



GRID Project Case Study:

'Science 4 U'

St Joseph's Specialist Science School,
Bradford, West Yorkshire, UK

I School Context

a. Introduction

St. Joseph's Catholic College is a Voluntary Aided 11-18 Comprehensive School for girls. Founded in 1908 by the Sisters of the Order of the Cross and Passion the College looks forward to Centenary celebrations in 2008. These will mark the achievements of thousands of women who have benefited from a well rounded and challenging educational experience founded on Gospel values.



b. School Policy

The staff, governors and girls work very hard to further enhance their already good reputation. The legacy the school has inherited, and continues to seek to provide, is a first class education that enables each girl to fulfil her potential, to gain a sense of achievement, and to acquire the confidence to take up her place in the world with enthusiasm. In September 2001 the College was awarded Beacon School status by the DfES an initiative is designed to raise standards through the dissemination of good practice¹.

II Context of the Pedagogical Project

a. Description of the Whole Plan

In the UK, students generally undertake a week of work experience in their 4th year of secondary education. Some schools, like St Joseph's College, have developed these further into enriching activities.

At St Joseph's, girls have always been encouraged to reach their full potential and success in the Sciences has always been a strength. However, in the very recent years numbers at Advanced level have started to decrease. This of course was a national trend, science was perceived as "too hard". The College was making an application to become a Specialist Science College and the project Science 4U played a part in the bid. In 2004, the college was awarded specialist science status - and has resulted in

¹ More information about the Beacon Schools initiative available on the DfES website:
<http://www.dfes.gov.uk/beacon/>

enhanced facilities for students and staff, some excellent work with our wider community and the continued development of the Science 4 U programme.

SETNET, the 'Science Engineering and Technology network' assisted the school with the initial start up of this project through the West Yorkshire regional SetPoint. They provided the vital links with the University and industry through the Science and Engineering Ambassador Scheme. They also gave the college initial funding to begin developing the Science 4 U programme. The project has since become self-sustainable and the costs are now reduced as the links and systems are in place. There are still costs for staffing, catering and travel. These have been funded via the Specialist Schools funding.

b. Learning Process

The learning objectives of the Science 4 U programme:

- To begin to understand how an aspect of science is used in industry.
- To develop core skills such as problem solving, team working, organisation and communications skills through group work.
- Understand an aspect of science/maths through practical project work.
- Become more familiarised with the work environment as a whole.
- Develop ICT skills through Powerpoint.

c. Curriculum Links

For many years, work-experience placements have formed a part of the British national curriculum. In 2004, a new statutory requirement for work-related learning was introduced. Schools have to provide planned activities that use the context of work to develop knowledge, skills and understanding useful in work, including learning through the experience of work, learning about work and working practices, and learning the skills for work.

Science 4 U also makes links with the subject curricula – the subject matter depends entirely on the company who has devised it. In this particular case study, students have to conduct scientific experiments and work with mathematical formulas as part of their industrial projects.

III Concrete Case Study

a. Introduction

Identification	
<i>Establishment:</i>	St Josephs Catholic College, Yorkshire Water and United Utilities, University of Bradford
<i>Teacher's name:</i>	Elaine Barker, Assistant Head Teacher
<i>Subject:</i>	Science 4 U

Context	
<i>Class: level</i>	Year 10 students (age 14-15)
<i>Number of pupils</i>	20 Students
<i>Date/Hour</i>	5th – 9th June
<i>Duration of the observation (when applicable)</i>	At various times throughout the week
Learning/teaching objective	
<i>Summary description</i>	<p>Science 4 U is an isolated work related project that runs on an annual basis in just one school. The event involves 2 days in Industry and two days in Higher Education with a strong emphasis on Problem Solving and Skills acquisition. The event involves approximately 20 female students to raise awareness of STEM related careers for women and to give students an opportunity to work on a real world problem in an industrial environment. The event involves 2 major local utility companies: Yorkshire Water and United Utilities (formerly Transco). Students are split into groups of 5 and spend 2 days in industry at one of the partner companies. The 2 groups at Yorkshire Water have to design mixing systems for dead zones in reservoirs. The 2 groups at Transco have to design and work out the parameters for a 99% fail safe mechanism for a gas holder. The students then spend a day each at Bradford University visiting Science Departments, finding out about the research that was going on, solving some scientific problems and discovering the opportunities at degree level and in Science based careers. All students then spend the 4th day at the University learning how to produce high quality PowerPoint Presentations. On the final day the groups give presentations in a lecture theatre at the University of Bradford. The audience includes their parents, teachers, and governors, friends from industry, Setpoint staff and University staff. The focus of this innovation is to encourage girls to have the confidence and recognize their ability to pursue Science subjects at Advanced level.</p>
Description of the sequence	
<i>Intentions of the teacher</i>	<p>The event has been designed for girls aged 15 with an aim to change perception of science and related careers. By using industry contacts and female role models the event gives students an opportunity to take a break from the usual school classroom and</p>

