



# In2nanotech Outreach Program

Gippsland

26 – 29 November 2007



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## **In2nanotech Outreach Program**

### **Gippsland – 26 – 29 November 2007**

In2science in conjunction with Nanotechnology Victoria Ltd ran the second year of its nanotechnology-based roadshow to engage students in science through interaction with Peer Mentors from the In2science program. This year the tour went to schools in Gippsland, Victoria.

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 a theme for the roadshow as this is a field new to schools and teachers and is increasingly being included in the curriculum. Students in years 9 and 10 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. Students also had an opportunity to talk to the Peer Mentors about university and careers.

### **Trip summary**

Many of the schools in the region were running a Head Start program, whereby they roll over to the next year's timetable to make a start to the new year and making more productive use of the last few weeks at the end of the year. This had an impact upon which schools could host the roadshow.

Schools were keen to be involved in the activity and were extremely grateful of the visits as these types of activity are rarely offered to the more remote and smaller schools. At each school there was a warm welcome and support. Students seemed genuinely interested and excited about the activity. Approximately 3 hours was spent at each school which included 1/2 hr set up time, 2hr presentation and workstations and 1/2 hr pack up.

Comments were extremely positive from teachers, students and Peer Mentors about the experience with only some minor recommendations for future changes.



*Mentors Tom, Emma, Leigh and Daniel have a break at Lakes Entrance*

**Trip leader:** John McDonald

**Attending students:** Leigh Sands, 3<sup>rd</sup> Yr Nanotechnology/Science (la Trobe), **Daniel Langley**, 3<sup>rd</sup> Yr Nanotechnology/Science (la Trobe), **Tom Payton**, 3<sup>rd</sup> Yr Nanotechnology/Science (la Trobe), **Emma Thornton**, 2<sup>nd</sup> Yr Nanotechnology/Science (la Trobe).

**Itinerary:**

Monday 26<sup>th</sup> November,

Depart, 7am, travel to Maffra

11.00am – 12.30pm, In2nanotech session at Maffra SC

Pm, travel to Sale

Tuesday 27<sup>th</sup> November,

7.45am, depart Sale

9.00am – 11.00am, In2nanotech session at Bairnsdale SC, Bairnsdale

1.40pm – 3.15pm, In2nanotech session at Lakes Entrance SC, Lakes Entrance

3.30pm – 4.30pm, Whole school staff PD session, Lakes Entrance SC

Wednesday 28<sup>th</sup> November

8.30am, depart Bairnsdale

11.10am – 12.55am, In2nanotech session at Traralgon College – Junior Campus, Traralgon

1.30pm – 3.15pm, In2nanotech session at Traralgon College – Senior Campus, Traralgon

Thursday 29<sup>th</sup> November

8.00am, depart Traralgon

9.00am – 11.00pm, In2nanotech session, Kurnai College, Morwell

1.25pm – 3.30pm, In2nanotech session, Warragul Regional College

6.45pm approx, return La Trobe University

**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 two universities along with **NanoVic**.
- Empowerment of teachers with new curriculum areas.
- Teachers able to interact with university science students and update their skills (especially valuable where non-specialists are teaching science).
- Schools able to engage their students in a nanotechnology problem-solving challenge.

**Predicted Outcomes for Schools**

- Introduction of new areas of emerging science into classrooms (nanotechnology).
- Empowerment of teachers with 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).
- Schools gain access to support in nanotechnology curriculum material.
- Schools able to engage their students in a nanotechnology problem-solving activity.
- Competitive challenge between schools to engage teachers and interested students in a locality.

## **Preparation – trial visits to other schools**

In preparation for the trip, sessions were conducted at several schools in the metropolitan area, broadening the number of students benefiting from the activity. These schools were:

Gleneagles Campus, Eumemmerring College, Viewbank College and Coburg Senior High School.

