

In2nanotech Outreach Program

South West Victoria

29 November – 2 December, 2011



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*I love how you made every station interesting
and made it relate to real life."*

Student

In2nanotech Outreach Program

Year 6

South West Victoria 29 Nov – 2 Dec 2011

In2science runs this nanotechnology-based roadshow (**In2nanotech**) to engage students in science through interaction with Peer Mentors from the **In2science** program. This year the roadshow went to schools in South West Victoria. The In2nanotech program is offered to government schools and is free of charge.

In2science is extremely grateful once again to La Trobe University for their support of the program by supplying a vehicle.

As regional schools do not have access to the **In2science** Peer Mentoring program on a weekly basis, a roadshow was deemed the best method of allowing students to interact with Peer Mentors as science role models. Nanotechnology was selected as the theme for this roadshow as it is a field still new to schools and teachers and is increasingly being included in the curriculum. Students in Y9 and Y10 were targeted for involvement as these are students making decisions about areas of future study at VCE and beyond. The program was also aimed at teachers to introduce them to the topic and build their interest and confidence in this area of science. School students also gain an opportunity to talk to the Peer Mentors about university and careers.

Trip summary

Seven schools were invited to participate in the incursion. Five schools accepted the invitation and were visited. Two sessions ran at Warrnambool Coll:

Cobden Technical School
Warrnambool College
Portland Secondary College

Mortlake P-12 College
Heywood District Secondary
College

Schools were keen to be involved in the activity and were extremely grateful of the visits indicating these types of activity are rarely offered to the more remote and smaller schools. At each school there was a very warm welcome and support. School students seemed genuinely interested and excited about the activity.

Approximately 2 hours was spent at each school which included set up time, 1hr 35 minute presentation and activity stations and pack up.

Several of the schools selected students to participate in the activity who had shown interest for science in the past.

Comments were extremely positive from teachers, students and Peer Mentors about the experience.

Trip leader: John McDonald

Attending students (Peer Mentors):

Michael Chami, 3rd Yr Science/Education (La Trobe),
Alistair Grevis-James, final Yr BSc (University of Melbourne),
Anne Manssour, 2nd Yr Robotics and Mechatronic Engineering (Swinburne University of Technology),

Itinerary:

date	AM (session time)	PM (session time)
Tues 29/11		Cobden Tech School (1.40-3.15)
Tues 1/12	Warrnambool Coll (9:12 - 10:52) (11:20 - 1:00)	
Wed 2/12	Portland SC (9.10 -10.52)	Heywood District SC (1.45-3.25)
Thurs 3/12	Mortlake P-12 Coll (9.02 - 10.50)	

(Approximately 20-25 minutes spent setting up and packing up prior to and after each session)

Activity Aims:

- To engage Year 8/9/10 students from regional schools in science/nanotechnology activities
- To enhance the learning in science
- To introduce students to a new field of science – nanotechnology and its applications
- To allow students to interact with role model science Peer Mentors
- To raise students' aspirations in science
- To promote links between schools and the **In2science** universities
- To empower teachers with new curriculum areas
- To allow teachers to interact with university science students and update their skills (especially valuable where non-specialists are teaching science), and
- To offer a free program to schools.

Predicted Outcomes for Schools:

- A new area of emerging science introduced into classrooms (nanotechnology)
- Teachers with a greater knowledge of a new curriculum area and ideas for delivery
- Students with a greater awareness of nanotechnology and its application
- Scientifically motivated and enthused students
- Teachers able to interact with young scientists and update their skills (especially valuable where non-specialists are teaching science), and
- Schools gain access to support in nanotechnology curriculum material.

Activity sequence

As in previous years the following format was adopted.

The program started with a 15 minute PowerPoint **presentation** to introduce the students to nanotechnology and getting them to understand the scale at which nanotechnology operates.

This was followed by the **activity stations** each lasting approximately 15 minutes:

For the duration of the visits the resources were arranged for use into **four** activity stations, each run by one of the attending In2science Peer Mentors.