	<p>take part in solving real-world problems in an industrial context. The event is also a confidence building activity, at the end of the event girls present their experiences and work to an audience of parents, members of industry and higher education.</p>
<p><i>Description of the activity stage</i></p>	<p>Day 1 – Monday 5th June</p> <p>Group 1 – Yorkshire Water</p> <p>09.00 - Arrival and Introductions 09.30 - Yorkshire Water Company Overview 10.35 - Clean Water R&D Team and Function 11.05 - New R&D Engineer in Clean water Team 11.15 – Introduction to Project 13.15 - Travel to Headingley Water Treatment Works for Site Visit</p> <p>Group 2 – United Utilities</p> <p>09.00 Introductions 09.30:</p> <ul style="list-style-type: none"> • Introduction to the company • Brief overview of pressure regimes / LGI's in view of site visit • Detail of opportunities available to female engineers • Site induction i.e. safety videos etc <p>11.05 - Interactive Session on Holders 12.30 - Visit to 2 sites at Tong and East Bierley 15.00 - Introduction to the revolutions problem</p> <p>Day 2 - Tuesday 6th June</p> <p>Group 1 – Yorkshire Water</p> <p>09.00 - Water Aid Presentation 10.00 - Group Brainstorming for your project 10.45 - Control Room Visit 13.00 - Brainstorming continues 14.15 - Progress Meeting Ideas from Group-A 15.00 - Progress Meeting Ideas from Group-B 15.30 - Who wants to be a Millionaire</p> <p>Group 2 – United Utilities</p> <p>09.15 - Site visit to Birkshall Holder station 13.00 - Revolutions Problem 14.30 - Look at results and work through solution 15.15 - Conclusions and Quiz</p> <p>Day 3 – Wed 7th June</p>

	<p>Bradford University (am)</p> <p>09.45 - Courses and Careers Talk 10.30 - “Just what are we up to here” A Research Presentation by the staff of the University 11.30 - Campus Tour</p> <p>School (pm)</p> <p>GROUPS from Yorkshire Water will be based in school for the afternoon where they will work on their projects in the Science laboratory. GROUPS from United Utilities will be based in school with a teacher of Mathematics who will supervise their project work.</p> <p>Day 4 – Thu 8th June</p> <p>Bradford University</p> <p>9.30 – 15.00 – Preparing Presentations</p> <p>Day 5 – Fri 9th June</p> <p>Bradford University (pm)</p> <p>14.15 - Final Rehearsals 16.00 – Guests Arrive 16.30 - Final Presentations</p>
<p><i>Pupils’ output</i></p>	<p>Pupil output depends on which company the girls have visited during the event. The Yorkshire Water group will come up with a solution to dead water zones, and the United Utility groups will work on the design and parameters for a 99% fail safe mechanism for a gas holder. After the two industry days, students will collect their results and experiences (along with some video diaries) into a presentation for parents and members of the companies involved.</p>

Intentions of the Person in Charge

Elaine Barker, assistant head teacher at St Joseph's College has created Science 4 U to give girls confidence to study sciences at advanced level – altering the perception that science 'is too difficult' for them. The week long event is designed to give the students an opportunity to take part in some quality work related learning. The girls will meet female scientists to act as role models. They have a chance to work on a real-life science problem in order to understand the way scientific skills are used in industry. It is hoped that this experience will help build the students confidence and that they will continue to study sciences at advanced level.