## **Activity sequence**

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

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

For the duration of the visits the materials were arranged for use into **four** or **five** workstations (dependent upon student numbers), each run by one of the Peer Mentors.

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

### **1. Nanotechnology and diagnostics, gold nanoparticles**

Here students 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 use.

### **2. Cutting out harmful solar radiation - sun screens and glass**

Here students discussed their knowledge of the electromagnetic spectrum and the problems of UV and IR rays and how nanotechnology layers in glass can reduce their effects. Students also learnt about self cleaning glass which used UV rays to break down organic matter using a photocatalytic process. They also learned how nanotechnology can make zinc sunscreens clear.

### **3. Nanotechnology and textiles, water repellent smart surfaces**

Students investigated the properties of Nano-TEX and compared it to normal fabric. They also tested it under different spill-type conditions. Students also observed the properties of non wetting surfaces on glass, wood and stone.

### **4. Liquid nanotechnology - Ferrofluids and liquid crystals.**

Students got to investigate the properties of Ferrofluids and Liquid crystals. They had the opportunity to see if they could identify different temperature ranged exhibited by different liquid crystal sheets.

### **5. Memory wire. (sometimes run with activity 1)**

Students got to investigate the properties of memory wire and also had the opportunity to see if they could train the memory wire to learn a new shape.

After the workstations 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 some other examples of nanotechnology including testing for water quality, Barracouta fish tank glass and the use of nanotechnology for injectionless drug delivery. A little time was also spent discussing the advantages and disadvantages that they saw for nanotechnology and some ethical considerations.

In conclusion the “Inter School Challenge” was explained to them.

**Evaluations** were completed by both students and teachers. All but one school completed them on the day of the visit.

## Summary of school visits in Gippsland

### In2nanotech session at **Maffra SC**

This was the first full run through of the session. Students participated where all in Year 9. Approximately 80 students attended this session plus three staff members.

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

The initial 15 minute introductory talk was well received with only a couple of students having some prior knowledge of nanotechnology.

This introductory session was followed up with the students being split into five groups and visiting each of five workstations 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 properties.

The session ran roughly to time and teachers were positive about it. Unfortunately there was some confusion when the lunch bell went and the students left the session at the next change around without returning for the plenary session.

This was a little disappointing as it prevented an orderly closure to the session and the students did not get to see some of the other applications as part of the plenary.

Upon leaving the school the activity what happened was discuss with the Science Coordinator.

School students did not fill in evaluations on the day.



*John explains the role nanotechnology can play in sunscreens*



*Tom explains about gold nanoparticles*



*Daniel explains memory metal properties*

### In2nanotech session at **Bairnsdale SC**

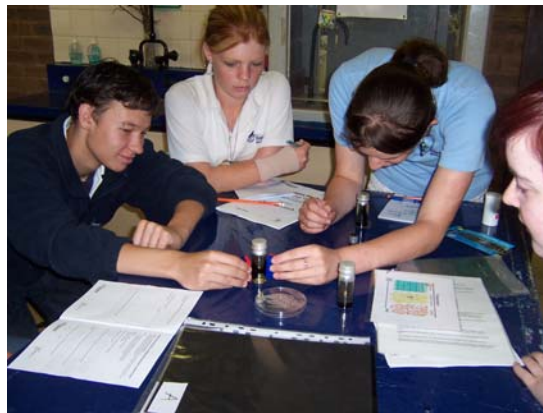
At this school students from Year 10 participated in the activity; approximately 30 students in total. These students had a diverse interest and knowledge of science. The same format for the session worked well and students asked lots of questions and their feedback was very positive. Four activity stations were set up with each Peer Mentor looking after one.

Student evaluations showed that just fewer than half the students knew nothing about nanotechnology. Half the students said they knew a little prior to the event. Students found all aspects of the session interesting. They found the liquid nanotechnology workstation most interesting followed by memory metal.

Students commented that *“all information was well presented and very interesting”, “it was fun”, “I learnt a lot and it was very interesting”, “I really enjoyed today’s science tour and would love to become a nanotechnologist”*.

