

2006 Showcase Awards for Excellence in Schools Submission Form

Title of submission: ***Fast-track to a Science Future***

School/s: **Cavendish Road State High School**

District: **Brisbane South**

Region: *Greater Brisbane*

Key Contact Person:

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Please nominate (✓ or x) the Showcase category your project is to be entered into.
(See section 1.2 of the guidelines for more information.)

| | |
|-------------------------------------|---|
| <input type="checkbox"/> | Showcase Award for Excellence in the Early Phase of Learning |
| <input type="checkbox"/> | Showcase Award for Excellence in the Middle Phase of Learning |
| <input type="checkbox"/> | Showcase Award for Excellence in the Senior Phase of Learning |
| <input type="checkbox"/> | Showcase Award for Excellence in Inclusive Education |
| <input type="checkbox"/> | Showcase Award for Excellence in Leadership |
| <input checked="" type="checkbox"/> | Showcase Award for Excellence in Innovation |
| <input type="checkbox"/> | Showcase Award in Academic Excellence |
| <input type="checkbox"/> | Showcase Award for Industry or Community Partnerships |

OPTIONAL multimedia items:

Multimedia items are not required electronically. A maximum of TWO items are to be supplied on ONE compact disc with the hard copy.

If included, please nominate (✓) the file type

PowerPoint presentation

Media Player file

N.B. Multimedia items are not required electronically. A maximum of TWO items are to be supplied on ONE compact disc with the hard copy.

Signature/s of principal/s

Cavendish Road SHS

Date

I support this submission and its entry in the Showcase Awards for Excellence in Schools 2006. This submission meets the requirements set out in the Executive Director's Checklist.

Signature of Executive Director (Schools)

Date

Other documentation:

Signed supporting statement from the principal.

Signed supporting statement from the Parents and Citizens' association.

APPENDIX A: Brisbane Academy of Science results - Year 11 and 12 students studying University subjects

APPENDIX B: Year 12 results and School Opinion Surveys.

APPENDIX C: Typical Comments from Academy Students.

APPENDIX D: Primary Teacher Survey Results and Comments.

APPENDIX E: Sample Middle School Assessment Tasks

APPENDIX F: Statement by 2006 Year 12 Academy Students.

Personnel involved in the project :

| NAMES | ROLES |
|-----------------|--|
| Judith Felton | HOD Science, establish GU links, organise camps, arrange guest visitors, primary school survey, arrange science PD, establish primary school contacts, rewrite Chemistry work program to embed GU module, rewrite Junior electives, rework Chemistry trial pilot |
| Stacey Hunter | Teacher, Biotechnology expert, establish GU links, designed biotech pracs, contact with industries, arrange visits to GU, arrange guest lecturers, work with primary teachers as mentor, organise Learning Place project room |
| Bob Logan | HOD Curriculum, established QUT partnership for Human Movement and Biomechanics, pedagogy support and PD |
| Nathan Maddox | Teacher, assist with camps, designed Academy test for year 8 selection, rewrite Junior electives, assist with Biology work program |
| Margie Bland | Teacher, Science week activities, rewrite several Junior electives |
| Annetta Cayas | Teacher, work with primary schools, run Science Club |
| Joanne Campbell | Teacher, links with GU for Chemistry, rewrite Junior electives |
| Rhonda Barker | Teacher, rewrite Junior electives, coordinate new Biology work program |
| Dr Peter Darben | Teacher, Science21 coordinator, Junior Electives, run Science Club |
| Chinh Nguyen | Teacher, Design robotics program for year 10 |
| Ashley Dickson | Teacher, Science week coordinator, designed modified year 9 program |
| Michael Denner | Teacher, rework trial-pilot Physics program |
| Dr Ross Bowles | Teacher, QBEN contact, Industry contacts |
| Shaun Thayer | Primary school coordinator 2006 |

Submission overview:

Cavendish Road State High School (CRSHS) has achieved so well in its quest to raise the focus of science study at their school that they are now branded in the community as a school of excellence in science and in human movements. This reputation is reflected in the statistics showing up to 48% of 2005 year 8 enrolments saw this as 'science school'. Several years before the State Government released its Spotlight on Science agenda, Cavendish Road SHS began to develop a specialisation in science education to complement its existing Sporting Excellence programs.

