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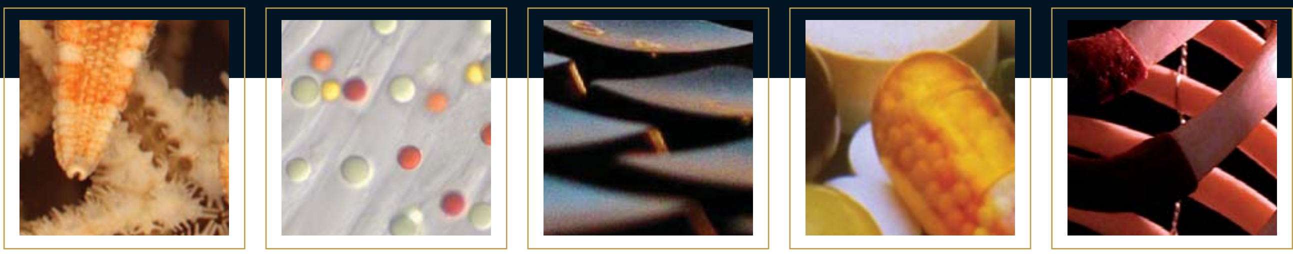
Bachelor of Science Review



Submission to the Academic Board Review Committee for the Bachelor of Science Degree Program from the Faculties of:

- Biological & Chemical Sciences
- Engineering, Physical Sciences & Architecture
- Social & Behavioural Sciences

2006

Abstract

This submission to the Academic Board Review of the UQ Bachelor of Science degree has been jointly prepared by the faculties of Biological & Chemical Science; Engineering, Physical Sciences & Architecture; and Social & Behavioral Sciences. It represents the outcome of discussions that have occurred between the faculties over the last year. In preparing our submission for the Review, we have sought to capture and present advances at the interdisciplinary boundaries whilst ensuring the expression and growth of fundamental knowledge in existing disciplines. To drive the discussions four Working Parties were established: (1) Structure of the BSc; (2) Pedagogy; (3) Student Experience and; (4) Honours and Careers. The Working Parties reported on a regular basis to a Steering Committee that was comprised of Executive Deans, Heads of Schools that teach into the BSc, and staff that have obtained national teaching awards. Members of the above Working Parties and Steering Committee attended a two day Retreat at Caloundra on 8 & 9 June, and a Symposium was held on campus for all staff on 30 & 31 August to have input into the review. In addition, through a range of evaluation tools and personal involvement of students, significant input into the review process was obtained from this key stakeholder group. The review has highlighted the need for the curriculum to be under continual renewal to reflect the most recent pedagogical and scientific advances. The key proposals stemming from our discussions can be summarized as follows:

1. Development of a proposed structure that focuses more on the quantitative and information aspects of science, in which all students are required to take the courses entitled (i) Foundations of Science and (ii) Analysis of Scientific Data and Experiments.
2. A very concerted effort to teach a range of courses in a more interdisciplinary manner, rather than as isolated entities.
3. Strong recognition that mathematics, physics, chemistry and biology are enabling sciences and this is reflected in the expectation that all students who graduate with a UQ BSc will have achieved a level of competence in all of these areas.
4. A dramatic reduction in the number of majors, from around 40 to 14.
5. A significant reduction in the number of first year courses; for example, the number of first year Biology courses has reduced from 6 to 3.
6. Discipline specific streaming to commence much later than at present, in the second semester of second year.
7. A significant reduction in the number of second and third year courses offered, which should enable students to plan their program of study in a more rational manner and simplify student advising.
8. Creation of proposals for undergraduate research experiences, which assist in embedding the students into the research community and will reduce alienation of students early on in their studies.
9. A major focus on teaching excellence, pedagogical advances and the science of learning, especially on how these areas can assist us to deliver a high-quality educational program.
10. Special attention placed on the student experience, with a number of significant recommendations on how this can be improved, particularly in terms of delivering an enhanced cohort experience and student-staff interactions.
11. Submission of a $22 million grant proposal for a Science Teachers Center to Atlantic Philanthropies, which will help the University promote the importance of science to the primary, middle and secondary school sectors. It will also ensure that our undergraduate teaching practice is evidence based and provide a forum for industry and government to have input into and ownership of our BSc degree.
12. Tabling of a submission for an undergraduate research learning space to significantly enhance the quality of the learning environment for science students which reflects current research and practice into how students learn.

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List of Supplementary Documents

Glossary of Terms

ACDS	Australian Council of Deans of Science
AIBN	Australian Institute of Bioengineering and Nanotechnology
ANAT	Anatomical Sciences
ANU	Australian National University
ASPinS	Advanced Study Program in Science
APRC	Academic Programs Review Committee
ARTS	Faculty of Arts
ARWU	Academic Ranking of World Universities
BACS	Faculty of Biological & Chemical Sciences
BA	Bachelor of Arts
BAppSc	Bachelor of Applied Science
BBusMan	Bachelor of Business Management
BCom	Bachelor of Commerce
BEd	Bachelor of Education
BEcon	Bachelor of Economics
BEL	Faculty of Business, Economics and Law
BEng	Bachelor of Engineering
BInfTech	Bachelor of Information Technology
BIOC	Biochemistry
BIOL	Biological Sciences
BIOM	Biomedical Science
BJ	Bachelor of Journalism
BSc	Bachelor of Science
BSc(Hons)	Bachelor of Science (Honours)
BSc/LlB	Bachelor of Science / Bachelor of Law
BBiotech	Bachelor of Biotechnology
BEnvSc	Bachelor of Environmental Science
BMarSt	Bachelor of Marine Studies
BOTN	Botany
CAL	Computer Assisted Learning
CAPP	Committee of Academic Programs Policy
CBT	Computer Based Teaching

CEQ	Course Experience Questionnaire: The annual national survey of recent university graduates that provides information about graduates' perceptions of the quality of teaching, the clarity of goals and standards, the nature of assessment, the level of the workload, and the enhancement of their generic skills. It also asks graduates to indicate their overall level of satisfaction with the program just completed. (Here "Course" is used in the sense of an overall program of study rather than one particular component.)
CHEE	Chemical Engineering
CHEM	Chemistry
CML	Computer Manager Learning
CMS	Centre for Marine Studies
CMT	Computer Managing Testing System
COGS	Cognitive Science
COMP	Computer Science
CONASTA	Conference of the Australian Science Teachers Association
CONSTAQ	Conference of the Science Teachers Association of Queensland
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSSE	Computer Systems and Software Engineering
DEST	Department of Education Science and Technology
DITR	Diamantina Institute for Translational Research
ECTS	European Credit Transfer System
EDUC	Education
EE	Electrical Engineering
EFTSU	Equivalent Full-time Student Unit: A measure required in reporting student statistics to the Commonwealth Department of Education, Science and technology
EFTSL	Equivalent Full-Time Student Load - is a measure expressing student enrolments as a proportion of the standard annual program for a full-time student undertaking a normal full year of study in a particular year of a particular course. It is expressed in Equivalent Full-Time Student Load values. A student undertaking a standard full-time annual program for a course generates one EFTSL. Each subject / unit offered by a department is weighted in terms of the proportion (of one) that the subject/unit represents of a year's work in a given course for a full-time student. These weights are then multiplied by the number of students enrolled in each subject/unit to determine the total subject load.
ENG	School of Engineering
ENGG	Engineering
ENTER	Equivalent National Tertiary Entrance Rank
ENTM	Entomology
ENVM	Environmental Management

EPSA	Faculty of Engineering, Physical Sciences & Architecture
ERTH	Earth Sciences
GCCA	Graduate Careers Council of Australia
GEOM	Mapping Science
GEOS	Physical Geography
GO8	Group of 8 - An alliance of eight Australian universities: University of Adelaide, Australian National University, University of Melbourne, Monash University, University of New South Wales, University of Queensland, University of Sydney and University of Western Australia.
GPA	Grade Point Average
GradDipEd	Graduate Diploma in Education
GSS	Generic Skills Scale
HMST	Human Movement Studies
HLTH	Health Sciences
HS	Faculty of Health Sciences
iCEVAL	Course Evaluation Questionnaire
INFS	Information Systems
iLC	Interactive Learning Centre
IT	Information Technology
IMB	Institute of Molecular Bioscience
ITEE	School of Information Technology and Electrical Engineering
ITI	Interstate Transfer Index
LAND	Agriculture
MARS	Marine Sciences
MATH	Mathematics
MATE	Materials Science
MBBS	Bachelor of Medicine / Bachelor of Surgery
MECH	Mechanical Engineering
MICR	Microbiology
MPhil	Master of Philosophy
MSc	Master of Science
NEUR	Neuroscience
NGDS	National Graduate Destinations Survey
NRAVS	Faculty of Natural Resources, Agriculture and Veterinary Science
OCMPS	Online Content Management and Publishing System