72% of students said that having had the activity they were more interested in science at VCE which was encouraging.

Teachers commented that the session was excellent and that they planned to introduce nanotechnology into their curriculum possibly in 2009. Several teachers were keen to find out more and where to obtain resources.



*Students test Ferrofluid with Emma*



*Daniel explains the properties of Nitinol metal*

### In2nanotech session at **Lakes Entrance SC**

At this school a mixed group of Year 9 and 10 students participated in activity, approximately 15 in total. The group was to have been bigger through several students were absent.

Due to the small number of students the Peer Mentors paired up and took half the students each through two activities then swapped over.

Students displayed interest and enthusiasm for the activity and many of them asked good questions about the materials.

A number of teachers were able to see the activity and they too were asking questions.

Students commented the session was *“Very good and interesting”, “it kept me interested the whole way through”, “I learnt a lot”, “The session was good and it would definitely spark a few interests”, “very good and interesting”*.



*Leigh explains how to compare the wetting properties of materials*

Student evaluations showed that 43% of students knew nothing about nanotechnology and only 1 student said they knew a lot prior to the event. Students found the workstations most interesting with Ferrofluid and liquid crystals along with memory metal being the most popular.

21% of students said that having had the activity they were more interested in science at VCE. 64% said they may be more interested.

### **Teachers Professional Development session**

The program has always offered the opportunity for schools to have a PD session for teachers as many may not have been able to attend the session with the students. Lakes Entrance SC took up this offer and not only asked for the session to be for science staff but the school principal asked for the session to run in place of a general staff meeting. Therefore the session tried to show how nanotechnology as a theme can be incorporated into a diverse range of curriculum areas from Art to English and Textiles.

This took place after school and was attended by about 35 staff. In this session an introductory presentation was made followed by the nanotechnology students from La Trobe going through the science of the different products in more detail and explaining the applications. Teachers seemed to get all their questions answered and were positive about the session. In feedback from the school it was noted that the topic of conversation in the staffroom the following morning revolved around the session and how positive and enthusiastic the staff were.



*Teachers' PD session – Daniel explains how we can cut out UV and IR rays with nanotechnology*



*Teachers' PD session – Tom explains how we use nanoparticles in diagnostics.*

### **In2nanotech session at Traralgon SC – junior campus**

Traralgon SC asked if the program could run at both its Junior and Senior campuses on the day. This was able to be accommodated. This morning session was offered to two Year 9 classes in the school, approximately 30 students. The session was able to be run in two adjoining rooms allowing easy movement of students between the activity stations.



*Daniel explains how liquid crystals work*

Most students at the junior campus were enthusiastic and asked lots of questions.

53% of students said they knew nothing about nanotechnology prior to the session, 17% said they knew a lot and were interested in finding out more.

Students found the workstations the most interesting followed by the plenary session. They liked the liquid nanotechnology the best followed by the Nano textiles and smart surface coatings.

A quarter of students said they were now more interested in science at VCE after doing the session and 30% said they may be more interested.

Comments students made included; *"it was good"*, *"I thought it was really cool and different"*, *"boring"*, *"great"*.

Teachers attending the session said the session was excellent and were keen to include examples in their teaching of science to show new technology and developments in science.



*Students test glass properties at Traralgon.*

#### **In2nanotech session at Traralgon SC – senior campus**

This afternoon session at Traralgon occurred during the students transition phase to the next year level so was made up of students in Year's 10 and 11. There were 21 students who attended the session.

Students commented that some of them had attended a recent nanotechnology session at Monash University's Gippsland campus so had seen some of the resources but found that the Mentors made the session fun today. Others commented that, *"it was an interesting part of science that I did not know existed"*, *"it was really fun and I learnt a lot"*, *"very interesting and fun"*, *"lovely mentors. Very helpful and interesting"*, *"makes me excited about going to Uni"*.



