In2 science
science peer mentoring in schools

nanoVIC
nanotechnology victoria

In2nanotech Outreach Program

North East Victoria

30 Nov – 3 December, 2009

Department of Education and Early Childhood Development (State Government Victoria)

La Trobe University

The University of Melbourne

Monash University

The George Alexander Foundation

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In2nanotech Outreach Program

Year 4/5

North East Victoria 31 November – 3 December 2009

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 Wast Victoria. The In2nanotach program is offered to government schools and is free of charge.

In2science is extremely grateful 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. Six schools accepted the invitation and were visited. Two sessions ran at Mansfield SC:

Beechworth Secondary College
Bright P-12 College
Euroa Secondary College
Mansfield Secondary College
Myrtleford P-12 College
Wangaratta High School

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 2½ - 3 hours was spent at each school which included set up time, 2hr 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):

Emma Thornton, 3rd Yr Nanotechnology/Science (La Trobe),
Anne Saletti, 3rd Yr Nanotechnology/Science (La Trobe),
Johann Lee Chuen, 2nd Yr Nanotechnology/Science (La Trobe),
Amanda Perdomo, 3rd Yr BSc/Bachelor of Science Education (La Trobe).

Itinerary:

date	AM (session time)	PM (session time)
Mon 31/11	**Mansfield SC** (11.00-12.30)	**Mansfield SC** (1.40-3.20)
Tues 1/12	**Myrtleford P-12 Coll** (9:00 - 11:09)	**Bright P-12 Coll** (1.45-3.20)
Wed 2/12	**Beechworth SC** (9.00 -10.40)	
Thurs 3/12	**Wangaratta HS** (9.00 - 11.00)	**Euroa SC** (1.45-3.20)

(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 15-20 minutes:
For the duration of the visits the resources were arranged for use into **four** activity stations, each run by one of the attending 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 East Victoria

In2nanotech session at Mansfield SC

Amanda explains about the applications of phase change glass

Two sessions were run at the school; one in the morning and one in the afternoon. In both sessions students who participated where a mix of Y9 and Y10. Approximately 65 students attended the sessions plus several staff members.

The staff were extremely positive about the program and had set up two rooms to use; one for the presentation and the other for the activity stations.

The initial 15 minute introductory talks were enthusiastically received. From the evaluations just over 60% of students indicated they had some prior knowledge of nanotechnology before the session (36% '*a little*', 33% *'a lot'*). Most students commented that they had some or a lot of interest in science (74%).

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

Joe talks about the issue of managing IR and UV rays.

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 good to learn new things", "I found them interesting and I will look into sciences that I can do at school", "it was very interesting", "I liked the hands on stuff, and it has made science seem a little more interesting", "near perfect, just needed more time!".*

From the evaluations 31% of the students said they knew nothing about nanotechnology prior to the day. Students preferred the activity stations best, with 74% finding these '*interesting'*. Fifty seven percent commented that they were more interested in studying science beyond Y10 after the session. Their favourite activity station was the iGlass and Nitinol (35%), followed by the nano textiles and water repellent surfaces (26%).

In2nanotech session at Myrtleford P-12 SC

At this school students from Year 10 participated in the activity; approximately 26 students in total.

66% 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.

Emma demonstrates magnetic fields using ferrofluids

Anne gets students testing the properties of Nano-Tex fabric

58% of the students knew nothing about nanotechnology prior to the session with just one student commenting they knew a lot already.

Again the activity stations were the most popular aspect of the program with 65% finding them interesting. Myrtleford students found the textiles and waterproof surfaces along with the memory wire and phase change glass their favourite workstations.

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

Students commented:
"I learnt a lot, thank you", "today's session was very interesting", "it was great and I would like to thank the nice staff", "the textiles one was the best".