OMC	Office of Marketing and Communication
OP	Overall Performance – Year 12 Tertiary Entrance Score OP Scale is 1-25 with 1 being the highest
OHS	Occupational Health & Safety
OS-HELP	Overseas Study Help
PASE	Pedagogy and Student Experience Working Party
PASS	Peer Assisted Study Sessions
PHYS	Physics
PSYC	Psychology
QBI	Queensland Brain Institute
QSA	Queensland Studies Authority
QTAC	Queensland Tertiary Admissions Centre
SBS	Faculty of Social & Behavioural Sciences
SBMS	School of Biomedical Sciences
SEng	School of Engineering
SGPA	School of Geography, Planning and Architecture
SIB	School of Integrative Biology
SMI	Sustainable Minerals Institute
SMMS	School of Molecular & Microbial Sciences
SPS	School of Physical Sciences
SPSY	School of Psychology
SSRI	Social Science Research Institute
STAT	Statistics
STC	Science Teachers Centre
T&L	Teaching and Learning
TER	Tertiary Entrance Rank
TEVALs	Teaching Evaluations
UAI	Universities Admissions Index
UNSW	University of New South Wales
UQ	The University of Queensland
UQSES	The University of Queensland Student Experience Survey
URLS	Undergraduate Research Learning Space
UROP	Undergraduate Research Opportunity Program
UWA	University of Western Australia
ZOOL	Zoology

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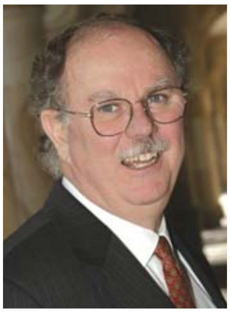
Introduction from the Executive Deans



BACS

Professor ***Michael E. McManus***
EXECUTIVE DEAN

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Faculty of Engineering, Physical Sciences & Architecture

SBS

Professor ***Deborah Terry***
EXECUTIVE DEAN

Faculty of Social & Behavioural Sciences

Science and engineering are at the heart of the 21st century. New knowledge is a powerful driver of economic prosperity and a force for human progress. That makes new knowledge the most sought after prize in the world.

Dr Rita R. Colwell, Director of US National Science Foundation 1998 – 2004

We are living in an era of unprecedented change, in which knowledge is reported to be doubling every couple of years. This, coupled with an increasingly diverse and demanding student body, is raising enormous challenges for effective science and technology education. Globally, the traditional activities and *modus operandi* of tertiary education institutions are also changing, as societies require such institutions to undertake broader roles, often with decreasing or static levels of resources and with greater accountability (www.ed.gov/about/bdscomm/list/hiedfuture/reports/pre-pub-report.pdf).

Within this context, in 2005 the Academic Board of The University of Queensland (UQ) expressed a wish for the Bachelor of Science degree (BSc) to undergo a major review. This request from the governing academic body of the University provided a timely opportunity for the Faculties of Biological & Chemical Sciences (BACS; teaches ~70% of the BSc), Engineering, Physical Sciences & Architecture (EPSA; teaches ~20% of the BSc) and Social & Behavioral Sciences (SBS; teaches ~10% of the BSc) to focus, in an holistic manner, on all aspects relating to the UQ BSc, ranging from its contribution towards achieving the broad vision of the University, to specific details of the BSc structure and content.

A key step in realizing this vision and meeting the goals of the University was ensuring active involvement and input from all stakeholder groups, including students, staff from all relevant faculties, the University (including the UQ Research Institutes), and industry/government. This has been achieved via a comprehensive process of formal and semi-formal consultation, including broad committee representation and discussions, presentations, symposia and forums for stakeholder input, surveys, and opportunities for individual and group input.

The consultation and discussions provided an opportunity to reflect on the rapid scientific advances that have occurred over recent years, and to consider how we can best address the key requirements of science in the future. We must capture and present advances at the interdisciplinary boundaries whilst ensuring the expression and growth of fundamental knowledge in existing disciplines. It is clear that partnerships between industry/government and the university sector are essential to provide the diversity necessary for us to meet the needs of the wider employer base/economy as well as to respond more readily to external changes. We also recognize that the ability to face and respond to these external challenges requires strength and quality of leadership that can drive cultural change at all levels and set the values and direction for the university in partnership with all the stakeholders.

The Review process has highlighted many examples of excellence in the current UQ BSc experience, but also identified a number of opportunities for improvement. A key step towards developing and implementing a visionary and high-quality BSc experience and meeting the goals of the University has been planning how to best deploy resources and people in order to undertake the key University business of *discovering, managing and imparting knowledge.*

In this submission, the three faculties have sought to present an innovative, flexible and sustainable 15-20 year plan that will position the BSc at the forefront of science programs nationally and internationally. As a result, graduates from the UQ BSc will be well-positioned to address critical challenges facing the modern world in areas such as health, food, water, energy, and the natural and man-made environments.

Student Outcomes

Students are the highest priority of any university and therefore must be at the heart of the curriculum review process. In developing its Teaching & Learning Enhancement Plan, The University of Queensland (UQ) has emphasized that teaching is underpinned and informed by recent advances in disciplines. This is in line with the Boyer Report [Reinventing Undergraduate Education: Blueprint for America's Research Universities (http://naples.cc.sunysb.edu/Pres/boyer.nsf/)], which emphasizes the need for student learning to be based on discovery and guided by mentoring, rather than the passive transmission of knowledge. This theme was also strongly endorsed by the international Conference held at UQ in 2004 entitled "Science Teaching & Research: Which way forward for Australian universities" (http://www.brightminds.uq.edu.au/TRC/report.htm).

Within this context there was a strong awareness amongst academic staff that they are equally responsible for the learning process in partnership with students. Indeed, in opening the above Conference the Vice-Chancellor of UQ, Professor John Hay, stated that *best practice incorporates both teaching and research, and that students are best served when horizons and imaginative possibilities in their fields of interest are "available to them sooner than later."* Thus the linking of teaching and research is strongly inculcated in UQ culture and is reflected in our strategic planning process and at the highest level of the University. However, it is likely that the most exacting test of any science curriculum in this age of rapid knowledge gain will be whether it provides the students with a curiosity for and the strategies to enable life-long learning. These are the graduate attributes that will provide future generations with the capacity to unravel the increasingly complex world in which we live.

As a guide to framing the review process we used a recent book by *Newman et al (2004)* that proposed the following questions:

- What knowledge do we expect students to acquire to be productive and effective in the workforce and as citizens? What does it mean when we say that students are prepared for successful participation in the economy and society?

- What knowledge and skills do our students currently have when they leave high school or enter from the workforce?
- What skills and knowledge are necessary for all students regardless of a major?
- Which teaching methods do we use, and are they producing successful outcomes for all students?
- What roles can technology play in improving teaching and learning? What roles can it play in assessing learning?
- What assessment tools should be used to demonstrate mastery of agreed-upon academic goals and knowledge levels?

These questions and principles have guided many of our discussions about the future of the BSc.

Student Expectations

The report on the Science Teaching & Research Conference referred to above (http://www.brightminds.uq.edu.au/TRC/report.htm) concluded that students have the right to expect that they will be continually challenged intellectually and will be part of a community of learners while at UQ. It went on to identify that the best way to do this is within a research-based learning system where several methods of interaction take place between lecturer and student, rather than simply the traditional "large lecture theatre with a non-accessible academic at the front". Inquiry/discovery-based learning inherently implies exchange of elements in both directions between lecturer and student, to the mutual benefit of both. Students also have the right to expect that the outcome of their educational experiences at a research university will equip them, not only to be worthwhile citizens, but also with the knowledge, technical and communication skills to make a significant contribution to their chosen field of endeavour, and to be internationally competitive. Finally, students have the right to expect a significant amount of contact with academic researchers and scholars, who will take the role of advisors and mentors. Importantly, academic staff should not be constrained in this role because of pressures due to other aspects of their University commitments. These recommendations significantly echo the major thrusts of the Boyer Report (http://naples.cc.sunysb.edu/Pres/boyer.nsf/) and Bio2010 that have guided much of our discussion. Our challenge is how to facilitate these interactions in the context of a large research intensive university. In particular, how do we best embrace the large student numbers to our advantage in terms of innovative cutting-edge education delivery modes?