To step up its science capabilities, the school facilitated professional development opportunities for teachers, established partnerships with primary schools and universities and reworked the science curriculum.

The school also chose to specialise in Biotechnology and Biomechanics because of their importance and potential growth in the Queensland economy. Educational outcomes for Year 12 students with their eyes on a scientific future include credit points towards a Science degree at Griffith University or an Applied Science degree at QUT.

Description:

In 2000 the need for differentiation was identified by the school community, and through the Secondary School Renewal Program, Science became a key focus area.

The **objectives** of the program were:

- Construct a science curriculum that would encourage the active involvement of students in their own learning.
- Establish links/clusters with feeder primary schools to share resources and enthuse students in Science, particularly in the middle years of schooling.
- Secure professional partnerships with tertiary institutions to design an exciting and challenging curriculum.
- Specialise in particular sciences. Biotechnology and Biomechanics were chosen as two specialist areas because of their importance and potential growth in the Queensland economy and the Smart State agenda.
- Provide and encourage career pathways for students in science.
- Develop a distinctive school brand within the marketplace, which revolved around reinvigorating science education.

To develop this sustainable school improvement the following key **action steps** have been implemented:

1. **Equipment appropriate to Biotechnology and Biomechanics** was purchased as part of the Secondary School Renewal Program and included a force plate, peak-motus software, light gates, PCR, gel electrophoresis, centrifuges, as well as a wide range a data logging devices. Staff with expertise in the two areas were employed 2001/2002.
2. **Partnerships were established with Griffith University (GU) and Queensland University of Technology (QUT)** to enable capable students to gain accreditation for university modules embedded into our Senior curriculum. With GU students can gain credit towards a Bachelor of Biotechnology or Bachelor of Bio-molecular Science degree. With QUT the credit is towards a Bachelor of Applied Science (Human Movement Studies) degree. The partnership with GU is the first of its kind between Griffith University and a high school.
3. The **Brisbane Academy of Science (BAS)** was established to provide accelerated pathways for academically talented students in Years 8, 9 and 10. A process is in place to identify talented students. Since 2002, students apply for entry to the BAS and sit an entrance exam at the start of year 8. These students not only cover core work but are accelerated with individual research tasks that promote higher order thinking skills and self-directed learning. Examples of student work include topics such as forces on helicopters during flight, the chemistry behind fireworks and the technology of gene transfer.
4. Students are prepared in their studies to commence Year 11 Biology in Semester 2 of Year 10. To assist students in this first unit of Biology on Classification, a 3 day **Science camp** has been designed where students work both in the field and in the laboratory with scientists at the Moreton Bay Research Station. A similar camp for year 9 Academy students has been

designed to provide cross-curricula educational activities as well as opportunities for group bonding.