Scenario

The first two days take place in industry – generally at the host companies' offices. The companies involved arrange talks and activities suitable for the students – this can vary from year to year. In the case of United Utilities and Yorkshire Water, both companies took the students on site visits. The students return to school to conduct their experiments in the laboratories. The majority of 3 days are spent at their local universities. They have a chance to listen to talks about courses and research, meet tutors and have a tour of the university campus. They spend a day in the computer labs creating their presentations. Finally, they present their work in a university lecture theatre to a group of industry guests and parents.

b. Real Progression of the Session

Phase 1 – Introductions

When the students arrive they first spend some time learning about the company they are visiting. Students are based either at Yorkshire Water or United Utilities, two local utility companies. Then the students meet different members of staff and learn about the companies research and development and what the jobs involve. They are introduced to female role models who work in as scientists and engineers. Teachers and staff encourage students to ask questions during the day – to make sure they find out what they want to know.



Meeting Research and Development Staff - Yorkshire Water

Phase 2 – Site Visits

In the afternoon, both groups go on site visits. The Yorkshire water group visit a treatment works to begin to understand how the water is processed and cleaned. This allows them to visualise much of what they have learned during the morning's presentations.

The Headingley site is also an education centre – providing informative resources concerning water.



Headingley Water Treatment Works



United Utilities Gas Sites

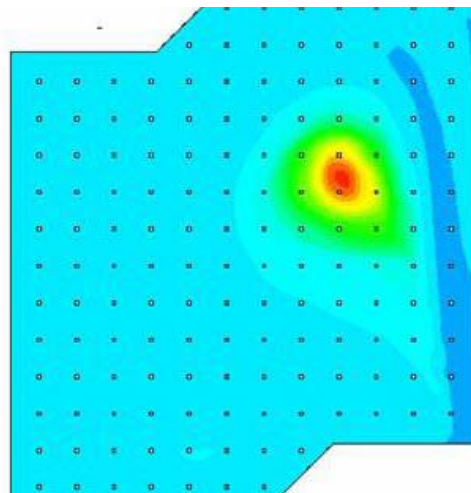
The United Utilities group go on a different site visit to learn about the distribution of gas. Here they learn about the 4 main parts of a pipe: valves, regulator, filters and the 'slam shut'. These are important features need to compress gas safely.

Phase 3 – Introduction to the Problem

Each of the groups are given a problem to solve depending on the company they are visiting.

Yorkshire Water Problem

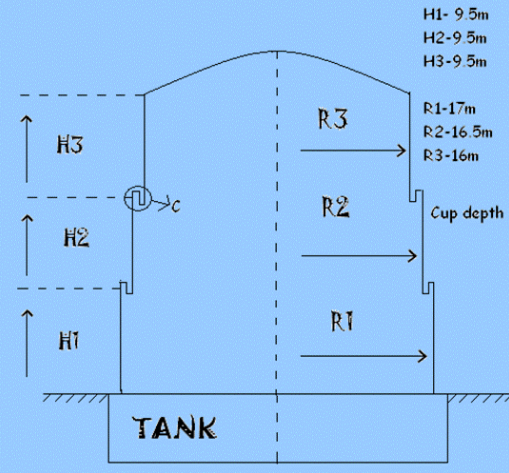
The project given to students concerns service reservoirs (SRE). This is where the water resides for up to 4 days before it is delivered to the public. Currently there is an issue with the movement of the water in these reservoirs leaving stagnant water in certain areas of the tank. The students have to design a mechanism that will ensure an even mix of chlorine and avoid dead spots of stagnant water like in the image below:



United Utilities Problem

In this group, the problem given a maths related project concerned gas holders:

The problem.....



The diagram shows a cross-section of a gas holder tank. The tank has a flat base labeled 'TANK' and a curved top. The height is divided into three sections: H1 (9.5m), H2 (9.5m), and H3 (9.5m). The radius at different levels is labeled R1 (17m), R2 (16.5m), and R3 (16m). A cup depth (C) of 0.6m is indicated. A valve is shown on the left side of the tank.