The review of the BSc has also presented an opportunity to consider recommendations concerning the curriculum stemming from the seven yearly Academic Board reviews of the following schools: Biomedical Sciences, Molecular & Microbial Sciences, Integrative Biology Physical Sciences, Geography Planning and Architecture, and Psychology. A number of University wide centers have also recently been reviewed and the reports to Academic Board on their performances contain recommendations about contributions to undergraduate education. The BSc review has provided a unique opportunity to assess the different review recommendations in an holistic context and to come forward with a curriculum that enhances the student experience. Many of the important issues highlighted in the above reviews have been embedded in the new curriculum.

Access, Equity & Excellence

Increased access and equity in higher education has resulted in massification of the Australian Higher Education system over the last two decades. There has been a tendency for this to overshadow the sometimes tenuous state of excellence as a driver. In recent times we are witnessing an alarming "flight from science", but at the same time a decrease in resources per student is reducing our capacity to achieve excellence in teaching. For example, the cut-offs for our BSc have gone from OP7 in 2003, to OP10 in 2004 and to OP12 in 2006 (see Section 4). While the ability to address such changes may only in part reside with this review, it highlights the need for Universities to continue their drive to have their contract with the Commonwealth Government renegotiated. Obviously, justifying such a change requires us to be more accountable to our students, in particular ensuring that their Higher Education experience produces an engaged and appropriately skilled citizen. A greater effort is required to impart in our students generic skills such as leadership, teamwork, problem-solving, analytical thinking, global consciousness, ethical thinking, quantitative skills, information skills, reading, writing and oral communication. Our ability to deliver these core attributes is frequently questioned by both industry and government sectors. They flag the need for us to look critically at how we educate our students, the way in which these generic skills are embedded in our courses and most importantly, how we can evaluate attainment of these skills. We are encouraged by the fact that the literature shows that a rigorous curriculum has the most significant effect on student learning (*Adelman, 1999; Geiger, 2002*). Thus at UQ we must ensure that our students are continually challenged intellectually during the course of their BSc studies. This will require current and future leaders (Heads and Deputy-Heads of Schools) to embrace the idea of collaboration and innovation in science education. It will also require the University to commit to a new collaborative vision for science education.

Student Consultation

To gain student input into our teaching and learning programs, it is University policy that such programs are subjected to formal evaluation using the following instruments:

1. Course experience questionnaire (CEQ);
2. Student experience survey (UQSES); and
3. Course evaluation questionnaire (iCEVAL).

In general, the University has data from these instruments for the period 1999 to the present. These data enable identification of trends in student satisfaction over this period, and a summary of these data in relation to the different areas of the BSc degree can be found in Section 5 of this submission.

It is also University policy that individual lecturers carry out regular teaching evaluations (TEVALs) of the courses to which they contribute. However, these data cannot be used in a public analysis as the information is considered private to the individual lecturer and the Head of Unit.

To obtain further information on student satisfaction with the BSc degree, a number of focus groups were held and a comprehensive survey was administered by the UQ Social Research Centre on the recommendation of the Student Experience Working Party. In total, more than 900 students replied to the survey and the results can be found in Supplementary Document: BSc Review Student Survey of this submission. To further engage student involvement in the Review, the Secretary of the UQ Student Union was invited to be a member of the Steering Committee. An Open Forum was held on 25 May for students to provide additional input into the Review process. Further, six students were invited to take part in a panel discussion at the Caloundra Retreat. This enabled them to highlight, from a student perspective, the major issues that the Review should address. It also provided an opportunity for staff to ask questions of the student representatives.

Student Destinations

There is little doubt that Higher Education has become part of the market place (*Geiger, 2002; Bok, 2003; Kirp, 2003; Newman et al, 2004; Washburn, 2005*) and this is probably best emphasized by the publication of University rankings and fierce competition for research funding and full fee-paying students. In the Australian context, top academic staff are expected to bring in funding from the Australian Research Council, the National Health & Medical Research Council and industry funding, both to support research activities and to raise the prestige of the University. This prestige is further reinforced by attracting outstanding students (such as OP1 to OP3 students), and it is very apparent that elite Universities need top students every bit as much as top students need the Universities (*Kirp, 2003*).

In considering the student mix within the BSc, it was possible to break the composition down into three broad categories that reflect the different career trajectories of our graduates:

1. Those students who are present to obtain a general science-based education,
2. Those students who are positioning themselves to enter a professional degree (e.g. medicine, pharmacy, physiotherapy, psychology, engineering, law etc), and
3. Those students who see science as a career path and will proceed to Honours and probably a PhD (including industry, academia, technical sales and support, government, patent attorney etc).

The second category often elect to participate in the dual degree program (e.g. BSc/BA, BSc/LIB, BSc/BCom, BSc/BEcon) and currently about 25% of our student body is in this category. A further group choose to prepare as science teachers through the BSc/BEd or BSc/GradDipEd. The above highlights the rich and diverse backgrounds of our students and has required us to be increasingly sensitive to their needs to ensure they participate in a quality undergraduate experience at UQ.

Our success in attracting high-quality international students has been impressive, and these students have helped us realize that we live in a global village. They bring a wealth of cultural backgrounds to the University that enriches our community and we are appreciative of the honour they bestow on us by choosing UQ for their education. However, we struggle as a community in providing the right mechanisms to encourage domestic UQ students to go either interstate or overseas to enrich their personal and educational horizons. This lack of movement of domestic students at both the undergraduate and postgraduate levels is still a major shortcoming of the Australian Higher Education system. The advances in modern communication and travel, the rapidity of movement of industries and jobs to other states and countries, and the challenge for us to be a player in a knowledge-driven society requires all our students to develop a global competency. To meet this goal we have attempted to develop a flexible future curriculum that allows students the ability to have an interstate or international experience during their undergraduate science degree. The recent introduction of Overseas Study HELP (OS-HELP) by the Government (http://www.goingtouni.gov.au/Main/Resources/StudentSupport/Study+overseas/OSHELP.htm) will at long last assist in the internationalization of domestic students in Australian universities. However, for such a mechanism to work effectively, it will require the prioritization of an interstate/international experience for our students in the curriculum and for us to commit some of our own funds to such an endeavour. This again is one of those areas that signifies we are on a continual journey to appropriately position the UQ BSc.

Interaction with Secondary Schools

In his book entitled *"The Uses of the University"* (*2001*), Clark Kerr, the former President of the University of California, stated that forming meaningful interactions with High Schools was a difficult task to master. This is very much the same in Queensland and elsewhere in Australia, but we must recognize that these schools provide the feeder system that drives much of our student intake. Interestingly, the Queensland Studies Authority (QSA; http://www.qsa.qld.edu.au/consultations/) is currently undertaking a "Review of the Syllabuses for the Senior Phase of Learning" and we have contributed to this process. The "flight from science" that is currently happening at both the high school and tertiary level in Australia demands that we, as key stakeholders, continue to provide input and guidance into the school curriculum. Similarly, we have extended to the Queensland Studies Authority an opportunity to participate in our review. It has also highlighted the need for us to examine the prerequisite knowledge base for entry into our degree and to ask how much "remedial" teaching is acceptable. It is fair to say that while this area was actively debated over the last year, our ability to adequately engage the QSA has not been optimal. It is one of those areas that signifies we are on a continual journey to appropriately position the UQ BSc.

In addition to domestic students, we were also aware that approximately 15% of our student intake is comprised of international students from a vast array of backgrounds. This mix is also being impacted upon and enriched by mid-career adults, growing numbers of students with English as a second language, and retired persons wanting education for consumption purposes. This diverse composition of our student body required us to look afresh at the opportunities we are providing for them within the science market.

