

In2nanotech Outreach Program

North West Victoria

5 – 9 December, 2010



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*"Very interesting. Thank you for coming – I
can't wait for VCE science now".*
Y9 Student

In2nanotech Outreach Program

Year 5

North West Victoria 5 – 9 December 2010

In2science in conjunction with Nanotechnology Victoria Ltd has been running the 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 North West Victoria. The In2nanotech program is offered to government schools and is free of charge.

In2science is extremely grateful once again to Gary McMillan Toyota, Preston 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 Red Cliffs SC:

Chaffey Secondary College
Charlton College
Irymple Secondary College

Ouyen P-12 College
Red Cliffs 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 exited 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 other selected whole year levels.

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

Trip leader: John McDonald

Attending students (Peer Mentors):

Emma Thornton, final Yr Nanotechnology/Science (La Trobe),
Lori Ferrins, final Yr Medicinal Chemistry (La Trobe),
Piotr Pytka, final Yr Mechanical Engineering (University of Melbourne),
Vanessa Lo Nigro, 2nd Yr BSc (University of Melbourne),

Itinerary:

date	AM (session time)	PM (session time)
Mon 6/12	Charlton Coll (11.30-1.00)	
Tues 1/12	Chaffey SC (9:30 - 11:00)	Mildura PS* (12.00-1.30)
Wed 2/12	Red Cliffs SC (9.00 -10.40) (11.05-12.50)	Irymple SC (1.55-3.20)
Thurs 3/12	Ouyen P-12 Coll (9.00 - 11.00)	

** the nanotechnology staff attended a primary roadshow session to support colleagues.*

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

Activity Aims:

- To engage Year 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 at the end of the session.

Summary of school visits in North West Victoria

In2nanotech session at Charlton College

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

The teachers were extremely positive about the program and allowed the program to set up in the schools flexible learning area providing a perfect space for both the presentations and activity stations.

The initial introductory talk was enthusiastically received. From the evaluations 60% of students indicated they had some prior knowledge of nanotechnology before the session (53% 'a little', 7% 'a lot'). Over half the students commented that they had 'some' (53%) or 'a lot' (13%) of interest in science.

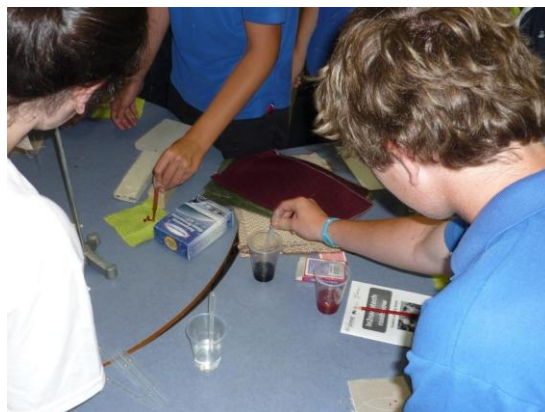
This introductory session was followed up with the students being split into four groups and visiting each of the activity stations in turn.

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.

Teachers commented that the sessions were very good and engaged the students.

School students filled in evaluations on the day. Their feedback was very positive with students commenting that "*it was very informative and the activities were a good way to get people on their feet*", "*today I learned a lot*", "*it was fun and interesting and gave me a look into nanotechnology*", "*awesome, thanks for coming*".

From the evaluations 40% of the students said they knew nothing about nanotechnology prior to the day. Students preferred the activity stations best, with 63% finding these 'interesting'. Fifteen percent of students commented that they were more interested in studying science beyond Y10 after the session while another 47% said they may be more interested. Their favourite activity station was the iGlass and Nitinol (32%), followed by the nano textiles and water repellent surfaces (31%).