*Senior students at Traralgon College.*

Half of the students said they knew nothing about nanotechnology before the session with only 2 saying they had a lot of prior knowledge. They liked the workstations the best followed by the plenary session. Most popular was the Nano textiles and smart surface coatings followed by the liquid nanotechnology.

76% of students said they were now more interested in science at VCE after doing the session.

Teachers commented that it was something they were looking at introducing to Y11 Chemistry and possibly Y10. They also commented that the session was a great opportunity for their students to experience the activity and interact with active researchers in the field.

### In2nanotech session at **Kurnai College**

Kurnai College had participated in the In2science ASISTM funded project during 2006-07 with Monash University and it was great to be able to go back there with the roadshow.

On the day of the visit the school was on a curriculum day so the students came in especially for the session. The students were from the schools Year 9 accelerated learning program and they displayed excellent enthusiasm and interest in what was on offer. In total there were 17 students.

Both students and staff were active participants in the session and asked a lot of questions.

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

Over half of the students knew nothing about the topic beforehand. At the end of the session, 65% of them felt it had helped them become more interested in continuing their studies of science.

Students commented *"it was great fun", "it was great, I loved it", "was cool", "needs to be longer!", and "today was so interesting. I'm now looking forward to learn more about this science. Thank you so much", "the activities were interesting and well organised. It was great!", "it was very worthwhile. I learnt a lot of interesting stuff that I can take with me – thank you"*.



*Plenary session at Kurnai.*



*Testing glass at Kurnai.*

### In2nanotech session at **Warragul RC**

Warragul was the last stop for the week and despite being tired the Peer Mentors put on an excellent session.

A range of students attended the session from Year 9/10, with different levels of interest in science, 42% expressing a lot of interest in science. 31 students attended the session in total. Over half knew nothing about the field of nanotechnology before, with the other half knowing just a little.

Again the students found the activity stations the best though there was a lot of interest in the plenary session also.

Most popular was the liquid nanotechnology followed by the memory metal and gold nanoparticles.

Student comments on the session included: *"it was a good way to get out of classes", "awesome", "I really liked how involved we were", "nanotechnology is currently a career I am considering", "thank you for this it was good"*.

Of the students who attended, 58% commented that they felt it had helped them become more interested in continuing their studies of science into VCE.

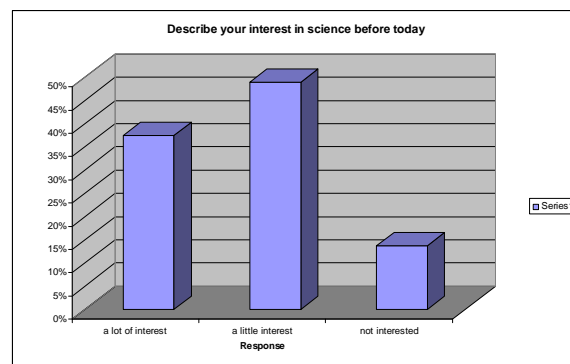
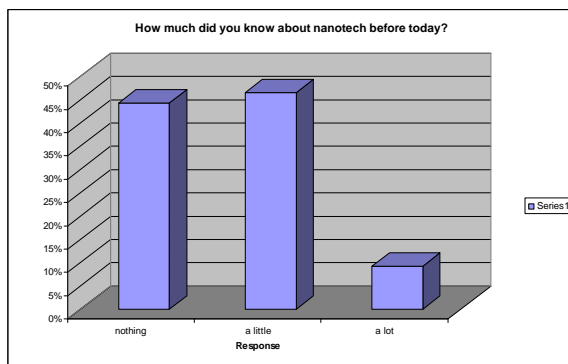
## Mentors feedback

All 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.