5. Senior Academy students have **regular contact with the relevant university** by attending lectures, using University library facilities, performing practicals in their laboratories and having lecturers attend our class sessions.
6. In 2002 **partnerships** were established with 3 local feeder **primary schools** for the sharing of science resources and to attract talented science students to CRSHS. Currently we work with 10 local primary schools in a variety of ways:-
 - a) A **Science club** runs Wednesday afternoons in our facilities for 50-60 of the most talented year 6 students from these schools. This has already doubled since its inception in 2004.
 - b) **Loan of equipment** as needed (eg microscopes, human model kits etc). In 2005 an ICT grant has enabled sharing of data logging sensors such as heart rate and lung capacity monitors as part of a Sport Science unit, "Healthy Lifestyle through Science and Technology". This ICT grant is allowing Science, PE and Home Economics to integrate and influence students diet and exercise patterns.
 - c) Teacher assistance with implementing the P-10 Science syllabus, especially the concept of **working scientifically through inquiry learning**. Our staff and students make frequent visits to primary schools to conduct science activities. Primary classes also visit our facilities for an afternoon of Science activities. We have allocated teacher release for one staff member to act as mentor to primary teachers as required. This latter strategy is successful in contributing to a Primary school's progress with the science curriculum it is developing.
 - d) **Science Week Challenge and Science Fair**. In 2004 CRSHS introduced a Year 6 Science Challenge at which 30 teams of 4 students each competed. Due to high demand, this will be expanded to 40 teams in 2005 and included a Science Fair where primary students entered results of their investigation projects for awards and recognition.
 - e) A **Learning Place project room** was established 2004 for year 7 students to ask questions regarding transitioning to high school. CRSHS students from Years 8, 9 and 10 (in either the Science or Sport excellence programs) provided the answers. We have assisted in setting up a similar project room for Sport Week (May 2005) to tie in with our Healthy Lifestyle unit.
7. Since 2002 our **middle school work program** has been revamped to provide students with a range of subject options and to promote scientific enquiry. Pathways are available to students with differing interests, for example, students can choose electives such as Robotics, Forensic Science, Sports Science, Marine Science, Earth and Beyond and Health and Diseases. Our Academy students specialise in Biotechnology and Biology. However, Biotechnology units and practicals are embedded in many of the electives mentioned above and will be major contexts for our new Senior work programs for Biology, Chemistry and Science 21. The accompanying Power-point presentation illustrates the range and variety of hands-on tasks our students experience. A list of typical assessment topics is provided in Appendix D.
8. **Staff members** have enrolled in **further studies** or are members of groups such as Bright Minds, at their own cost and time, in order to keep abreast of their fields and to develop experiments/activities suitable for our electives as well as for primary school visits. Staff have made great efforts to incorporate the new equipment and technology into work units, namely data loggers, video and digital cameras, electrophoresis, PCR and genetic transformation, as well as various computer software.
9. In an effort to **expand students' understanding** and awareness of Science and current issues:
 - a. Students are encouraged, and assisted, to **enter competitions** (eg Genetics, Brian Bee, Engineering Challenge) or attend Science camps (Siemens, UQ Engineering), lectures and forums (eg Frontiers in Science, Biofutures, National Youth Science Forum) or act in capacity of UQ Science Ambassadors.

- b. Numerous **guest speakers** are invited to highlight interesting developments and possible careers in the fields of Biotechnology, Forensics, Marine Science, Electronics, Industrial Chemistry etc. These speakers come from universities, research organisations as well as industry.
 - c. 2 **new initiatives** were commenced in 2005. CRSHS has registered as a Reef Guardian school to provide opportunities for students to understand their environmental impact on the health of ocean environments. Further, year 8 and 9 students are encouraged to participate in CSIRO's CREST awards as a means of developing investigative skills in topics of their own choice.
10. Having revamped the Junior curriculum with a focus on 'real-life' contexts through inquiry learning, the school committed in 2004 to being a **trial pilot school for the new Senior Chemistry, Physics and Science²¹**. These syllabi complement our Junior curriculum in that they all place a high emphasise on the 'real world' significance of science and on independent student investigations and research.
 11. There has been a whole school approach to pedagogy change. All teaching staff have been involved in a **Dimensions of Learning PD program** over 2004 and 2005. This ensures cross-curricula dialogue and planning as well as provides a supportive network for implementing inquiry based methods.