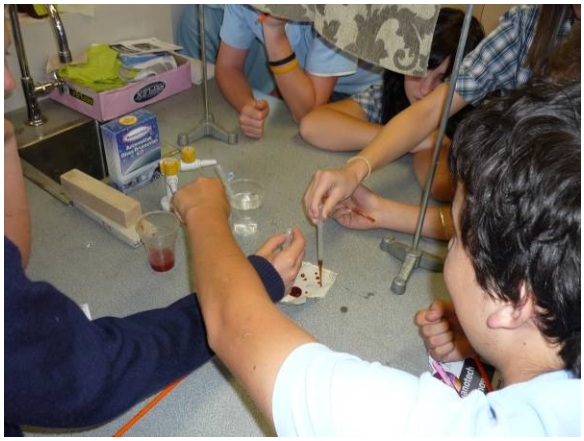
During this session a teacher of textiles in the school attended the session and asked if some of her students could visit the workstations to learn more about the fabric applications. This was a good opportunity to demonstrate the applications of nanotechnology to a wider audience.

In2nanotech session at Bright P-12 SC

This session was run in the afternoon and was attended by 38 students. These students were mostly from Y9 though some Y8 students also attended.

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 too asked lots of questions and were keen participants. 86% of students stated they knew '*nothing'* (44%) or '*very little*' (42%) about nanotechnology prior to the session.



Students test fabric for its waterproof properties

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 79% finding them interesting. Their favourite activity station was the nanoparticles and ferrofluid (32%), followed equally by iGlass and Nitinol (27%) and the nano textiles and water repellent surfaces (27%).

Students attending commented:
"It was a really great learning experience", "I loved it!!", "it wasn't really my thing but it was really good", "I really enjoyed what you did today. Thank you for your time it was really good".

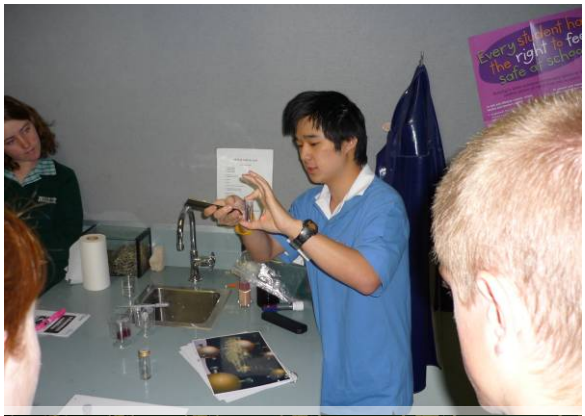
In2nanotech session at Beechworth SC

At this school the session was run for a group of Y9 students, totalling approximately 30. Staff members were also able to attend and had an interest in establishing aspects of nanotechnology into their 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 cool", "it was really good", "science is fun","it was very interesting and everything I learnt I'd never heard of before", "I really enjoyed the session today and feel more informed about science"* and *"I found all the workshops interesting and enjoyed it".*

Teachers too commented that they enjoyed the session.

50% of the students said they knew nothing about nanotechnology before the session with the rest indicating they knew something. 60%



Students test how nanotechnology can reduce IR and UV radiation

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*'. Beechworth students found the nano textiles and water repellent surfaces the most interesting work station enjoying testing the fabric properties and magic sand.

33% of the students said they were now more interested in science beyond Y10.

In2nanotech session at Wangaratta HS

This morning session was for approximately 26 Y9 students.

Once again the program was well received by both students and teachers alike. Teachers said the session was of value to their students.

Teachers commented that they had not considered teaching nanotechnology as part of their science curriculum but felt that it was something they could investigate in the future.

Half the students said they knew a little about nanotechnology prior to the session. When asked what their level of interest was in science, 30% commented they had '*a lot'* of interest, while 57% 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 good", "I had great fun", "very informative"* and "*was pretty interesting and the interactivity was good*". Their only negative comments were that the session "*was a bit too long*".

Amanda lets the students try setting shapes into pieces of memory metal.