The activity stations worked well with students being introduced to an aspect of nanotechnology and its uses. The stations were:

1. Cutting out harmful solar radiation - sun screens and glass



Here students discussed their knowledge of the electromagnetic spectrum. They investigated the problems associated with UV and IR rays and how nanotechnology layers in glass can reduce these effects. Students tested how such glass can cut out the UV light using UV detection beads. They also learned how nanotechnology can make zinc sunscreens appear invisible on the skin.

2. Nanotechnology and textiles, water repellent smart surfaces



Students investigated the properties of Nano-Tex fabric and compared it to standard cloth. They tested the fabrics under different spill-type conditions. Students also observed the properties of non-wetting surfaces on glass, wood and stone. 'Magic sand' was demonstrated and students were asked to explain its properties in water.

3. Nanoparticles – Ferrofluids and magnetism, gold nanoparticles



Students got to investigate the properties of Ferrofluids and uses of nanoparticles. Students also learnt about the influence of particle size on light and the fact they different nano-particle sizes of gold can give a different colour. Students were also introduced to their biomedical applications.

4. Memory Metal liquid crystals, and iGlass



Students investigated the properties of memory wire (Nitinol) and also had the opportunity to see if they could train the memory wire to learn a new shape. They had the opportunity to see if they could identify different temperature ranges exhibited by different liquid crystal sheets. Students also observed the properties of iGlass and learned how electricity can be used to create switchable glass that can be opaque or clear.

In all activities the students were encouraged to think about applications of the products in everyday living.

After the activity stations all the students were brought back together for a **plenary session**. Here they were asked about what impressed them the most and what they thought would be the most useful to society. Following this there was the presentation of other examples of how nanotechnology was changing everyday items. They were also introduced to medical applications including the use of nanotechnology for transdermal drug delivery. A little time was also spent discussing the advantages and disadvantages that they saw for nanotechnology and some ethical considerations.

Evaluation forms were completed by the school students and teachers at the end of the session.

Summary of school visits in South West Victoria

In2nanotech session at Cobden Secondary College

This session was conducted on the journey west to Warrnambool. Approximately 40 students from Y8, 9 and 10 attended the sessions plus several staff members.

The teachers were extremely positive about the program and valued the activity coming to their school. A single space was used for both the presentations and activity stations.

The initial introductory talk was well received. From the evaluations 51% of students indicated they had some prior knowledge of nanotechnology before the session (40% 'a little', 11% 'a lot'). Over half the students commented that they had 'some' (66%) or 'a lot' (6%) of interest in science.

This introductory session was followed up with the students being split into four groups and visiting each of the activity stations in turn.

At each station the students were lead through the activity by one of the Mentors and at each station the aim was to get students thinking about the properties of the materials, trying to identify how they worked and then having a go at manipulating or testing the various properties.

School students filled in evaluations on the day. Their feedback was very positive with students commenting that "it was cool", "it was cool watching the uni students do their activities", "it was really interesting and I liked it".

From the evaluations 49% of the students said they knew nothing about nanotechnology prior to the day. Students preferred the activity stations best, with 58% finding these 'interesting'. Six percent of students commented that they were more interested in studying science beyond Y10 after the session while another 60% said they may be more interested. Their favourite activity station was the nano textiles and water repellent surfaces (40%), followed by the iGlass and Nitinol (29%).



Students testing the properties of Nitinol memory wire



Learning about waterproof surfaces

In2nanotech session at Warrnambool College

Two consecutive sessions were run at this school. Firstly an accelerated group from Y10 followed by a session of mixed Y9/10 students; approximately 50 students in total.

70% of students commented that they had some or a lot of interest in science.

Students were very enthusiastic and willing to ask questions about the resources on display. They enjoyed testing the materials especially the memory metal and iGlass. 'Magic sand' was also a popular experiment.



Investigating the properties of gold nanoparticles



Testing V-Kool glass with Alistair



Testing Nitinol with a hair dryer!

Over 44% of the students knew nothing about nanotechnology prior to the session with just three students commenting they knew a lot already.

Again the activity stations were the most popular aspect of the program with 100% finding them interesting. Warrnambool College students found the iGlass and Nitinol memory wire to be their favourite station (47%) followed by textiles and waterproof surfaces and sun screens and V-Kool glass workstations.