We had to work out how long the actuator had before the gas leaked out, using the diagram opposite.

Slide from student presentation



Phase 4 – Brainstorming

In the brainstorming sessions students work in their groups and discuss solutions to the problem they have been given. Using flipcharts they discuss the materials, shapes and sizes and how these would be implemented. They also have to consider the cost and feasibility of each design. Ambassadors from the company are available to support but are in no way intrusive. They are there to answer questions and assist the students whilst ensuring they remain on track with their ideas. Students take responsibility for their own work, they are left to develop their own ideas and form their own conclusions.

Phase 5 - Experiments

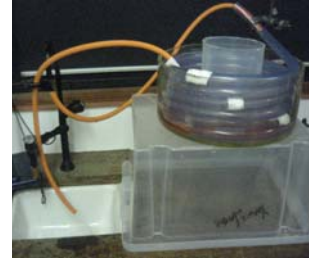
The students return to school along with their designs from the previous session. Here they organise and conduct experiments in the laboratories to help them find the optimum solution to their problem. The Yorkshire Water groups return to the science laboratory. They try out 3 designs with running water and video their results with help from a teacher. Dye is added to observe the flow of water:



Experiment 3
Empty Tank



Experiment 2
Sectioned Tank



Experiment 3
Circular Tank "The Spring"

Phase 6 – Preparing for Presentations

Students visit the university labs to prepare their presentations. Tutors are available to assist them with technical issues. Within their groups, students brainstorm their ideas and build a structure for their presentations. Images/video are included to illustrate their ideas.



Phase 7 – Final Presentations

After completing their presentations in school on the Friday morning, the girls return to the University of Bradford for the afternoon. They have been allocated one of the largest lecture theatres in the university – nerves begin to set in for the students – as it is the first time they will be speaking in such a room. At first they practice their presentations in turn – they get used to talking to the audience of fellow students. The guests arrive at 4.00pm, after introductions

c. Open Conclusion

All students have been actively involved throughout the week long initiative with great enthusiasm. All groups completed their experiments and presented their experiences and solutions to a group of parents, teachers and company representatives. The students' presentations revealed that they had thoroughly enjoyed the experience with some considering a scientific career for the future.

Achieved Objectives

The main objectives of this initiative have been achieved. This is shown by:

- The student's active involvement during the whole event.
- Diagrams and illustrations created by the students whilst brainstorming ideas.
- Presentation delivered to parents at the end of the week recording their experiences and solutions to the science problem.

Students have greater confidence when meeting people outside of school and a much better understanding of the way science is used in the world of work. A real 'can do' mentality has been developed. Students demonstrated great pride and satisfaction with their presentations. In previous years, Science 4U has made a positive impact on the number of students taking Science subjects at Advanced level, class sizes have more than doubled in Physics, Chemistry, Mathematics.

Added Value

This initiative gives students an opportunity to take part in some quality work related learning that is not usually possible during work experience placements. It is extremely structured and allows the students to work in a team on a real-life industrial problem. Students apply knowledge already gained from secondary school science and maths, but in a real-life scenario. The great emphasis on teamwork and cooperation allows the students to really develop confidence and communication skills. The girls involved have gained greater awareness of scientific careers available to women having met female scientists during the visit.

Obstacles

One of the obstacles is the amount of organisation involved. A member of staff must liaise with the companies before the event. The students are out of classes for a week so this could also be perceived as an obstacle for them. A member of staff has to accompany the students at all time, appropriate cover has to be made back at school. The project organisers are looking to expand into other subject areas, however, finding other companies for the school to work with is proving to be a challenge.

Transferability

This project is relatively easy to transfer, and can be applied to a variety of different scenarios and activities. It relies on a good relationship with a local company who is willing to prepare and host different talks and activities suitable for young students. They must also be willing to introducing staff members who can act as role models for the students involved.



Future Developments

After 3 successful years, the project is looking to expand into other disciplines, such as the arts and humanities. The project organiser is currently looking contacts with for relevant companies and college/university departments to become involved with.