

Real World Science, an introduction

There is need to re-imagine the way science is taught in schools. Locally, nationally and globally a situation exists that demonstrates student disengagement from science subjects, in particular the physical sciences. Whilst it can be demonstrated statistically that more students pursue avenues of higher education the numbers of students choosing to engage in science career avenues is disproportional.

Students in year 5-9 demonstrate decreasing interest and motivation to choose to participate in school science. When asked, student perspectives highlight the most influential supporting factor with regard to their own learning is the quality of the teacher, opportunities to question and discuss science and community issues and the availability to participate in meaningful practical work that facilitates intrinsically interested and motivated enquiry (P. Jones, 2009, Masters Research dissertation: *Student Engagement in Science*, a case study. (Not to be cited))

Local industry and employment providers have concerns regarding the lack of suitably qualified young adults who are prepared for and have interest in applied sciences and technology sufficient to make valid contributions to the economic growth of the Australian business community and to the productivity of the nation as a whole.

Real World Science is positioned to make a contribution to enhancing student engagement in science learning and nurturing a shift in interest and motivation to choose science based career avenues.

The vision of Real World Science is to bring a shift to student engagement in school science through meaningful and challenging science experiences.

The mission:

To provide relevant teacher professional development that builds the capacity of the classroom practitioner and as a consequence enhances student engagement in science.

To provide meaningful, relevant, challenging and hands-on science learning experiences for local high school students.



Science, Education and Applied Technology Association, SEATA

It is suggested that there may exist a need in the region of Rockingham and Kwinana for effective collaboration between science teachers in local middle and senior high schools.

Rockingham and Kwinana Schools are ideally situated for science learning through a place based pedagogy in an area high in industrial applications, mineral resourcing and preparation and other advance technological companies and organisations. A growing and concerning rate of youth unemployment is currently at 12%.

An association of science educator professionals will support local community capacity building. The demand from local industry for suitably qualified and intrinsically interested and motivated young adults would support the notion that the establishment and maintenance of a Science, Education and Applied Technology Association would be timely.

SEATA, as an association that will endeavour to engage students with learning in the science classroom by:

- Coordinated Teacher Industry Tours to bring together industry based scientists and technologists with science and technology teachers.
 - Contributing to teacher capacity building through exposure to local industry.
 - Facilitate place-based learning pedagogy through opportunities for teachers to contextualise school science curricula with applied science in local industry.
 - Provide Industry-placement opportunities for teachers.
 - Encouraging and highlighting the advantages of collegiality between and amongst science and technology departments located in KIEP member & LCP schools.
 - Raise a mutual awareness of the functionality of schools and local Industry re real world science.
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-Support the development of effective pedagogy in the science classroom.

Research of student perceptions of science in the classroom would indicate that the knowledgeable teacher is the most influential factor contributing to student learning (Sjöberg, ROSE project 2000; Goodrum, Hackling, & Rennie, 2000)and that student engagement is related to a theoretical framework of interest ,attitude and choosing to be come involved in learning(Lindahl, 2003). Whilst concerns exist regarding disengagement in general, the high school science classroom is recognised in particular as a location where students have become disengaged from learning (Tytler 2005; Goodrum & Rennie, 2007 & 2008)

There is a genuine need to re-imagine the way science is taught in the high school classroom (Peacock in Tytler). New approaches toward classroom methods, effective pedagogy and considerations for shifts in curricular orientations are seen as avenues' that may support the critical re-engagement of secondary school students in science learning.

Phil Jones, 2009,
Real World Science Coordinator, KIEP.

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Real World Science 2010 – Introducing the Interschool Year 8 Real World Science Quiz

(A discussion document)

Who is it for?

All students enrolled in year 8 at local LCP and KIEP member schools

What is it about?

This initiative may be considered as making a valuable contribution to community capacity building. Bringing schools together may enhance a shift in student science learning in middle school and lend support to concern surrounding the need for future science and technologists in Australian industries. Creating and building structures of collegiality both within and between schools validates a truer meaning of education partnership within the community as a whole.

How does it do this?

Teams of Year 8 science students participating in this event may be elected/nominated by their science teacher. In so doing the school identifies the best candidates and nominates an elitist team of students.