Mentor Anne explains how nanotechnology can improve sunscreens

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 38% indicating '*maybe'*.

In2nanotech session at Euroa SC

Amanda Explains how iGlass works

The final session of the week was at Euroa.

Teachers commented that they knew a little about nanotechnology beforehand and they thought the session was excellent; well presented and their students enjoyed it.

Around 30 students participated in the session. Fewer than 40% of the students knew nothing about the topic beforehand. At the end of the session, all but one of them felt it had helped them become more interested in continuing their studies of science, with 40% saying they were now interested and 57% saying they '*maybe'* more interested in sciences beyond Y10.

Students commented: *"fantastic", "helped me learn about being an astronaut", "today was good and fun 10/10", "it was all really enjoyable and the [Mentors] of each station included everyone. Thank you", "I am glad that these people gave up their time to teach us something new" and "it was great, thanks".*

Nano-textiles and water repellent smart surfaces were most popular along with the iGlass and Nitinol.

Emma gets the students testing waterproofing on fabric

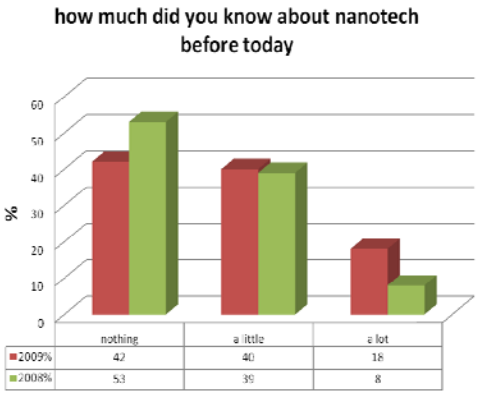
Mentors contribution to the event

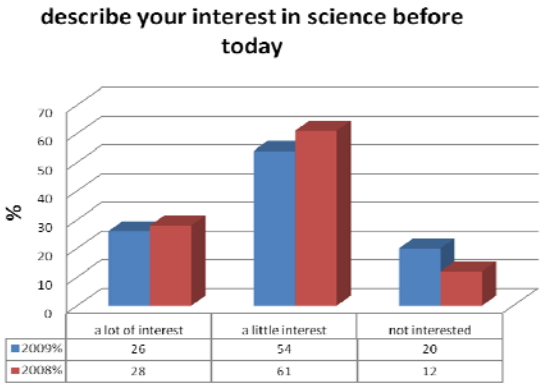
As in previous years the four Mentors did a fantastic job during the visits and had lots of enthusiasm for every session. They ran the activity stations extremely well and were very good at conveying the concepts and ideas to the students. They were flexible in how they explained the technology, quickly getting a good grasp of the different ability levels of the students. One of the Mentors was completing her third 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. Three of the Mentors undertake studies in nanotechnology and have a much broader knowledge base with each passing year of study and this is reflected in their interaction with both teachers and students.

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

Summary Results

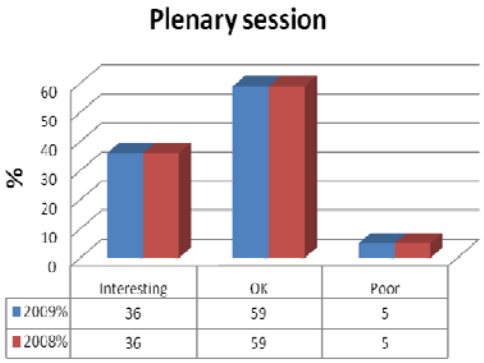
Evaluation results from students' feedback (2009 n=211, 2008 n=120, for comparison):