Twenty nine percent commented that they were more interested in studying science beyond Y10 after the session, with 51% indicating they 'maybe' more interested.

Students commented:

"Good learning experience and cool concepts", "very interesting and I am keen to find out more", "it was better than I expected and everyone was super nice". "I actually found this fun", "it was awesome".

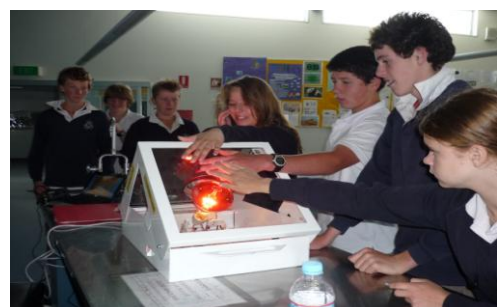
Teachers commented that the session was excellent and that they have some money to purchase nanomaterials and will be introducing aspects into Y10 science. *"something went right, refusers and a few harder kids were really taken in by the format – fast paced and relevant".*

In2nanotech session at Portland Secondary College

At this school Y8 students participated in the program. In total 30 experienced the activity.

Several science staff were able to attend the session and gave positive feedback during the event. Teachers actively participated in the station.

Students here asked lots of questions and were keen participants. Students stated they knew



Students test the properties of V-Kool glass

'nothing' (37%) or 'very little' (47%) about nanotechnology prior to the session.

The majority of students commented that they had some or a lot of interest in science (90%).

Once again the favourite aspect of the program was the activity stations, with 69% finding them interesting. Their favourite activity station was the iGlass and Nitinol (31%), equal with sun screens and UV reducing glass.

Students attending commented:

"It was fun and cool", "it was really fun", and "Interesting, now I am considering a career in nanotech".



Students test liquid crystal sheets as indicators of temperature



Students try testing ferrofluid for its magnetic properties

In2nanotech session at Heywood District SC

The program was well received at this small regional school. Several teachers and 25 Y8 students participated.

Both students and teachers expressed interest and enthusiasm for the activities and asked many questions. The feedback from the session was excellent with students commenting, *"It was fun and I learnt a lot, thanks"*, *"It was a great day, had lots of fun"*, *"I love how you made every station interesting and made it relate to real life"*, and *"would do it again, very fun"*.

Teachers too commented that they enjoyed the session, *"Excellent. Students engaged and interested"*.



Student tests setting memory wire into shape with Michael



Students test Nano-tex fabric

28% of the students said they knew nothing about nanotechnology before the session with the rest indicating they knew something. 52% indicated that they had some interest in science and 30% said they had a lot of interest in science. The workstations were again the most popular aspect of the session with all students indicating they found it 'interesting' or 'OK'. Heywood students found the iGlass and Nitinol the most interesting work station and they also enjoyed testing the properties of gold nanoparticles and ferrofluid.

44% of the students said they were now more interested in science beyond Y10.

In2nanotech session at Mortlake P-12 College

This school has approximately 270 students and the session was run for a range of Y8/9/10 students totalling approximately 36 students.

Once again the program was well received by both students and teachers alike. Teachers said they loved the session and that small country schools need these sorts of activities.

Teachers also commented that now they had a better understanding of the applications of nanotechnology they would consider introducing aspects into their curriculum.

Half the students said they knew a little about nanotechnology prior to the session, only one student commented that they knew 'a lot'. When asked what their level of interest was in science, 35% commented they had 'a lot' of interest, while 53% said they had some interest.

Once again the most popular aspect of the roadshow was the activity stations, with most students scoring it at the highest level. Students expressed that their favourite activity station was the iGlass and Nitinol as they enjoyed setting the memory metal to new shapes.

Students commented that "I want iGlass windows at home", "today was great fun", "today was really good and I learnt a lot about everything. It definitely wasn't boring – thank you", "it was interesting to find out more about nanotechnology because I didn't know much beforehand" and "really interesting, lots of fun".

The response to the question 'are you now more interested in science at VCE after having the session?' was positive with 29% indicating 'yes' and 44% indicating 'maybe'.