Teaching & Learning

This review process has been a time for us to recognize and support our staff in the passion they have for teaching and learning. We are blessed with an academic staff who not only show excellence in many teaching and learning activities, but also contribute significantly to the creation of new scientific and pedagogical knowledge. This is best seen in UQ being ranked on most national research indicators between first and third (http://www.avcc.edu.au/). UQ is also highly ranked in global university ratings such as those published by Shanghai Jiao Tong University (http://ed.sjtu.edu.cn/ranking.htm), Melbourne Institute (http://www.australian-universities.com/rankings/) and The Times Higher Education Supplement (http://www.thes.co.uk/worldrankings/). Furthermore, UQ is the most highly cited Australian teaching university, having won Australian Awards for University Teaching in each of the eight years since they were introduced, including the Prime Minster's Award for University teacher of the Year three times overall. From the three faculties involved in this review, Assoc. Professor Peter O'Donoghue, Professor Ian Cameron, Dr Michael Bulmer and Dr Merrilyn Goos have all been recipients of these awards as individuals, as has the first year psychology team for excellence in teaching larger classes.

UQ is in a unique position to integrate its excellence in both teaching and research to construct a truly innovative, internationally leading BSc experience, at the cutting edge of science education. In reinvigorating our BSc degree it is important for us to recommit to our goal of contributing to a knowledge-led society that has as its core concept the educated person. This rapidly expanding and changing world requires disciplines to go where knowledge takes them (*Gould, 2003*). Our academics need to be engaged with students as equal players in the knowledge game. This means that academics have to embrace the fact that undergraduate education is demanding closer cooperation between disciplines. Disciplines can no longer adopt a *modus operandi* that affords a kind of protection against other disciplines. Living in a digital age also demands that the excitement of learning be driven by new pedagogical approaches, and we must recognise that knowledge will be gathered from many sources that know no boundaries.

The UQ Research Institutes

At the time of writing this introduction, the scientific milieu at UQ is in the process of major change. In particular, the three faculties of BACS, EPSA and SBS have given rise to five new research institutes on the St Lucia campus. The Institute for Molecular Bioscience, which is part of the Queensland Bioscience Precinct that includes CSIRO, was opened in 2001 (~700 staff), and the Sustainable Minerals Institute was opened in 2004 (~225 staff). The new building for the Australian Institute of Bioengineering & Nanotechnology is currently being occupied and the Queensland Brain Institute will be completed in August of 2007. These institutes are each expected to have staffing compliments of approximately 300 scientists when at full capacity. The Institute for Social Science Research will commence operations in 2007 with a core staff of more than 100. This adds a scientific workforce in the institutes that is comparable to the combined staff of BACS, EPSA and SBS. In addition, the new UQ Clinical Sciences Centre at the Royal Brisbane Hospital complex is due for completion in late 2007. Plans are also well advanced for the new Diamantina Institute for Translational Research (DITR) at the Princess Alexandra Hospital.

Such significant developments provide unprecedented opportunities for Science at UQ, especially in undergraduate, Honours and postgraduate research training. These institutes are already helping faculties to attract a higher quality of academic staff, and the opportunity for research staff in institutes to contribute to a new look BSc degree is in our hands. A major challenge for the review of the BSc degree is to find new pathways for this critical investment in institutes to impact in a significant positive way on undergraduate education. To achieve this end, there are proposals from both EPSA and BACS for a high-quality, comprehensive undergraduate research experience.

The Review Process

Background

It is important to highlight that the review process has been significantly guided and informed by the wealth of excellent resources that were available to us. We have drawn heavily on the Boyer Report (http://naples.cc.sunysb.edu/Pres/boyer.nsf/) and the documentation provided by the Faculty of Arts and Sciences and Harvard College, on the review of the Harvard College curriculum at Harvard University (http://www.fas.harvard.edu/curriculum-review/). We have also followed the spirit of Bio2010, a project of the National Research Council of The US National Academies, which has as its subtitle “Transforming Undergraduate Education for Future Research Biologists”. Further, Derek Bok’s book entitled “Our Underachieving Colleges: A candid look at how much students learn and why they should be learning more” and the book by Newman et al entitled “The future of higher education: Rhetoric, reality and the risks of the market” have helped to significantly shape our thinking. In being guided by the above we have asked what parts of our current activities and curriculum represent best practice and what parts require renewal. In the process of preparing our submission we spent critical time on deciding what is required to educate a person in the rapidly expanding and changing sciences of the 21st century. We also challenged our staff to answer the question “what is the UQ BSc degree seeking to deliver and where does it fit within the Teaching & Learning Enhancement Plan of the University?”

Preparation for the Review

The review process has involved a number of meetings, forums, working parties and conferences. It has been underway since 18 November 2005, when a special seminar was held at which Dr Fiona Q. Wood and Dr Leo Goedegebuure of the University of New England’s Centre for Higher Education Management Policy, presented talks entitled “Meeting the demands for innovation: Implications for Australian science training” and “Trends and issues for S&T education: Comparative reflections,” respectively. The presentations from these talks are available at the Review web site (http://www.bacs.uq.edu.au/cirricu_review-forums).

This event was then followed by an Open Forum for members of the Faculties of BACS, EPSA and SBS on 28 November 2005. The Deputy Vice Chancellor (Academic), Professor Michael Keniger, opened the Forum and presentations were given by each Executive Dean and the relevant Heads of School. To help stimulate debate each school was requested to develop a position paper on the future of science education prior to the Open Forum. Presentations from the Forum can be accessed from the Review web page (http://www.bacs.uq.edu.au/bsc-review) and the position papers are in Section 9 of this submission. The Forum also had presentations on six different national models of science education (from England, France, Germany, Scotland, Singapore and the USA), along with presentations from the UQ institutes outlining their vision for the future. The Forum concluded with a general discussion which addressed the questions:

- Is the current UQ BSc degree internationally competitive? and
- Is the current model of science education capable of positioning Australia to be a knowledge-based economy?

It was clear from much of the discussion that the academic staff were engaged in the process of the Review and that the journey towards reviewing the BSc degree was well underway.

To further assist in focusing the minds of staff on this important undertaking the following presentations were prepared:

1. Australian Higher Education and the review of the UQ BSc degree;
2. U.S. Higher education: A brief dot point history; and
3. A summary of the recommendations of the Boyer Report for curriculum review.

Like other background documentation they were made freely available via the Review web site (http://www.bacs.uq.edu.au/curriculum-review).

An outcome of the Open Forum was the establishment of a Steering Committee, comprising Executive Deans and Heads of Schools involved in the BSc degree and academic staff who have received national teaching awards, to oversee the Review, and four Working Parties to drive the Review. These Working Parties were:

1. Structure of the BSc;
2. Pedagogy;
3. Student Experience; and
4. Honours and careers (see Figure 1).

Co-chairs and members of these Working Parties were drawn mainly from the three faculties that teach into the BSc degree. Academic staff were invited to nominate for one of the Working Parties and others were approached directly, in particular the Co-chairs. The faculties of Health Sciences and Natural Resources, Agriculture & Veterinary Science were also invited to nominate representatives for the Working Parties.

To guide their initial discussions a set of questions was provided for each Working Party and these can be found in Section 1 of this submission: Terms of Reference and Guidelines for Working Parties. Each Working Party began discussions in earnest in February 2006. A detailed record of the meetings of the different Working Parties, including meeting minutes, is available on the SharePoint web site which was developed to encourage communication and discussion within and between the different Working Parties. This is password controlled and can be accessed throught the web page: http://www.bacs.uq.edu.au/curriculum-review.

To obtain guidance from the University concerning the Review, another Open Forum was held on the 13 February 2006 for the Senior Deputy Vice-Chancellor, Professor Paul Greenfield, the Deputy Vice-Chancellor (Academic), Professor Michael Keniger, and the President of the Academic Board, Professor Mark Gould, to address academic staff. The general outcome of this meeting was to empower the faculties to examine the BSc and to be bold about the way forward. Further, the point was made that any new recommendations should be placed in the current context of Australian Higher Education where resources per student have not been keeping pace with inflation. For example, Professor Greenfield emphasized the need to develop a structure that streamlined our teaching and, along with the other speakers, highlighted the importance of new pedagogical research being applied to our teaching. Speakers also emphasized the importance of enhancing the overall UQ experience for science students.

Over the period from February to September 2006, the four Working Parties provided reports on their respective areas to the BSc Steering Committee. The Working Parties also provided the position papers that drove the BSc Curriculum Retreat that was held at Caloundra on 8-9 June (See Suplemantary Document: BSc Review Retreet Booklet for details). Following this Retreat a decision was made to combine the Pedagogy and Student Experience Working Parties. This combined Working Party and the Honours & Careers Working Party, were asked to prepare their submission for the BSc Review Symposium that was held on campus from 30 & 31 August (see Suplemantary Document: BSc Symposium booklet for details). However, it was clear from the Caloundra Retreat that the Structure Committee had much unfinished business, and they were asked to continue their discussions.