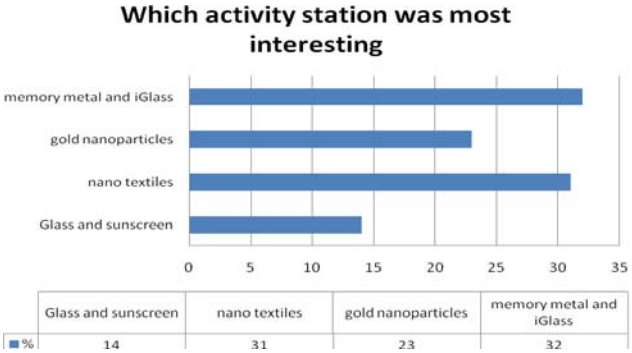




As in previous years students commented they knew little or nothing about nanotechnology prior to the visit. However, more students than last year commented they know something about it indicating a greater level of awareness of the field. This made the session much more interesting for them as it was new content. More students (20%) said they were not interested in science (up on 2008). The vast majority had some interest (54%) or a lot of interest (26%). This year the students seemed not to be as interested in science prior to the session as they were in 2008.

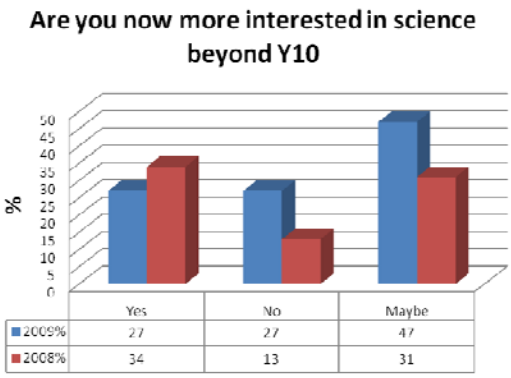
More students found the introductory session interesting (36%, 5% up on 2008). Students found the workstations the most enjoyable aspect and interesting part of the session as in previous years (75% - down slightly on 2008).





Nanoparticles and ferrofluids were just ahead of nano-textiles and water repellent surfaces for the most popular in 2009, similar to previous years.

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 47% saying they '*may be'* more interested. This is down on 2008 though double the number of students indicated '*no'* interest in science at the start of the session. There was an increase of 14% 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. 27% stated that they were now still '*not'* 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 to their curriculum from 2010.
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 26 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 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.

Overall review of the project 2006 – 2009

Since the funding partnership for the In2nanotech roadshow was established with Nanotechnology Victoria Ltd in 2006 the program has visited a total of 25 regional schools in the Wimmera, Gippsland and North Central Victoria and now north East Victoria.

In2nanotech has also made presentations in the following In2science schools over the years:

Eumemmering College, Coburg SHS, Northcote HS, Eltham HS (including staff professional development sessions), Viewbank Coll, Wodonga Middle Years College, the Mac. Robertson Girls HS, Pascoe Vale Girls College and Crusoe 7-10 SC.

An increasing number of schools are now teaching nanotechnology as part of their curriculum in Year 7-10 and support has also been offered to many of these schools to help develop their nanotechnology teaching units and materials.

Many In2science Mentors have made use of the resources to make presentations to students in their schools. Such discussions in schools by both Peer Mentors and the In2science manager have allowed more teachers to see the resources and students learn about aspects of nanotechnology. This has enabled the resources to be more widely used.

Some metropolitan schools have also asked to borrow the resources on a regular basis.

Schools have also arranged visits into La Trobe University to see the imaging instrumentation utilised in teaching nanotechnology.

It is felt that the **In2nanotech** program has been successful in what it set out to achieve and helped raise awareness and interest in nanotechnology as a field of study for both teachers and students. Many schools are interested or have started implementing nanotechnology into their science curriculum. Both students and teachers are becoming increasingly aware of nanotechnology in society.

Schools continue to request information on nanotechnology and/or in-school presentations.

In2nanotech has contributed to the increased awareness of the field along with SHINE, Access Nanotechnology, and the excellent work of NanoVic.

In2science has funding to run the roadshow for one more year. It is hoped that the roadshow will operate at a similar time of year in 2010.

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 where 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.**