Connection to QSE – 2010, Destination 2010 and/or Education and Training Reforms for the Future:

- Distinctive school: Through developing innovative curriculum and marketing programs our school has been successfully branded as a school of excellence in science and human movements. This claim is reflected in the statistics showing up to 48% of the 2005 year 8 enrolments see this as 'science school' compared with 2% in 2000.
- Community partnerships: Our School is now the secondary school hub of a science and human movements precinct which includes Griffith University, Queensland University of Technology and 10 feeder primary schools. This has built new science curriculum and opportunities for students and teachers.
- New pathways: Students can now leave year 12 with credit towards a Science Degree at GU or Applied Science at QUT. This is without HECS fees. The school subjects approved by both QSA and the universities provide new pathways.
- Equity and new learning opportunities: New learning opportunities exist for all our students in a revitalised middle school Science program. Hands-on tasks in topical and relevant electives are inclusive of all learning styles and capabilities
- Science for life (Spotlight on Science agenda): This project raises the base level of science education for all students and enhances the education and science experience of outstanding students who will become the next generation of scientists. A richer science experience is provided to students by offering a range of out-of-class activities in industry and universities.

Outcomes and Evidence:

1. This project has produced a **major change** in the way our school is viewed by the community. Through developing innovative curriculum and marketing programs, the school has been successfully branded as a school of excellence in science by the community. This claim is reflected in the statistics that 48% of the 2005 Year 8 enrolments see this as a 'science school' compared with 2% in 2000.
2. Data to date shows an **increased enrolment** of talented science students plus an overwhelming growth in school enrolment (750-1230 in 5 years) as the school's standing in the community continues to grow and as the science strand captures community interest.
3. In 2003, CRSHS was recognized by a **National Quality Schooling Award** for its efforts in establishing the BAS, in 2004 by a **Peter Doherty award** for success in Science

- education and in 2005 we were awarded the status of **Specialised School of Science** in the areas of Biotechnology and Biomechanics.
4. In 2003, 11 students received **GU accreditation** for one Biology subject. In 2005, this has grown to 16 students receiving Biology credit, 4 receiving credit for first year University Chemistry and 12 students gaining credit for their QUT Human Movement Studies. Of the students exiting the Academy in 2005, 68% have moved into Science related courses at University. Appendix A summarises these Brisbane Academy results.
 5. Our **Senior results in Science and Maths** subjects over the last 3 years have grown strongly and indicate the success of our accelerated programs and improved pedagogy and work programs in general. These are tabulated and graphically presented in Appendix B.
 6. **Interest to be part of our Academy of Science pathway is high.** Currently, we have restricted numbers to 30 in each of the Year 8, 9 and 10 levels. Selection is made on academic merit as well as motivation and attitude. Comments from our current Year 9 Academy students are included in Appendix C to indicate their level of enthusiasm for science.
 7. CRSHS has one of the state's largest Special Education Units (SEU). Many of these students who have a visual impairment or autistic spectrum disorder, are talented in maths/science and they have been **included in our Academy classes**. Since inception, there has been at least one of the SEU students in each of the Junior Academy levels.
 8. The introduction of the Academy and the emphasis on independent projects and intellectual rigour has led to an **increased motivation to learn**. A recent survey of Year 10 and 11 Academy students and parents yielded the following results:
 - 97% of students believe they benefit significantly from being in the program
 - Approx 90% of parents believe their child's level of motivation and interest in school was high due to the Academy programs
 - 98% of students have their sights set on a tertiary pathway and 50% indicating Biotechnology as a career they would like to pursue.
 (Typical comments are included in Appendix C)
 9. Teachers specialising in Biotechnology and Biomechanics were employed 2001/2002. They have been instrumental in training other science staff in use of new equipment and technology and in writing **modules that have been incorporated across our science curriculum**. For example, a detailed, lengthy practical using electrophoresis in order to identify gene patterns and make comparisons and conclusions on genetics issues is now performed by all year 10 science students. Teachers report that all students are engrossed and highly motivated while performing this intricate and very relevant scientific procedure. Student task sheet for this assessment is included in Appendix E.
 10. **Science staff are supportive and enthusiastic about the initiatives** the school is taking in science. This is evidenced by their willingness to attend PD (often in their own time), write new Middle School units and to commit to the extended trial-pilot Chemistry and Physics as well as undertaking to be a Science 21 trial school.
 11. Through our leadership in Science, CRSHS was invited to be a hub school for pre-service teachers under the QUT accelerated entry scholarship scheme. During 2005, we had 4 pre-service teachers fulfilling all of their 16 weeks of maths/science practical teaching at our school.
 12. Benefits of this initiative have flowed to the **whole school community**. Data from School Opinion Surveys over the last 4 years have shown a marked improvement in satisfaction from students, staff and parents. Graphs are presented in Appendix A. In addition, seeing the success of this science initiative, **other curricula areas** within the school are expanding on the established primary school links (notably, German, Music and HPE). In June 2005 a 'Connection Day' was held for year 7 students to experience a range of cross-curricula activities at our school.
 13. Early in 2004 a **survey of local primary school teachers** was conducted, with some 150 responses. Analysis showed 95% would benefit from access to help in preparing work