The bulk of the critical discussion at the Review Symposium in August centred on recommendations stemming from the Structure Committee. The Symposium highlighted that a large amount of progress had been made, but that more discussion of curriculum change was still needed, particularly within BACS. Meetings in early September led to agreement on details of the new second and third-year curricula.

Summary

Throughout the process of preparing our submission for the Review of the BSc degree, we have attempted to view the process as a major opportunity to influence the future education of our students. It is very encouraging to report that to date, a significant outcome of the review process has been the establishing of numerous cross-disciplinary interactions in the context of an integrated BSc. At the same time we also acknowledge that some aspects of the review process have been confronting, and that change is often difficult to manage. While taking into account these caveats, we can be very proud of our achievements as significant gains have been made. The key achievements are highlighted below:

1. Development of a proposed structure that focuses more on the quantitative and information aspects of science, in which all students are required to take the courses entitled *Foundations of Science* and *Analysis of Scientific Data and Experiments*.
2. A very concerted effort to teach a range of courses in a more interdisciplinary manner, rather than as isolated entities.
3. Strong recognition that mathematics, physics, chemistry and biology are enabling sciences, and this is reflected in the expectation that all students who graduate with a UQ BSc will have achieved a level of competence in all of these areas.
4. A dramatic reduction in the number of majors, from 40 to 14.
5. A significant reduction in the number of first year courses; for example, the number of first year Biology courses has reduced from 6 to 3.
6. Discipline specific streaming to commence much later than at present, in the second semester of second year.
7. A significant reduction in the number of second and third year courses offered, which should enable students to plan their program of study in a more rational manner and simplify student advising.

8. Creation of proposals for undergraduate research experiences, which assist in embedding the students into the research community and will reduce alienation of students early on in their studies.
9. A major focus on teaching excellence, pedagogical advances and the science of learning, especially on how these areas can assist us to deliver a high-quality educational program.
10. Special attention placed on the student experience, with a number of significant recommendations on how this can be improved.
11. Submission of a $22 million grant proposal for a Science Teachers Centre (STC) to Atlantic Philanthropies, which will help the University promote the importance of science to the primary, middle and secondary school sectors. It will also ensure that our undergraduate teaching practice is evidence based and provide a forum for industry and government to have input into and ownership of our BSc degree.
12. Tabling of a submission for an Undergraduate Research Learning Space (URLS) to significantly enhance the quality of the learning environment for students in science, engineering, technology, and the behavioural sciences, which reflects current research and practice into how students learn.

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Figure 1. Committee Structure

Steering Committee

Industry/Government Reference Group

Alumni Reference Group

BSc Review Manager:
Louise Mattick – BACS

Steering Committee
> Mick McManus – Co-Chair
> Stephen Walker – Co-Chair
David Adams – SBMS
Scott O'Neill – SIB
Alastair McEwan – SMMS
Paul Bailes – ITEE
Halina Rubinsztein-Dunlop – SPS
Debbie Terry – SBS
Peter O'Donoghue – SMMS
Ian Cameron – SEng
Erin Fentiman – Student Rep.
Merrilyn Goos – SEd
Jimmy Botella – SIB
Martin Bell – SGPA
Christina Lee – SPSY

Structure of BSc

Co-Chairs
> Susan Hamilton – BACS
> Caroline Crosthwaite – EPSA
Christine Sinclair - Coordinator

Members
John Mattick – IMB
Paul Young – SMMS
Hamish McCallum – SIB
Lesley Lluka – SBMS
Julie Duck – SBS
Gary Tuck – SPS
Kaye Basford – NRAVS
Tony Bracken – SPS
Trevor Appleton – SMMS
Bernie Degnan – SIB
Andrew White – SPS
Jon Curlewis – SBMS
Philip Machanick – ITEE
Hamish McGowan - SGPA

Pedagogy*

Co-Chairs
> Peter O'Donoghue – SMMS
> Peter Adams – SPS
Paula Myatt - Coordinator

Members
Phil Poronnik – SBMS
Mia O'Brien – TEDI
Andrew Barnes – CMS/SIB
Tony Wright – SBS
Linda Richards – SBMS
Michael Bulmer – SPS
Paul Meredith – SPS
Leith Woodall – PSE Library
Cath Lovelock – CMS/SIB
Jimmy Botella – SIB
Anton Rayner – SPS
Mary Garson – SMMS
Roger Moni – SBMS
Sophie Dove – CMS
Elwyn Oldfield – PASS/SMMS
Ray Peterson – HS
Stuart Phinn – EPSA

Student Experience*

Co-Chairs
> Kim Summers – SMMS
> Hugh Possingham – SIB
Helen Byers - Coordinator

Members
Peter Sutton – ITEE
Elizabeth Billington – SPS
Joanne Blanchfield – SMMS
Paulo Vasconcelos – SPS
Margaret Wegener – SPS
Steve Barker – SMMS
Irene Sachs – BioSci Library
Helen Byers – EPSA
Virginia Slaughter – SPSY
Alan Cody – BACS
Kurt Knesel – SPS
Ian Godwin – NRAVS
Mike Bennett – SBMS
David Neil – SGPA
Valda Miller – PASS
Craig Franklin – SIB

Honours & Careers

Co-Chairs
> Mark Blows – SIB
> Brian Key – SBMS
Michelle Hall - Coordinator

Members
Ottmar Lipp – SBS
John Pandolfi – CMS/SPS
Ross Barnard – SMMS
Rob Capon – IMB
Paul Bernhardt – SMMS
Rod Minchin – SBMS
Massimo Gasparon – SPS
Elizabeth McGraw – SIB
Anthony Roberts – SPS
Boris Martinac – SBMS
John Drennan – CMM
Liz Gillam – SBMS
Neal Menzies – NRAVS
Paul Ebert – SIB/SMMS
Helen Cooper – SBMS
Fred Meunier – SBMS
Patrick Moss – EPSA

* *It was resolved at the Review Retreat on 8/9 June that the Pedagogy and Student Experience (PASE) Working Parties should merge and prepare a joint document for the final submission to Academic Board*

Section 1

Terms of Reference

The Review will seek to determine what is required to fully educate a person in the rapidly expanding and changing sciences of the 21st century. It will take into account the strategic directions of the University and relevant Faculties especially in terms of the strengths and expertise that have been built up over the last 10 years which place UQ in a globally competitive position.

In reviewing the Bachelor of Science it is important to see it as an integral component of the University's Teaching & Leaning Enhancement Plan and the Teaching and Learning and Operational Plans of the Faculties of Biological & Chemical Sciences (BACS), Engineering, Physical Sciences and Architecture (EPSA) and Social & Behavioural Science (SBS). These plans can be found at the following web address: www.bacs.uq.edu.au, and then by accessing the curriculum review arrow.

The Review Committees will report to Academic Board and where necessary make recommendations in relation to which parts of the current degree represent best practice and which parts of the current degree require renewal.

In conducting this Review, the BSc Review Committee will examine and report on:

- The structure, content and overall quality of the BSc degree with reference to national and international standards and emerging trends in science;
- The quality of the degree in relation to perceptions of peers in the Australian and international scholarly communities;
- The destinations and graduate outcomes for those who complete the degree;
- The quality of students entering the degree;
- The place and form of Honours within the degree; and
- The effect of any proposed changes to the BSc on related programs, including changes to course offerings available in other programs by way of service teaching arrangements.

To ensure the Review of the BSc is owned by the academic staff within the Faculties the following 4 Working Parties have been established: (1) Structure of the BSc (2) Pedagogy (3) Student Experience and (4) Honours and Careers.

Higher Order Issues/Questions for the Steering Committee and Working Parties to consider when developing the new BSc

1. What is the UQ Bachelor of Science degree seeking to deliver?

1.1 Is the mission of the UQ BSc to deliver the best quality undergraduate science experience?

1.2 Are we committed to pedagogical excellence within a rich research environment?

1.3 Do we recognize the important role of science education in underpinning a knowledge economy (Backing Australia's Ability and the Smart State initiatives) and do our courses reflect this goal?