Alternatively, a class of yr. 8 science students, under the guidance of their science teacher may adopt a more democratic approach working as researchers/co-researchers. Together as a research group the class may enter as a team, nominating jointly, their “active” quiz team to participate on the quiz night. Different “active” quiz teams can be nominated by the group to go into subsequent rounds.

General questions in each quiz round will address the science curriculum for Western Australia. A specialist field bringing a focus toward local industries and applied sciences in those industries will form part of each quiz night. With regard to the latter point, to achieve higher levels of success teams will be required to research local industry endeavoring to identify and map contextualized science found in these industries. A suggested avenue to achieve this might be to participate in Coordinate Industry Tours run through KIEP. The quiz will further provide opportunity for the enhancement of science teacher collegiality in support of the ongoing aims and objectives of SEATA/KIEP.

Do schools/students have to participate?

No, this is not a compulsory event. The key word is “fun”. Let’s make science fun, community relevant and pertinent to students’ current and future lives.

What if a school withdraws form the quiz?

Each school will be recognized for its level of involvement by a letter and certificate of participation. Schools that withdraw give their next round competitor a bi.

When will schools/students be involved?

Depending on the number of teams registering to participate it is anticipated the competition will require 4 rounds. Round 1 term 1&2; Round 2 term 2; Round 3 term 3; Round 4 term 4. Each round will take place mid-week out of school hours, provisionally 4:00 – 5:00pm. The finalists round attended by all past teams, family members and school representatives, will take place at Murdoch University Rockingham.

What are schools/students required to do?

Discuss and decide if departments would like to be involved. Identify participating teachers and how the school might choose a team. Review the delivery of the curriculum and considered alternative pedagogy where necessary.

How do schools/students register?

Details and nomination package will be sent to schools early term 1 2010.

What does it cost?

There is no cost. Schools will be required to considered and take responsibility for transportation to and from each round of the quiz.

Are there prizes for competitors/winners??

Each quiz night will provide elementary prizes in honor of student involvement at that stage. The finalist team will each receive a \$ prize to be spent on high cost middle school science equipment. Suggested amounts are: 1st. prize - \$2000; 2nd prize \$500.

What next?

Start some discussion and decide for your school and the community to which we are accountable if this is something worthwhile engaging in and fully supporting. Provide feed-back to Real World Science for follow-up and consideration in the final organization and planning process.

Real World Science Quiz, RWSQ!! How might it work?

The development of this initiative demands school support in the form of proactive science teachers/school representatives.

The KIEP Real World Science Quiz, RWSQ, is aimed at engaging students in science knowledge construction, skill development and an extension of science literacy in most areas of school Science as mapped in the State Curriculum Framework and the Australian National Curriculum for Science. To this is added a local industry specialist research topic of student choosing. I.e. A group of student may nominate ALCOA as their chosen industry area.

How could it work?

RWSQ knock out competitions run each terms 2, 3 & 4 of the school year for specific year 8 student groups.

RWSQ is for school teams of four students. The competition consists of two rounds of 15 questions. Each round is a week apart and support information will be accessible on the KIEP website.

What are the competition subject areas?

Each competition contains Science in Action questions with Real World contexts; questions will be designed to encompass most areas of the year 8 science curriculum including scientific methods and investigations, and local KIC industry areas.

Competitions may cover the following subject areas:

- Term 2 Competition - Earth & Beyond (Environmental science, Geology/Astronomy) + Energy & Change (Physics)
- Term 3 Competition - Life & Living (Biology including genetics and biotechnology) + Natural & Processed Materials (Chemistry)

Questions will be asked within contexts that are relevant to student's current and future lives and pertinent to their nominated field of specialization.

Participating teachers will be encouraged to provide banks of suitable questions. An endeavor will be made to ensure that questions in each round reflect student participations and experiences in the school situation

The next step!!?

It is imperative for local science departments to commit to this competition.

A meeting of SEATA early in term 1 2010 and identification of concrete support is an essential pre-requisite for securing the success of this community capacity building activity.

Phil Jones, Real World Science Coordinator, 7 October 2009



Year 9 Science Enrichment Activities.

