance of mathematics they experience at school.
Developing the project

Creating a booklet containing approx 30 diverse professions all of whom use mathematics in their daily lives

Devising an assembly to give students a flavour of the diversity of the professions involved

I was overwhelmed by the diversity of the professions of those who responded, and the stereotypical accountancy professions were few and far between. A booklet of responses was compiled click, and here is an example of what was received. Click on the hyperlink

An assembly illustrating many of the careers was devised, to use a more visual approach to raise the profile of the project in school. Click This made a very significant impression on both staff and students alike as here was tangible proof that a vast array of careers uses maths in one way or another, but presented in a way that connected with each pupil personally - as the examples I gave them were students who, like them, were from similar backgrounds and had sat in their classrooms studying the same subjects even being taught by the same teachers! And this empathy is important. This next slide is an example of one case study which was used.
What have all of these got in common?

I asked our students to put their hands up if they owned any of the devices they were about to see. All of the devices are linked to former student Tudor Brown of ARM Technologies who detailed how he uses maths in the workplace.
This is Tudor Jones. After leaving Kingswood he worked in computing, and high speed devices such as graphics display controllers became his speciality. He then became part of the company that created the ARM microprocessor which now powers virtually every mobile phone, and many other consumer devices. He led the engineering of that company for many years and then became the Chief Operating Officer in 2001, helping to develop the company to the 1700 people in 38 offices worldwide that it is today.

This particular example showed the students how an ex-pupil of Kingswood stated explicitly how important mathematics is in his workplace and how his workplace and, particularly, his products impact so profoundly on our everyday lives.

Of the other professions represented in the booklet, there were contributions from an epidemiologist, bomb disposal operator, bridge engineer, lawyer, organic pizza company owner, Prof of Thermofluids Engineering, Research meteorologist, Intensive Care charge nurse, contract geologist, operations analyst with National Rail enquiries, agricultural adviser to Soil Association, and yet to name but a few.
Assessing pupil perceptions

The need to quantify outcomes
The questionnaire statements - a likert scale
Outcomes of the initial pre-test data
Comparisons of pre- and post-testing

From the outset of the project, I felt it was important to try to assess the potential effect that it could have on the intended audience ie the current students.

After some background reading I came across the Mathematical Skills in the Workplace Final Report to the Science, Technology and Mathematics Council By Celia Hoyles, Alison Wolf, Susan Molyneux-Hodgson and Phillip Kent, of the Institute of Education, University of London. I was very interested in the on-site guidelines for observation and interview, and thought that these questions would be an ideal starting point to open up a dialogue with students – so I approached Alison Wolfe to seek permission to incorporate some of the questions into a questionnaire. Having organised the layout, pre- and post- testing could then take place, and so the students were asked to complete the questionnaire before the maths week in March, and then again several months later. This took place last month in October.
Expected outcomes

Using workplace examples illustrating how former students use mathematics generated empathy among students – not just Mr Musto says…

Enhanced levels of motivation among students
Raised awareness of relevance of maths to everyday lives
Forging links with former students
A network of potential speakers who are happy to share their experiences with our students

Just to summarise these were the outcomes that I had hoped for. However there were a number of other issues which I became aware of.
Unexpected outcomes

Caution matching speakers with their intended audiences
Questionnaire identified trend in Y8
Targeted Y8 support through enrichment programme
Current parents involved
Spin-off activities

Far more students in year 8 seemed to answer certain statements in a negative way. Also the students in Targeted support for Year 8 has enhanced levels of awareness of relevance of maths through initiatives such as Question Time: regular opportunities built into the curriculum for students to ask whatever maths related question they like.

Finally, I had hoped that there might be opportunities for classes or, indeed, year groups to pick up on a theme and run with it, and indeed a number of spin off activities have taken place.
A case study of Leslie Cram and his work as an archaeologist. He compared impressions of paw prints made in wet clay floor tiles found in various Roman sites in Britain with those of dogs in a nearby dogs’ home, and then used this information to make comments about the size of dogs in Roman Britain. Year 7 and 8 project to show there is a correlation between paw width and dog height in the canines of today.
Joint Maths, Drama and possible Economics A level trip to Belfast in the pipeline to visit John Botteley, theatre manager of Belfast Opera House.
After showing the students the example of the paediatric ICU charge nurse I thought about the record keeping of newly born children. I managed to dust off my son’s little red baby book and found this progress chart, which got me thinking about another former student, Tony Law, who works in Glaxo Smithkline, and who introduced me to the notion of Six Sigma and how it can be used in business for improvement. I am now trying to put together a presentation and a series of support materials which will illustrate how relatively low level statistical concepts can help shape the development of an organisation.
Next steps at Kingswood

Develop programme of speakers for range of year groups
Develop ideas working with parents to create a series of short presentations given by students detailing parent job descriptions.
Develop links to include work experience placements for mathematics students in the sixth form.
Use day release arrangement during exam leave for interested departmental staff to gain experience of mathematics in the workplace with teachers videoing mathematics in action and creating a PowerPoint presentation which could be used at appropriate times within the programmes of study.
Wider developments?
Given the very positive outcomes - is it viable to attempt to replicate this in all schools?
Time constraints?
Generating a template for all schools?
How do mathematics teachers contact former students?
Start with industry & encourage employees to get in touch with their former schools?
Friends Reunited?