2. What is required to educate a person in the rapidly expanding and changing sciences of the 21st century?

2.1 How do we enable a student to become broadly educated and at the same time gain in-depth knowledge in a particular field?

2.2 How do we capture advances at the interdisciplinary boundaries within a science curriculum?

2.3 Do we know the brand of our Bachelor of Science degree?

2.4 Do we know the market position of the UQ BSc within the state, nationally and internationally (no boundaries)?

3. Is the way the BSc is run at UQ consistent with producing graduates that:

3.1 Are part of, and contributors to, the knowledge society?

3.2 Have the skills and "capacity to learn and grow intellectually throughout their lifetime?

4. Does the UQ BSc satisfy the six characteristics of a learning focused institution?

4.1 Clearly defined outcomes for student learning

4.2 Student participation in a diverse array of learning experiences

4.3 Systematic assessment and documentation of student learning

4.4 Emphasis on student learning in the recruitment, orientation, deployment, evaluation, and award of faculty and administrators

4.5 Institutional and individual reflection about learning outcomes leading to action aimed at improvement and

4.6 Focus on learning consistently reflected in key institutional documents, policies, collegial effort, and leadership behavior.

With reference to the above information, the BSc Review seeks to determine:

- What parts of the UQ BSc represents best practice?
- What parts of the UQ BSc require renewal?

Specific Questions and Issues

Working Party 1 > Structure of the BSc

The following questions are provided to help focus each committee on its particular mission in reviewing the BSc degree. They are not exclusive and it is expected that each committee will exercise a certain degree of creativity in shaping the focus of their discussions.

The composition of the student body is broadly comprised of the following groups:

1. Those students who are present to obtain a general education
2. Those students who are positioning themselves to enter a professional degree (e.g., medicine, pharmacy, physiotherapy, law, etc.)
3. Those students who see science as a worthwhile career and will proceed to Honours and probably a PhD

1. The following questions should be considered in light of these different aspirations of our students:

1.1 What should comprise the foundation or core courses of the BSc?

1.2 What constitutes a major and what percentage of a BSc should comprise a major?

1.3 When should streaming be permitted (3rd or 4th semester)?

1.4 How do we allow students to broaden their education through electives and to what extent?

1.5 How do we allow students to benefit from the rich research environment of UQ?

1.6 How do we use the new technologies to enhance student learning and communication?

- What proportion of our contact with students should be face to face Vs online?
- How do we facilitate student to student and student to staff communication without increasing individual workloads?
- How can we use technology to enhance and personalise student feedback?
- How can we use the technology to facilitate self-paced learning?
- What role for podcasting and vodcasting?
- What role for individual digital portfolio's and how might these be used to enhance student employment opportunities?
- How do we share content more effectively?
- How will the new technologies influence future teaching space in terms of design and function?
- Are we ready for and capable of taking advantage of, a technologically savvy student population?
- How does Blackboard and other systems best help us manage learning?

1.7 What entry requirements and subject pre-requisites should be prescribed?

1.8 Is there a role for remedial courses to bridge the gap between secondary school and university?

1.9 What is the best structure for the BSc (3+1+Masters/PhD; 4+Masters/PhD)?

1.10 What breadth of knowledge and experience is required for each major?

- Ist Year
- 2nd Year

- 3rd Year
- Honours

1.11 What types of duel degrees should we allow and how should they impact on the BSc?

1.12 What mechanisms should be put in place to generate greater co-operation between the disciplines?

2. How do we capture advances at the interdisciplinary boundaries within a science curriculum?

2.1 What level of interdisciplinary is considered essential?

2.2 What is the role of the enabling sciences (biology, chemistry, physics, maths)?

2.3 What emphasis will be put on communication in the curriculum and how?

2.4 What emphasis should be placed on quantitative skills and how?

3. How are the attributes listed below reflected in the structure of the UQ BSc? Do they provide a conduit to content and knowledge within our courses?

3.1 Leadership

3.2 Teamwork

3.3 Problem solving

3.4 Ethics

3.5 Analytical thinking

3.6 Information communication technology (gathering knowledge from as many sources as possible).

3.7 Global consciousness

3.8 Reading and writing

Key Questions

1. What should the BSc graduate attributes be?
2. What is the most effective way of organising knowledge within the BSc degree?

Specific Questions and Issues

Working Party 2 > Pedagogy

The following questions are provided to help focus each committee on its particular mission in reviewing the BSc degree. They are not exclusive and it is expected that each committee will exercise a certain degree of creativity in shaping the focus of their discussions.

1. In terms of teaching and learning responsibilities are academic staff who teach into the UQ BSc cognizant of:

1.1 Their responsibility to define what students need to know and how it is best learnt?

1.2 The need to be fully engaged in the mission of undergraduate education?

1.3 The need to see that student mentoring and advising is part of their core activity?

1.4 That they are equal players with students in the learning process and have a responsibility which goes far beyond lecturing, advising etc

2. How can courses be designed to ensure that students will:

2.1 Be intellectually challenged and part of a community of learners?

2.2 Be taught to understand the meaning of biocomplexity?

2.3 Be taught to be ethically and sociably responsible?

2.4 Have a meaningful relationship with their lecturers and that academic staff will provide quality mentoring and advising?

3. What procedures can be put in place to support staff in:

3.1 The adoption of mechanisms for pedagogical improvement, including contribution of research strengths to informing curriculum?

3.2 Use Technology in Teaching and Learning?

3.3 Reassessment of timetabling, and use of space and facilities?

3.4 Re evaluation of assessment as a mechanism to achieve deep learning?

3.5 Integration of UQ generic attributes across the curriculum?

Biocomplexity is a quantitative and integrative approach to how planetary systems work.

"Biocomplexity takes into account all of the biosciences, from the molecular to the organismic, from the community to the global, that is, a planetary understanding of how the whole system works. We have come from 50 years of reductionism, where we've gotten to smaller and smaller components, taking things apart to see how they work. Now we've reached a point where we need to put all of this information together so we can understand how the whole system works. That is, I think, the science of the 21st century—the complexity of the living system and the nonliving world and how it functions to sustain us on this planet."

Dr. Rita Colwell Former Director of National Science Foundation USA (1998 – 2004)

4. **How can courses be structured to impart knowledge through interdisciplinarity?**
   4.1 What percentage of the BSc should be committed to capturing the interdisciplinary area?
   4.2 Is science best taught as distinct disciplines or across disciplines?
5. **How do we cater for the different types of knowledge?**
   (a) Basic scientific and professional knowledge: enables the world to work - professional and professional training, inventions, patents.
   (b) Symbolic knowledge: deals with value judgments – ethical, cultural, aesthetic and philosophical argument.
6. **It is important to impart a group of core attributes to our students to produce an educated scientist. They provide the conduit to content/knowledge in all our courses. How are these attributes reflected in the structure of the UQ BSc?**
   6.1 How do we produce numerically literate students?
   6.2 How do we produce students with good verbal and written skills?
   6.3 What should be done to ensure that students are IT literate? (see Structure of the BSc Section 1.6)
   6.4 How can leadership and teamwork skills be developed within our student cohort?
   6.5 What type of ethical framework should our students be exposed to?
   6.6 Should every student graduate with quantitative skills?
   6.7 Should every student we graduate have a sound biological background?
   6.8 How do we measure analytical thinking skills within our student population?
7. **How do we get the correct balance between education and training within the curriculum?**
8. **How do we impart entrepreneurial skills to students so they are more aware of business requirements?**
9. **What types of duel degrees should we allow and how should they impact on the BSc?**
10. **How does our marketing strategy assist students in their choice of courses and the experience they would expect at UQ?**

Specific Questions and Issues

Working Party 3 > Student Experience

The following questions are provided to help focus each committee on its particular mission in reviewing the BSc degree. They are not exclusive and it is expected that each committee will exercise a certain degree of creativity in shaping the focus of their discussions.

1. What student expectations should be met throughout the BSc degree?

1.1 That they should be intellectually challenged in all of their courses?

1.2 That academic staff will provide quality mentoring and advising?

1.3 That students should have a meaningful relationship with their lecturers?

1.4 That the UQ BSc will reflect the global nature of science and that students receive a truly international experience?