Students testing the properties of Nano-Tex fabric



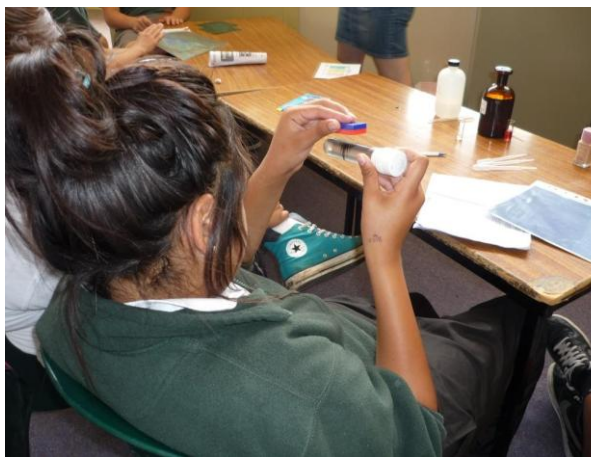
Discovering the properties of iGlass

In2nanotech session at Chaffey Secondary College

At this school students from Year 9 participated in the activity; 42 students in total.

62% 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 smart surface coatings on different materials. 'Magic sand' was a popular experiment.



Testing magnetic fields using ferrofluids



Vanessa gets students testing the properties of Nano-Tex fabric

About a third of the students knew nothing about nanotechnology prior to the session though seven students commenting they knew a lot already.

Again the activity stations were the most popular aspect of the program with 71% finding them interesting. Chaffey students found the textiles and waterproof surfaces followed by the ferrofluid and gold nanoparticles their favourite workstations.

Seventy eight percent commented that they were more interested in studying science beyond Y10 after the session.

Students commented:

"I really enjoyed it", "it was really good and well set out", "best thing I have done".

Teachers commented that the session was excellent and that they were developing a unit of study on nanotechnology so it was useful to see what was available and engaged students. *"loved the passion and enthusiasm".*

In2nanotech session at Red Cliffs Secondary College

Here two consecutive sessions were run to enable the whole of Y9 to participate in the program. In total 68 students experienced the activity.

Several science staff were able to attend the session and gave very positive feedback during the event. Teachers were asking questions and actively participated at each activity station.

Students here asked lots of questions and were very keen participants. 93% of students stated they knew *'nothing'* (44%) or *'very little'* (46%) about nanotechnology prior to the session.

The majority of students commented that they had some or a lot of interest in science (81%).

Once again the favourite aspect of the program was the activity stations, with 88% finding them interesting. Their favourite activity station was the iGlass and Nitinol (29%), followed by nanoparticles and ferrofluid (28%).

Students attending commented:

"Thank you very much", "presenters were very cool", "thanks for coming to our school", "Really informative and heaps of fun", "it was great and informative. We don't do this in normal science", "it was good, got us involved".

Teachers commented that they only knew a little about nanotechnology prior to the session and that they found the session was excellent. Here again they are looking to introduce some nanotechnology to the curriculum.



Students test gold nanoparticles for their properties waterproof properties



Students test how nanotechnology can reduce IR and UV radiation

In2nanotech session at Irymple Secondary College

Due to unforeseen circumstances at the school this session was reduced to a shorter timeframe though the activities ran well (only slightly shortened). The session was run for Y8/9 students, totalling approximately 45. Staff members were also able to attend and had an interest in establishing aspects of nanotechnology through the Australian Curriculum.

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 great", "a great way to introduce people to nanotechnology", "it was a very valuable session, thank you", "I really want to do the session again next year"* and *"it was really good and informative"*.

Teachers too commented that they enjoyed the session, *"Fantastic! Really engaging and worthwhile. The students loved it"*.

40% of the students said they knew nothing about nanotechnology before the session with the rest indicating they knew something. 64% 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'*. Irymple students found the iGlass and Nitinol the most interesting work station and they also enjoyed testing the properties of Nano-Tex fabric and magic sand.

56% of the students said they were now more interested in science beyond Y10.

In2nanotech session at Ouyen P-12 College

This morning session was for approximately 47 Y7, 8 & 9 students.

Once again the program was well received by both students and teachers alike. Teachers said *"Great session - thanks for a great activity. The kids really enjoyed it and had a great time"*.