The program brings focus to **year 9** students who demonstrate levels 4-6 in the criterion referenced WA Outcomes statements for Science.

Each program brings focus to the 'Working Scientifically' strand of the Curriculum Framework for WA. Participating students are guided through the real world science processes of research and investigation.

Endeavours are to be made to try to run the activities away from school premises, though for resource reasons, access to IT and suitability of rooming this is not always possible. Engagement and partnership with TAFE, Murdoch University and Naragebup environment centre facilitates acquisition of real world science locations.

Three programs are available with respect to chemistry, physics and biology. Each project runs for four weeks. Students enrolled onto RWSE 109 & 209 are provided opportunity to use their knowledge to further investigate water, its properties and usage, electric circuits with regard to energy generation and conversion incorporating an introduction to electromagnetism. Environmental issues are incorporated in RWSE309 involving a mini-research program that pursues questions emerging from student discussion.

All necessary and sufficient details are sent to schools early in the year in search of support by encouragement for this after hour's activity.

Student comments of RWSE have been very encouraging. The perceptions emerging through informal interviews and responses to questionnaires both in 2008 and 2009 indicate that they appreciate and enjoy opportunities to discuss questions and pursue investigations that address their own interests in science issues that they see as relevant to their current and future lives.

Year 10 Real World Science Student Continuity

The importance of maintaining links and supporting continuity of interest in science with year 10 students who participated in RWS 2009 is identified. Three possible activities are in place:

- 1.) Year 10 students are invited to participate as Research Group Leaders with RWSE 09. RGL's would have opportunity to operate as a team of peer group leaders using their knowledge of science to support year 9 students through student identified investigations.
- 2.) Two appropriately delivered Coordinated Industry Tours to gain first hand experience of local industry, meet scientists in the field and to enhance awareness re career avenues in science and technology.

The tours can be structured as follows:

Tour 1, Rockingham Water Reclamation Plant, Synergy Power Station, West Australian Maritime Training Centre.

Tour 2, TiWest Joint venture, Coogee Chlor alkali plant, ASEP training facility.

- 3.) Voluntary participation in one week of Science and Technology based work experience set up by KIEP .
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Real World Science, Year 11 Science Conference 2009.

As part of a drive to raise community awareness, importance and continued interest in science KIEP provides a Real World Science Camp for year 11 students. In an attempt to maintain and capture student interest in science career avenues the Real World Science Conference provides key note speakers, hands on activities and investigations to nurture a shift in student engagement toward higher levels of science and engineering study.

Statistics indicate that year 11 and 12 students who demonstrate high levels of attainment in science subjects are positively discriminating against science related undergraduate and TAFE science courses of study.

The conference is for young adults who have shown an interest and demonstrated higher levels of attainment in year 11 2A/B Science subjects.

To avoid disruption to school routine and minimising impact on learning programs for students and teachers and in consultation with Principals the conference takes place week 8 of term IV. It is believed that all year 11 examinations are completed by this time and students will have drawn to a close their programs of study. This period in the school calendar further permits teacher involvement and support and teachers interested in participating are encouraged to contact the KIEP Real World Science Coordinator.

This is a cost free event sponsored by KIEP. This event is recognised as an end of year reward for students who have demonstrated continued effort and interest in COS 2A/B science programs of study and supports awareness raising with regard to career avenues in science and applied technology.

Schools are invited to nominate up to **four** of their top students for participation in the conference. Sixty placements are available. See below for an overview of the RWSC 2009.