1.5 That students are part of a learning community from 1st year?

2. Does the UQ BSc develop the following skills in students?

2.1 Creative thinking?

2.2 Creative writing?

2.3 Quantitative reasoning?

2.4 Oral communication?

2.5 Information communication technology?

2.6 In depth knowledge in a particular field?

2.7 Ability for life long learning?

3. Does UQ BSc degree provide:

3.1 Effective induction programs/remedial teaching?

3.2 Procedures for enhancing the international context of BSc courses?

3.3 Effective alignment with secondary education and support for the transition between secondary and tertiary education?

3.4 Specific procedures to deal with students with problems?

4. Does the student experience align with the goals of the State and Federal Government which have emphasised the need for:

4.1 Leaner outcomes?

4.2 Greater access?

4.3 Improved teacher education?

4.4 Greater attention to workforce needs and lifelong learning?

4.5 Improved accountability of business practices?

4.6 Better alignment with economic goals at both the State and Federal levels?

5. What type of research experience do students get at undergraduate level?

6. How do we cater for retired people and mid – career adults?

7. How do we deliver a quality mentoring and advising program?
8. What types of duel degrees should we allow and how should they impact on the BSc?
9. How does our marketing strategy assist students in their choice of courses and the experience they would expect at UQ?

Specific Questions and Issues

Working Party 4 > Honours and Careers

The following questions are provided to help focus each committee on its particular mission in reviewing the BSc degree. They are not exclusive and it is expected that each committee will exercise a certain degree of creativity in shaping the focus of their discussions.

1. What is the true purpose of an Honours year?

The current Honours year is composed of:

(1) Research proposal

(2) Major essay/critical review

(3) Research project and thesis

1.1 Is this the right balance?

1.2 Should a MSc or graduate style program structure be considered?

The Science Teaching & Research Conference made the following recommendations (www.brightminds.uq.edu.au/TRC/index.htm):

Recommendation 3

Extend the university science degree from 3 to 4 years to accommodate the specific professional aspirations of science students e.g. Honours (for those students intent on pursuing a research/academic career); Internship (for those wishing to take up positions in industry); Teaching (teacher-training course); Hospital/pathology (laboratory placements); Biotechnology (business/project management course); Science communication (media/editing placements)

Recommendation 4

Foster strategic interactions between science faculties and research institutes by making 100 special "researcher-teacher" positions available (at 30% of a Level C appointment) to facilitate institute staff participation in undergraduate education.

Recommendation 5

Foster strategic interactions between science and education faculties to elevate the development of science education; especially for the training of primary and secondary science teachers by funding 100 special cross appointments nationally between science and education faculties to promote instruction in the combined programs with a science and education component.

2. How can the Institutes be more fully integrated into the Honours program?

3. How do we use the Honours year as a means of educating future primary and secondary science teachers?

4. What are the requirements of Industry and other Stakeholders?

5. How do we impart entrepreneurial skills to students so they are more aware of business requirements?

Section 2

Structure and Content of the Program

2.1 Summary of Degree Rules and Program Structure

The BSc degree along with the BA is one of the most flexible programs offered at the University of Queensland. Entry requirements are English, Maths B, and Chemistry or Physics. There are no compulsory courses. A system of compulsory prerequisites exists in some of the mathematical and physical sciences. Within the biological and chemical sciences, compulsory prerequisites are minimal, and are restricted to those needed to fulfil occupational health and safety requirements for laboratory components.

Students are not required to nominate a major (currently called a field of study). In 2004-5, the University policy relating to specialisations within all degrees was standardised so that the terms “major”, “minor” and “double major” was to be applied to all undergraduate specialisations. The policy on the total unit value of prescribed courses for a major and a double major is as follows (course terminology):

The following specific nomenclature is used to describe a cohesive group of courses within a set of program rules where it is desirable or required that the field/subdiscipline be included on a student’s academic transcript and/or testamur.

- Double Major - a field incorporating advanced studies with a disciplinary focus having a value of greater than or equal to 22 units (#22)
- Major - a field of disciplinary focus having a value of 12 to 20 units (#12 - #20)
- Minor - a field with a discipline focus equal to approximately half of the value of a major (i.e. #6 to #10)
- Field of Study (honours and postgraduate coursework award programs only); a disciplinary focus of at least 8 units (#8).

The BSc has been given permission to delay the application of the new policy pending the outcome of the BSc review. Currently most of the 40 fields of study in the BSc require #8 of level 3 courses selected from a specified list.

The BSc is currently structured as follows:

- #48 required for the degree
- #32 must be science courses, designated by the “Part A” list in the requirements
- #16 may be science or non-science
- #12 of the #32 of science courses must be at level 3 (late-year courses).

The BSc program list has four sections:

Part A – a list of approved science courses

Part B – requirements for Fields of Study

Part C – a list of courses which are considered non-science courses for the purposes of the BSc Rules

Part H – Requirements for Honours

The BSc program rules are outlined in Table 2.1 Current Fields of Study in the BSc are outlined in Table 2.2 The program rules, as for all programs at UQ, are streamlined, and are designed to be read in association with the General Award Rules (http://www.uq.edu.au/student/GeneralRules2006/2006GARs.htm). University policies on all matters related to teaching and learning are to be found in the Handbook of University Policies and Procedures (http://www.uq.edu.au/hupp/).

Table 2.1 Program rules for the BSc

1. Program rules dictionary:

1.1 “Executive dean” means the executive dean of the faculty to which the student has been allocated.

1.2 “Late year course” means a course at level 3 or higher.

1.3 “Part A; part B; part C; part H “ means the relevant part in the BSc list.

2. Field of study:

2.1 A student may undertake the program in one or more of the fields approved by the executive dean.

2.2 A student enrolled under these rules may not concurrently study in the fields of bioinformatics and computational biology.

3. Program requirements:

3.1 Program requirements: #48, comprising —

(a) #32 from part A; and

(b) the balance from part A, part D or other courses approved by the executive dean.

3.2 A student must gain #12 for late year courses from part A.

3.3 Only students undertaking the BSc/MBBS dual program in the field of biomedical science may undertake courses in part M of the BSc list.

4. Maximum credit for previous study: (See GAR 1.6)

4.1 Up to #8 may be granted towards the #12 required in rule 3.2 on the basis of prior study.

4.2 The executive dean may grant up to #32 from an award completed at this University or for any courses from elsewhere.

5. Honours: (See GAR 2.5)

5.1 Entry: To enrol for honours, a student must —

(a) (i) complete the requirements in rule 3.1; and

(ii) gain the GPA set by the head of school which must be at least 4.5 for #8 of late year courses from part A which the executive dean decides are relevant to the chosen field; and

(iii) satisfy any additional requirement set by the head of school; or

(b) satisfy the executive dean and head of school that —

(i) based on the student’s qualifications from this University or elsewhere; and

(ii) subject to completion of additional work if set, the student is suitably qualified to undertake honours.

5.2 Field of study: An honours student must complete honours in a field approved by the executive dean.

5.3 Program requirements: An honours student must complete #16 from a field listed in part H of the BSc list.

5.4 Part-time honours students: An honours student may enrol part-time if the executive dean decides that the student has commitments which require part-time enrolment.

Table 2.2 Specialisations (fields of study) in which BSc studies may be currently be undertaken

» AnatomicalSciences
» Biochemistry
» Bioinformatics
» Biological Chemistry
» Biomedical Science
» Biophysics
» Botany
» Chemistry
» Computational Biology
» Computational Science
» Computer Science
» Developmental Biology
» Drug Design and Development
» Earth Sciences
» Ecology
» Entomology
» Evolutionary Biology
» Exploration Geophysics
» Genetics
» Geographic Information Science
» Geographical Sciences
» Geology
» Human Movement Science
» Marine Biology
» Materials Science
» Mathematics
» Microbiology
» Mineral Science
» Molecular Cell Biology
» Nanotechnology
» Neuroscience
» Parasitology
» Pharmacology
» Physics
» Physiology
» Psychology
» Statistics
» Tropical Marine Science
» Wildlife Biology
» Zoology

The Part A program list (list of science courses for #32) are given in Appendix 1. A total of 391 courses are offered across 44 different subject areas. Thirty three courses are offered at level one, 103 at level 2, 233 at level 3 and 32 at level 4. Level 4 courses are from BSc Honours lists and other 4 year programs.

2.2 Brief History of the UQ BSc Curriculum 1965 - 2005

2.2.1 Compulsory requirements in the BSc

As alluded to above, compulsory requirements for both entry to and completion of the BSc have been reduced over the past 40 years, leading to a program which is arguably the most flexible at the University of Queensland and possibly within the GO8 universities.