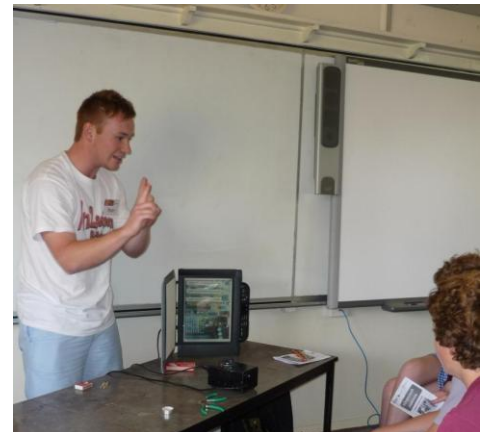
Teachers commented that they could see some great applications for their curriculum and felt more confident to include aspects of nanotechnology in their lessons. *"Everything was well organised and ran very smoothly. There was no pressure on us at all"*.

Almost 60% of the students commented they *'knew nothing'* about nanotechnology prior to the session. When asked what their level of interest was in science, 16% commented they had *'a lot'* of interest, while 67% 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 *"it was really enjoyable and I had a lot of fun"*, *"I know more about science now"*, *"I learnt heaps of things that I didn't know before"*.

The response to the question *'are you now more interested in science at VCE after having the session'* was positive with 30% indicating *'yes'* and 59% indicating *'maybe'*.



Piotr demonstrates phase change iGlass.



Mentor Lori explains how nanotechnology can be used to develop liquid crystals and thermochromic paper

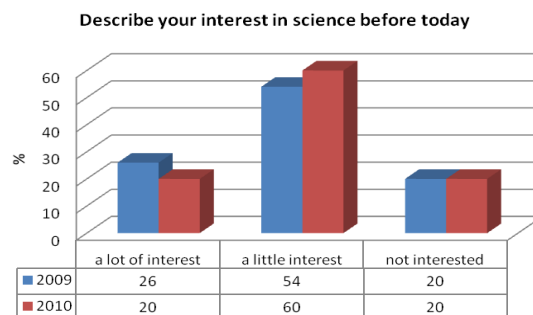
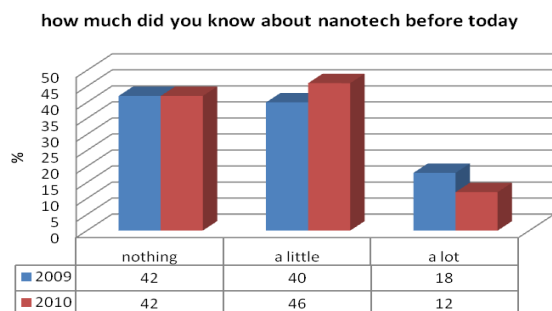
Mentors contribution to the event

As in previous years the four Mentors did a fantastic job during the visits and had lots of enthusiasm for every session. 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. One of the Mentors was completing her fourth roadshow and therefore was able to finetune her explanations to a high degree of relevance and accessibility. The other three Mentors were participating for the first time. All participate in the In2science program visiting the school weekly during semester 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.

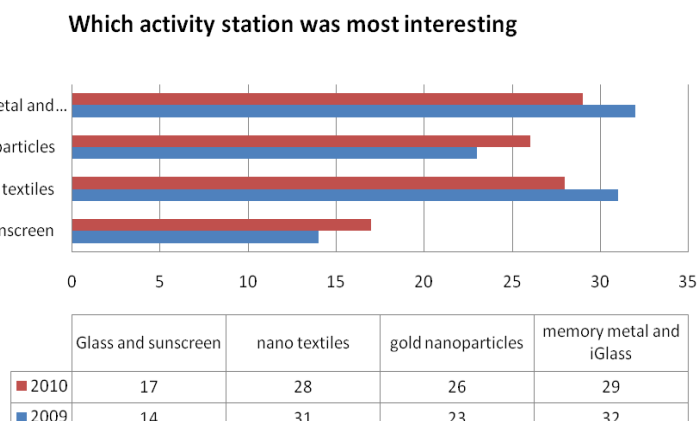
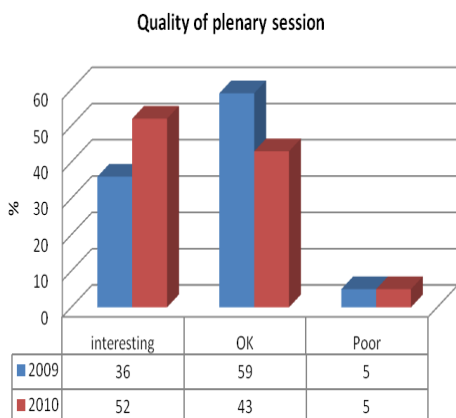
Summary Results