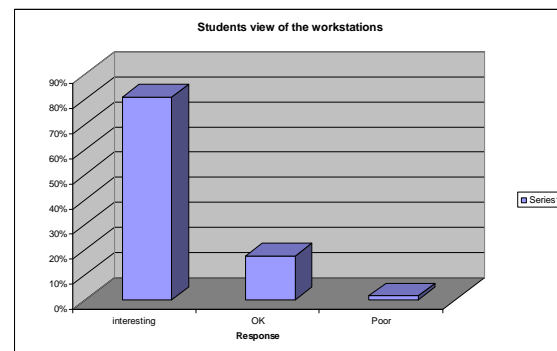
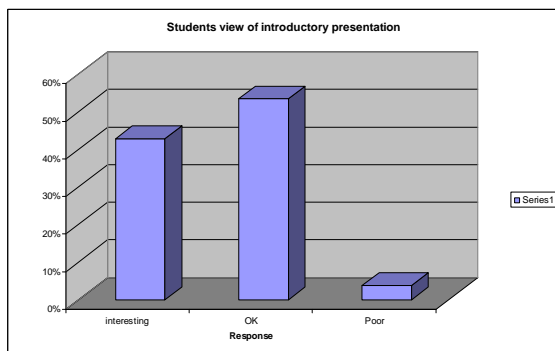
Mentors commented that the trip had been challenging and tiring but great fun. They were keen to be involved in similar trips in the future.

## Results

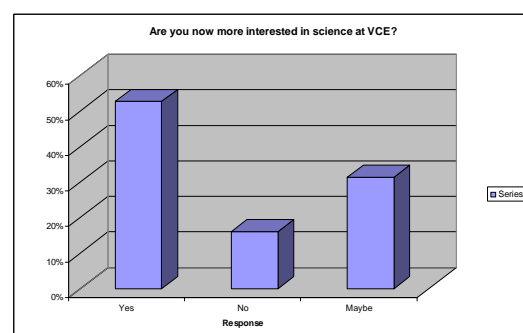
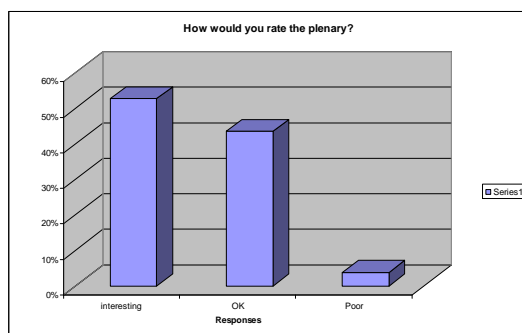
Evaluation results from students' feedback (n=131):

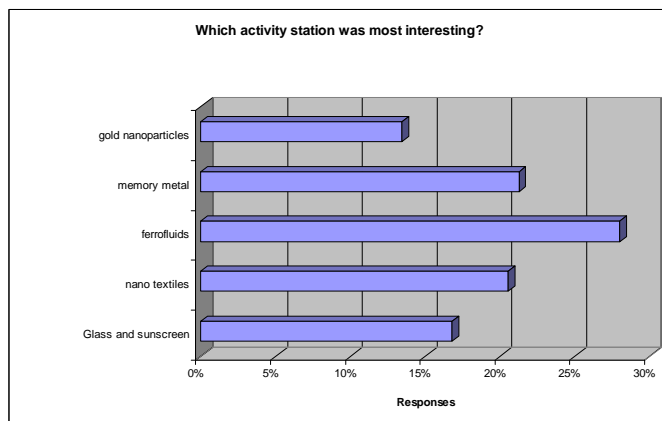


The majority of students knew little or nothing about nanotechnology prior to the visit. This made the session much more interesting for them as it was all new. Only a few students (14%) said they were not interested in science. The vast majority had some interest (49%) or a lot of interest (37%).



Students found the workstations the most enjoyable and interesting part of the session (81%) with 53% of students finding the plenary sessions interesting.





Students enjoyed the different types of technology on display but found that the Memory metal, Ferrofluid and Nano-Tex fabrics were their favourite.