Day 1, 3rd December 2009

Time	Location	Activity	Notes
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8:30	Murdoch University Rockingham, lecture theatre 4 (LT4)	Welcome	Register and introduction. Making new collaborations and recognising the need for quality science and engineering citizens.
8:45	LT4	Sci Tech presentation – “Beyond the Beaker”	Interactive activity with SciTech specialists considering science based career avenues.
9:55	LT3	STAR presentation	
11:15	On the lawn	Morning tea	
11:30 12:00	University Car Park TiWest	Boarding a bus to go on Coordinated industry tours TiWest Coogee Chemicals Joint Venture. Tracking the extraction, purification and preparation for customer of Titanium Dioxide. Experiencing the scientific process in action.	Industry tours are used to connect and make relevant, school science with applied science and technology. TiWest provides insight to extractive metallurgy and pathways leading to the production of a quality Australian product that has many applications in society.
1:30	TiWest	LUNCH	
2:00 – 3:30	Board bus to go to Kwinana Water Reclamation Plant.	Guided tour of Kwinana Water Reclamation Plant. Do you really know what osmosis means? How can osmosis be of value in our water-desperate environment? What current technologies are in place to help solve water shortage problems in WA??	An opportunity to see firsthand how osmosis can be manipulated to solve a global water resource problem.
3:30	On the bus	Return to Murdoch University Rockingham. Evaluation/questionnaire completion about the day- Feed-back time.	Delegates will be asked to complete a brief questionnaire as an evaluation of the day. Student opinion is much appreciated.
4:00	Finish for the day		

Day 2, 4TH. December 2009

Time	Location	Activity	Notes
8:45	Murdoch University Rockingham, LT 1	Welcome and general business	
9:00	Murdoch uni. PD Centre, Rm 3.018	Key note speaker: Dr. Delia Nelson, Curtin University, “Immunology and cancer research”	This is a real opportunity to come into contact with a scientist working at the “rock-

			face” of science discovery. Research in this field demands good knowledge and skills in biology, chemistry and physics.
10:30	Out on the lawn at MU	Morning Tea	
11:00	Challenger TAFE, SCIENCE DEPARTMENT LABORATORIES	Open ended laboratory investigations. <ol style="list-style-type: none"> 1. What factors affect the mass of a potato crop? 2. Investigating electric circuits to solve an energy problem. 3. Gel electrophoresis- using potential difference as a means of separation and analysis of complex mixtures. 	Working in research team’s delegates discusses, identify variables, plan and carry out an experiment to investigate and agreed research question.
1:00	Out on the lawn at MU	Lunch	
1:30	Murdoch University, engineering building, level 3, Rm. 3.017	Either: a) Working collaboratively to solve a team challenge. Or: b) A presentation on using Wave energy to generate electricity and extract fresh water from the ocean.(To be confirmed).	Whether you have a bias toward physical or biological sciences there is an expectation from science based industries of collaborative team work.
3:00	Murdoch University, engineering building, level 3, Rm. 3.017	Award ceremony, issue of certificates of participation, commemorative medallion and Real World Science gift. Plenary session to reflect.	Please take the time to consider how if at all this event for year 11 science students might be improved to enhance the quality of participation next year. Completion of a questionnaire will provide valuable feedback regarding the development of Real World Science Conference 2009!!!
3:30	Murdoch University, engineering building, level 3, Rm. 3.017	Close of conference.	

Applied Science and Technology in Industry. Mapping Science and Technology Concepts in Industry.

In the Rockingham and Kwinana district educators are struggling with issues of student engagement and early school leaving. Youth unemployment is approaching 12%. This is somewhat surprising given that the community is located within a resource rich region with a strong economic base and unique maritime heritage. Rockingham is a focal point of a prosperous and expanding urban region. Tourism, agriculture, fishing, mining, petro-chemical production, steel fabrication and a vast collection of manufacturing and service industries contribute to wide community developments. New technologies continue to bring demand of knowledge and skills and yet while the numbers of students enrolling into higher education is increasing the number entering science programs of study is disproportionately lower. The phenomenon of high achieving physical science students in year 11 and 12 who elect to pursue non science post school programs of study adds further concern to meeting the demands of industry and the community as a whole.

Contextualizing science and acknowledging the values of place based pedagogy may enhance a shift in student perspectives of science based career avenues. Building teacher capacity in terms of knowledge and understanding also contributes to effective classroom learning. Student voice would indicate a desire for a science curriculum that is relevant to their current and future lives and that the most influential factor with regard to their own learning is the quality, knowledge and expertise of the teacher. The mapping of science and technology concepts in industry endeavors to provide information for teachers and students that bring relevance to upper middle and senior school science programs of study.