Michael helps students test memory wire and set it into new shapes



Mentor Anne helps students test waterproof fabrics

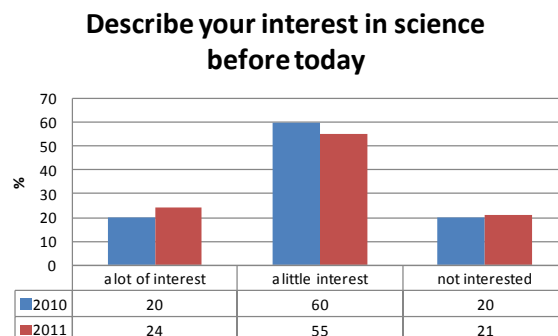
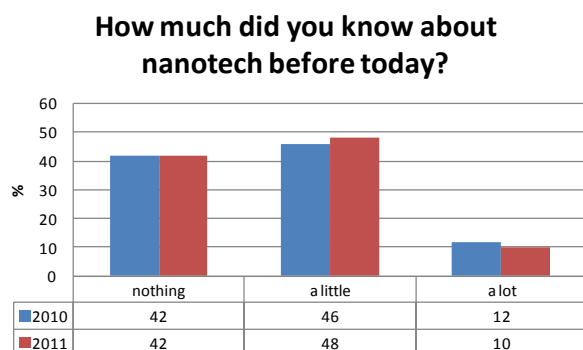
In2science Mentors contribution to the event

Once again the Mentors did a fantastic job during the visits and had lots of enthusiasm for every session. Representing La Trobe University, the University of Melbourne and Swinburne University of Technology, they ran the activity stations extremely well and were very good at conveying the concepts and ideas to the students. They were flexible in how they explained the technology, quickly getting a good grasp of the different ability levels of the students. All Mentors were participating for the first time. All participate in the In2science program visiting the school weekly during semester two 2011 where they gained a good grounding in presenting science to school students.

Mentors commented that the trip had been challenging and tiring but great fun and they valued the opportunity to participate.

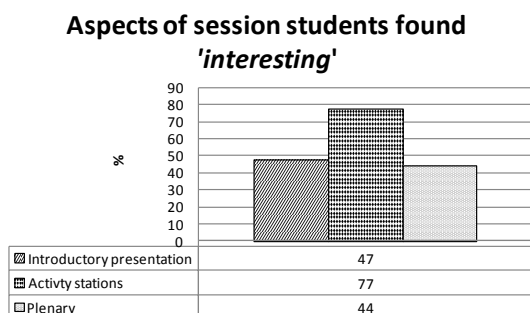
Summary Results

Evaluation results from students' feedback (2011 n= 171, 2010 n=223, for comparison):

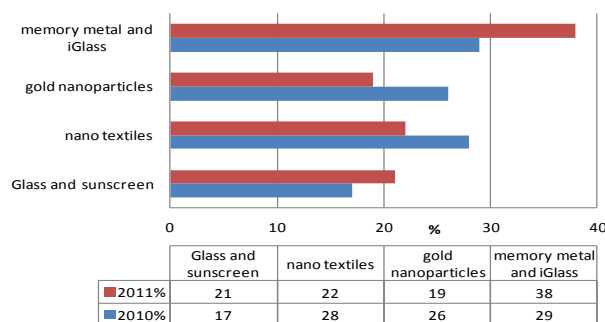


As in previous years students generally commented they knew little or nothing about nanotechnology prior to the visit. However, fewer students than last year commented they know something about it. This made the session much more interesting for them as it was new content. Slightly more students (21% compared to 20%) said they were not interested in science. More students indicated they had a lot of interest in science compared to last year (up 4%).

More students found the introductory session interesting (47%, 6% up on 2010). Students again found the workstations the most enjoyable aspect and interesting part of the session as in previous years (77% - up 5% on 2010).