Evaluation results from students' feedback (2010 n=226, 2009 n=211, for comparison):



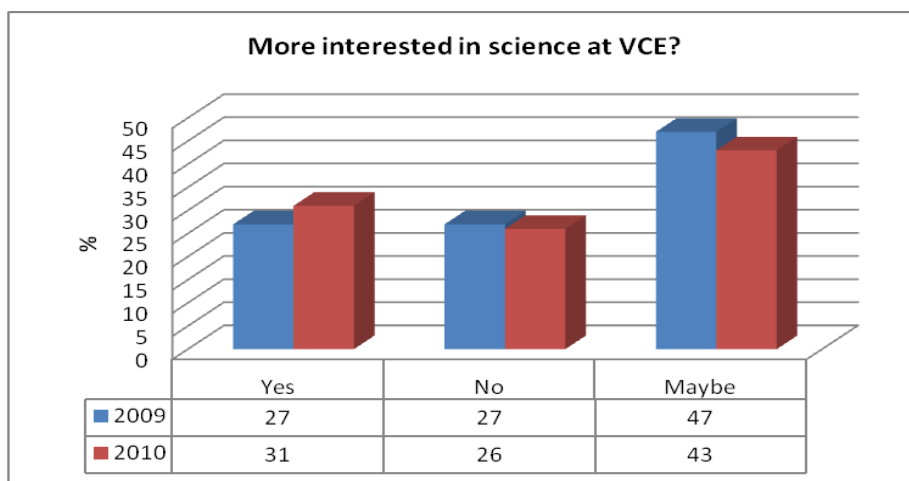
As in previous years students commented they knew little or nothing about nanotechnology prior to the visit. However, more students than last year commented they know something about it indicating a greater level of awareness of the field. This made the session much more interesting for them as it was new content. A similar number of students (20%) said they were not interested in science. The vast majority had some interest (60%) or a lot of interest (20%) down slightly on 2009.

More students found the introductory session interesting (41%, 5% up on 2009). Students found the workstations the most enjoyable aspect and interesting part of the session as in previous years (72%).



Memory metal and iGlass were just ahead of nano-textiles and water repellent surfaces for the most popular in 2010, different to previous years.

The sessions seemed to have had a positive impact upon the students with 31% of them saying they were now **more** interested in pursuing sciences beyond Yr10 and 43% saying they '*may be*' more interested. There was a decrease of 1% 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. 26% stated that they were now 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. Many teachers asked questions and were keen to find out about obtaining resources. Several schools were considering adding nanotechnology into 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.

The numbers of students participating in the sessions at each varied from 33 to approximately 47 and the smaller group sizes for the activity stations continue to work better. Many of the schools attended only had a small student population 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. This year we reduced the session time to fit the needs of the schools (based upon last year's experience). In a couple of schools it was reduced a little more which did have a detrimental impact on the presentation often with the plenary being cut short.

Peer Mentors did an excellent job once again 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.

Planning for 2011

The program will run again in 2011 and will visit schools in a different regional location of Victoria at a similar time of year.

Format is still good and the content relevant to the needs of the students and teachers.

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 **Gary McMillan Toyota, Preston**

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**.