The sessions seemed to have had a positive impact upon the students with 53% of them saying they were now **more** interested in pursuing sciences beyond Yr10 and 31% saying they may be more interested.

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:

<b>Predicted Outcomes for Schools</b>	<b>Evidence of achievement</b>
Introduction of new areas of emerging science into classrooms (nanotechnology).	44% 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 into the VCE curriculum. They also gained an understanding of resources available 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. 53% stated that they were now more 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 workshops and gain an insight into the topic. Many teachers asked questions and were keen to find out about obtaining resources. A PD session was run for all staff at Lakes Entrance SC.
Schools gain access to support in nanotechnology curriculum material.	This was done on the visits and will also be available for the duration of the Interschool Challenge Event.
Schools able to engage their students in a nanotechnology problem-solving activity.	Evidence to be obtained after Interschool Challenge Event judging.

Competitive challenge between schools to engage teachers and interested students in a locality.	Evidence to be obtained after Interschool Challenge Event judging.
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### Follow up - Interschool Challenge Event

As a follow up to the roadshow visits, each school is invited to put together a team of interested students to do some more research into the topic and present their findings at an interschool event. This event will hopefully be held in the Sale area at the end of Term 1 '08.

After last year it was decided that the majority of schools must commit to participating before the activity would be confirmed to ensure maximum benefits for the effort needed to run the activity.

The teams of interested students will be invited to research/investigate an aspect of nanotechnology and make a presentation of their findings.

**Possible** titles for the project are as follows:

- o Managing oil spills with nanotechnology
- o How can nanotechnology aid medicine
- o Improving sports performance using nanotechnology
- o The nanotechnology house of the future
- o How can nanotechnology aid fresh water supplies
- o The nanotechnology car of the future

Teams can either undertake research using secondary data or they can conduct some of their own experiments to test nanotechnology materials.

Ongoing support for these projects will occur through **E-mentoring**. This will involve the students having the opportunity to contact university students studying nanotechnology to seek help and advice about their project. This will be done through WebCT to ensure it is only the participating schools involved.

### Conclusion

Overall the program of visits 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 varied from 15 to approximately 80 and the smaller group sizes for the activity stations worked better. Many of the schools attended were only small and this had an impact upon the numbers involved.

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.

There was some difficulty arranging schools in a sequential geographical path and the distances prevented travel back and forward to accommodate times that suited some schools. Therefore some schools could not participate who were originally invited. All schools were government schools.

**Recommendations for 2008**

1. Continue to visit no more than two schools per day and only one on the first and last days if possible to facilitate travel.
2. Aim for schools to involve a maximum of 40-45 students in any one session. If schools have bigger numbers then this may require a double session in a school.
3. Aim for 4 Mentors to be involved in the program.
4. Six or seven schools in a round of visits would prove to be most effective on any visit. Any more may lead to fatigue of Mentors.
5. Aim to have a hub location to base the program at then to travel out to the schools each day. This would be better than trying to follow a path through a region and visit schools on the way.
6. Where possible suggest that schools select interested students or specific classes to participate, avoiding disinterested and possibly disruptive students.

## Resource suppliers

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

### Purchased materials -

#### NiTiNol memory wire, liquid crystal sheets and paper and Ferrofluids

These were sourced from Education Innovations in the USA: [WWW.teachersource.com](http://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:

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

Activ Glass from **Pilkington (Australia)**, South Oakleigh, Vic

ZinClear products and sunscreens from **Advanced Nanotechnology Ltd**, Welshpool, WA

Smart surface treatments, Nanovations Pty Ltd, NSW

#### Nano-Tex fabric

Donated by **Burlington House**, St Kilda, Vic

#### Gold nanoparticles

These were sourced and made up in the **Chemistry Dept, La Trobe University**.

#### Vehicle

The use of a Holden Commodore station wagon was provided by **Barloworld Holden** in Glen Waverley, Victoria.