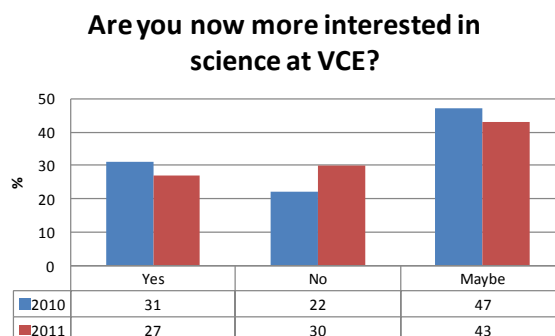


Which activity station was most interesting?



Memory metal and iGlass were by far the favourite of the students as far as the workstations went compared to 2010.

The sessions seemed to have had a positive impact upon the students with 27% of them saying they were now **more** interested in pursuing sciences beyond Yr10 and 43% saying they '*may be*' more interested. This is down on 2010 though more students indicated '*no*' interest in science at the start of the session. There was an increase of 8% in the number of students '*not interested*' in pursuing science after Y10.



The **planned outcomes** were listed at the start of this document and the extent to which they were achieved is noted in the table below:

Predicted Outcomes for Schools	Evidence of achievement
Introduction of new areas of emerging science into classrooms (nanotechnology).	42% of the students said they knew nothing about nanotechnology prior to the sessions.
Empowerment of teachers with new curriculum area and ideas for delivery.	Teachers had the opportunity to learn about the topic and commented that they felt more confident of introducing the topic both into the VCE Chemistry curriculum and middle years teaching. They also gained an understanding of resources available and how to use them.
Students with a greater awareness of nanotechnology and its application	Many students made positive comments about having a better understanding of nanotechnology and the potential benefits it could bring.
Scientifically motivated and enthused students.	On the whole students seemed enthusiastic and engaged in the activity and many commented that they learnt more than they expected. Only 30% stated that they were still ' <i>not</i> ' interested in studying science in Y11 and beyond.
Teachers able to interact with young scientists and update their skills (especially valuable where non-specialists are teaching science).	Many teachers were able to participate in the activity stations and gain an insight into the topic. Teachers asked questions and were keen to find out about obtaining resources. Several schools were considering adding nanotechnology to their curriculum from 2011.
Schools gain access to support in nanotechnology curriculum material.	This was done on the visits and schools were invited to maintain contact with the In2science program to follow up any questions they have.

Conclusion

Based upon feedback from all stakeholders the program of visits this year was deemed a success with the majority of planned outcomes being achieved.

Planning and preparation had gone smoothly and all schools were fully briefed as to what to expect and where ready for the visits. Two schools initially approached to participate declined involvement for various reasons – mainly around other activities occurring at the same time.

The numbers of students participating in the sessions at each varied from 25 to approximately 45 and the smaller group sizes for the activity stations continue to work better. Many of the schools attended only had a small student population (Heywood 170 in total, Mortlake 270 in total) and this had an impact upon the numbers involved. Most of the schools selected students to participate in the activity rather than involving whole year groups.

Peer Mentors did an excellent job of presenting material and engaging with the students in the schools. The quality of these students in both their knowledge and their communication skills was imperative and for this event appropriate students were selected. All were a credit to their university.

All schools participating were government schools.

Resource suppliers

Resources were obtained from a number of sources some being bought and some being kindly donated.

Purchased materials -

NiTinol memory wire, UV detection beads, magic sand, liquid crystal sheets and paper and Ferrofluids

These were sourced from Education Innovations in the USA: WWW.teachersource.com

Glassware was made up for containing the Ferrofluid to aid demonstration and to reduce the risk of spillages. The NiTinol was mounted on a steel dome for ease of demonstration.

Thanks go to the Dept. of Physics at La Trobe University for their help in making the resources into useable activities.

Donated materials and resources:

All these products were donated by the companies involved:

Vehicle - supplied by **La Trobe University, Fleet services**

iGlass from iGlass, Ballarat, Vic

V-Kool from **Protector Glass Industries** in Clayton, Vic

ZinClear products and sunscreens from **Antaria Ltd**, Welshpool, WA

Smart surface treatments, **Nanovations Pty Ltd**, NSW

Nano-Tex and Neutraliser fabric - Donated by **Nano-Tex**, St Kilda, Vic, and USA

Gold nanoparticles - These were sourced and made up by David Piper in the **Chemistry Dept, La Trobe University**.