units /activities for science and 45% indicated a lack of resources to teach science adequately. The graph in Appendix D, showing a break down over the science syllabus strands, reveals that primary teachers are less confident with Chemistry and Physics aspects of science. Having identified the needs of local primary schools, CRSHS attempted to redress the situation by mentoring teachers in developing units of work, by loaning equipment and resources as needed and running PD to up-skill teachers in the various strands of Science. A **recently awarded ASISTM grant** will allow for continued PD and mentoring support within our primary school cluster. Appendix D also contains quotes from primary teachers reflecting on the benefits of our middle school cluster.

14. Interest in our **Science Club for Year 6 students** has doubled since its start in 2004. We now have 50-60 enthusiastic students coming each week from the 10 feeder schools. Comments from participants are included in Appendix D.
15. As a member of the newly formed **Queensland Education Biotechnology Network**, in 2006, we have delivered Biotechnology PD and established a loan scheme for other high schools in our region.
16. Our Middle School focus on Science has allowed for **inclusivity of all students** and their differing interests, learning styles and capabilities. A wide range of guest speakers, excursions, camps, videoconferences as well as a strong emphasis on experimental work is making the learning of science more relevant and meaningful for our students. The development and refinement of units as well as the method of delivery is on-going. For example, one of our latest ventures is the 'Adopta-Shark' program run by Underwater World. Each year, some 90 Marine Science students in Year 10 follow the development of a shark from egg to adolescent (when it is released) over 12-18 months.
17. 2006 has seen the establishment of **industrial partnerships** to provide students with valuable research experience. The labs of Dr Ian Fraser and Dr Philip Teakle will provide a week's research experience for high achieving biology and physics students respectively. In addition, one of our staff had 5 days training at the CRC for Sugar to develop an experimental investigative unit for year 11 Biology. The quality of student work has been of such quality that results are being used in CRC research and the success of this partnership will be reported at CONASTA 2006 in Adelaide.
18. **Benefits from this initiative have also flowed to our local community.** Pathways from primary to tertiary have been established and there has been a significant increase in interest/enquiries regarding science education. Following local media coverage of our programs (for example, a Totally Wild episode on our Sports Science elective), working with primary schools and particularly 'word of mouth' marketing, science has a heightened profile within our network community. Clearly, a long-term benefit to the community will be the provision of well qualified Scientists in the Biotechnology and Genetics areas. This will take several more years to come to fruition.

FUTURE DIRECTIONS

- To strengthen the Science Precinct that exists with the current cluster of primary schools and tertiary institutions involved.
- To increase industry partnerships for sponsorship of Academy resources and programs and the provision of work experience for our students.
- To continue to refine units of work within the Middle School Science Programs.
- As a Reef Guardian school we will focus on environmental awareness in our Middle School. Although a Science Initiative this will be developed through a whole-school approach.
- To seek opportunities to expand our students' insight into Science and the range of careers it can lead to eg additional guest speakers, attending Science and Engineering Challenge at GU, Science Experience at UQ, Environmental camp at North Keppel Island EEC.