Under the wing of Real World Science, KIEP and the proactive support of KIC, local industries have been researched to produce a package that may enhance the classroom learner and support the professional teacher. Focus is toward industry partners of the Kwinana Industries Council. To date packages at varying degrees of development have been frame worked around ALCOA, TiWest Joint Venture, Nufarm, Wesfarmers LPG, Kwinana Water Reclamation and Perth Seawater Desalination Plant. The next stage of development demands collaboration with industry partners to agree the final content of the mapped industry areas. The plan is for each industry mapping package to include a user friendly poster and CD.

It is believed that each CD has the potential to be used in many different ways including:

To provide support during the teaching of a unit with students accessing the CD in class time, during library periods or at home.

To provide resources for teachers.

Given the demand for accurate research of science information and the challenge of managing effective collaborations with industry partners, it is unlikely that this valuable classroom tool will be fully ready by the start of academic year 2010.

Real World Science Teacher Industry Tours.

During the course of the academic year Real World Science, under the umbrella of KIEP and within the vision of SEATA to build the capacity of teachers and enhance student engagement in science provides a series of local industry tours for local science and applied technology teachers.

Tours during 2009 included :

Semester I

Tour 1: Rockingham Water Reclamation Plant.

Tour 2: Ti West Joint Venture, Coogee chemical chlor-alkali plant and the West Australian Maritime Training Centre.

Semester II

Tour 3 : Nufarm, Wesfarmers.

Tour 4 : Rottnest Island Tour.

Participants in these tours have opportunity to meet scientists in the workplace, gain enhanced awareness of connections to syllabi, have opportunity to meet other like minded teachers for discussion and collaborations and lend potential to the development of a community of local science teachers prepared to help and support each other through periods of curricular challenges.

Student career avenues are highlighted contributing further to the teachers' knowledge base.

Through informal discussions and responses to questionnaires teachers have indicated a high value of these tours with regard to relevance to their programs and positive support of the development of effective pedagogy.



Teacher Industry Placements - Back to industry opportunities.

In conjunction with discussions with Principals, teachers, School Dean of Education (Murdoch) and local primary industry providers an innovative initiative to the professional development of science teachers is available.

Research of student perspectives of factors affecting good learning indicates that the knowledgeable teacher has highest priority. Student comments further connect the importance of the current and future meaningfulness and relevance of science programs to their interest, motivation and engagement in science learning.

KIEP and Real World Science are well positioned to broker with industry, higher education and local high schools the facilitation of three day teacher placements in industry.

Teachers who would like to know more about the applications of science in the real world are to be contacted and invited to consider an Industry Placement.

Participation in this activity will:

- Enhance teacher knowledge of applied sciences.
- Provide opportunity to contextualize syllabi to real world science locations and applications.
- Engage with scientists in industry to promote an enhanced shift in awareness of current and future career avenues for science students.

For teachers interested in post graduate qualifications the completion of a report of their experience and identification and provision of classroom applications will provide assessable evidence for recognition of prior learning that can contribute to a Post Graduate Certificate of Education or Masters of Education Degree at Murdoch University.



School Liaison Activities

Some local high schools have pursued a management decision to employ primary trained teachers. The skills of these professionals are seen as vital in meeting the needs of students who demonstrate learning difficulties. Using effective primary school pedagogies efforts are made to raise communication and number literacy's.

Scientific literacy is acknowledged as necessary for young people to make valid contributions to living in society, and contribute their current and future lives as a whole.

Comments from primary trained teachers in this arena, through questionnaires and informal interviews highlight a need for relevant professional development that enhances knowledge, interest and confidence of delivery of science issues.

Real World Science, KIEP, offers support to schools willing to engage in partnership to research, design and produce real world science programs that reflect effective pedagogy and are transferable to other learning situations and/or schools.



Science and Small business enterprise

Aquaponics, whilst demonstrating potential for real world science in the classroom also supports a model of effective pedagogy across the curriculum. Liaison with “Backyard Aquaponics” and Naragebup Environment centre provide promise for local schools to access knowledge and support in the form of advice and Teacher P.D. The concept was presented to the Principals who indicated agreement to forward the idea to science departments. It provides potential for effectively supporting small business enterprise that enhances science learning and highlights career avenues with regard to business and administration, food production and environmental issues.