Since 1965:

1. Entry prerequisites have been reduced
2. The amount of non-science study that may be undertaken has increased
3. Course prerequisites and compulsory companion courses have been largely removed
4. There has been a large increase in the breadth of course offerings especially at level 3
5. There are no compulsory courses at any level, except that two thirds of courses must be taken from “Part A” of the BSc schedule. These are all science courses which have been judged as appropriate for the science-based component of the degree. The remaining one third of the degree may be taken from non-science offerings from all Faculties where permission to enrol as a BSc student is granted by the Faculty.
6. A minimum of 12 units of advanced level science courses (level 3 courses from the Part A list) is required.

These and other changes during this time are summarised in Table 2.3.

Table 2.3 Structure of the Bachelor of Science degree (1965 – 2005)

Year	Entry requirement	Total units	Course length	Number of courses studied per year			Compulsory Prerequisites	Compulsory companions	Min. units advanced level study	Nonscience study
				year 1	year 2	year 3				
1965	English, Maths 1, Chemistry and Physics plus languauge to Junior level for entry to BSc	28	Year	4	1 to 4	2 to 4	Nearly all second year courses have one or more compulsory prerequisites. All third year courses have compulsory prerequisites	Some compulsory companions at second and third level	4	No
1970		Similar in all respects to 1965								
1975	English, Maths 1, Chemistry and/or Physics, plus one more science if only one of the two.	290	Semester	~16	~20	~~20	Most second and third level courses have prerequisites	Some compulsory companions at second and third level	70	Up to 60 units with written approval of Dean
1980	English, Maths 1, Chemistry and/or Physics, plus one more science if only one of the two.	Similar in most respects to 1975								
1985	English, Maths 1, Chemistry and/or Physics, plus one more science if only one of the two.	Similar in most respects to 1980								
1990	English, Maths 1, Chemistry and/or Physics, plus one more science if only one of the two.	Similar in most respects to 1985								
1995	English, Maths 1, Chemistry and/or Physics, plus one more science if only one of the two.	Similar in most respects to 1985								Up to 80 units with approval of Dean
2000	English, Maths 1, Chemistry and/or Physics, plus one more science if only one of the two.	290	Semester	8	8	8	None	None	70	Up to 80 units with approval of Dean
2005	English, Maths 1, Chemistry or Physics	48	Semester	8	8	8	None	None	12	Up to 16 units, no approval needed

A comparative Table showing key features of science-based Bachelor's degrees at benchmarking universities can be found in Section 2.6.

2.2.2 BSc overview 1965 - 2005

In 1965, two science-based degrees were offered, the Bachelor of Science and Bachelor of Applied Science. Subjects were all year-long and typically comprised one quarter of a full year's load. A stringent set of prerequisites and compulsory companions was applied to most subjects at levels 2 and 3, leaving limited flexibility to mix areas of study. Assessment was by end-of-year examination, with a component of marks for laboratory reports in lab-based courses. Results were graded on a 6-point scale (High Distinction, Distinction, Credit, Pass, Pass Conceded and Fail). Honours courses were available as separate streams in some disciplines from first year.

In 1965, Queensland students entered the BSc from a senior secondary school matriculation system in which subjects were examined externally. Papers were set and marking was administered by the University of Queensland. There was thus some familiarity amongst University academics of the secondary school science curriculum, and the transition from Senior to first year University study at pass degree level was reasonably seamless. Chemistry, Physics, Mathematics I, English and a language to Junior standard were the entry requirements. The year was comprised of three terms of ~11, 10 and 8 weeks' duration.

The BSc degree structure remained essentially the same up until 1975 when the University moved from a three-term year to a two-semester year. In 1975, the Faculty of Science was comprised of 16 autonomous Departments, each of which developed their semesterised subjects separately. The resulting subjects in the BSc varied in unit size from #3 to #12 credit points. A full time enrolment in the BSc entailed between 16 and 20 subjects per year, compared with 2 – 4 subjects per year prior to 1975. The number of subjects, which might have been expected to double as a result of semesterisation but actually increased ~4 fold. The additional increase resulted from the division of existing subjects into multiple smaller unit offerings (credit points). The unit value of the BSc was changed from the original #28 to #290, arrived at by allocating #100 per year and giving students a #10 "leeway". The unit value of the BA was set separately at #240 (#80 per year).

Other consequences of the proliferation of small courses were: (i) the loss of all or most of the maths and physics from biology-focussed programs, even at level 1 and (ii) a significant decrease in laboratory contact hours (see below). In addition, the subjects in chemistry and the biologies were frequently structured to separate lecture and laboratory components. Students were able to avoid laboratory work if they chose.

Following semesterisation, the degree structure and curriculum remained relatively constant from 1975 until ~1990. In 1990, in the first serious effort to reduce the proliferation of courses which occurred on semesterisation, the number of first level biological subjects was reduced as a result of amalgamation of individual discipline-based courses into "BL" or Biological – coded cross-disciplinary courses. In 1995, a similar reduction in the number of first level mathematics, physics and earth sciences/geology courses took effect. Over the period, undergraduate Honours courses were also deleted.

In 1996, following Professor John Hay's appointment as Vice-Chancellor, the University was restructured from 16 faculties to seven. This was prompted mainly by the fact that academic programs and the resources to run them were under separate control. For example, the Bachelor of Science degree was run through the Faculty of Science under the control of the Dean of Science who had no financial line management responsibilities. The finances were administered by the Pro-Vice Chancellors of the Biological Science Group, Physical Science & Engineering Group and the Social Sciences Group. Following the restructure, Executive Deans were appointed to head each of the seven faculties and they were given responsibility for both the academic and financial matters. Following the University wide restructure, there was another round of change starting in 1998 within faculties that saw departments disappear and larger school administrative units formed.

A further structural change occurred over the period 1999 - 2001, with the progressive, university-wide "unitisation" of subjects/courses. [Note that nomenclature changed in 2001, with subjects now termed courses]. Course sizes were required to be standardised to a unit value (#2) equal to one quarter of a full semester's load and the requirement for the BSc degree became #48.

The process of unitisation began in the BACS Faculty in 1997, with the introduction of the new level 1 curriculum in 1999, and levels 2 and 3 in 2000 and 2001 respectively. The process coincided in later stages with the commencement of the restructure of BACS from ten Departments to three Schools, the introduction of the new postgraduate MBBS program in 1997 and preparation for the introduction of a new student administration system "Peoplesoft" in 2001. Restructuring of Departments into Schools within Engineering, Physical Sciences and Architecture (EPSA) mega-Faculty and the university wide unitisation of courses saw the consolidation and some rationalisation of courses in engineering, and physical and geographical sciences. Course sizes listed for the BSc offered by the departments in the Faculty which have previously ranged from #3 (Mining Industry Materials – last offered in year 1999) to #12 (1st year physics courses), to #15 for Information Systems projects, were standardised and this necessitated accompanying revision of course content. In SBS, from 1998-2000 the undergraduate and honours curricula in Psychology were reviewed for unitisation, reducing the number of courses and reconfiguring them, and the Bachelor of Psychological Science (a four-year degree program with pass and honours streams) was introduced. It was therefore a period of change on many fronts.

In the 1997 BACS curriculum restructure, much of the discussion centred on the first year where it was accepted to reduce the multiple first level biology courses to six, and four chemistry courses to two. The decision was made that the biology courses should be "Faculty" based, and that the distribution of teaching (and the associated EFTSL) across the ten Departments be maintained as far as possible at 1997 levels, providing this led to academically desirable outcomes in teaching and learning. The process of unitisation of courses in SBS and EPSA occurred independently, except for some discussion regarding level 1 Statistics and Physics for Biologists. Discussion of courses and curricula at second and third levels in BACS became progressively more school-centred. Efforts to establish some Faculty-wide guidelines for the amounts of didactic and student-centred teaching at each year level (eg lecture, laboratory, research project, field, tutorial and small group discussion etc were in general resisted. Figure 2.1(a) summarises the changes in numbers of BSc courses achieved as a result of unitisation. Figure 2.1(b) shows the current number of courses offered by various disciplines in the BSc. Table 2.4 gives a detailed breakdown of the BSc Part A courses by subject area and year level for 2005.

Figure 2.1 (a) Number of science courses in the BSc by level, 1965 – 2005

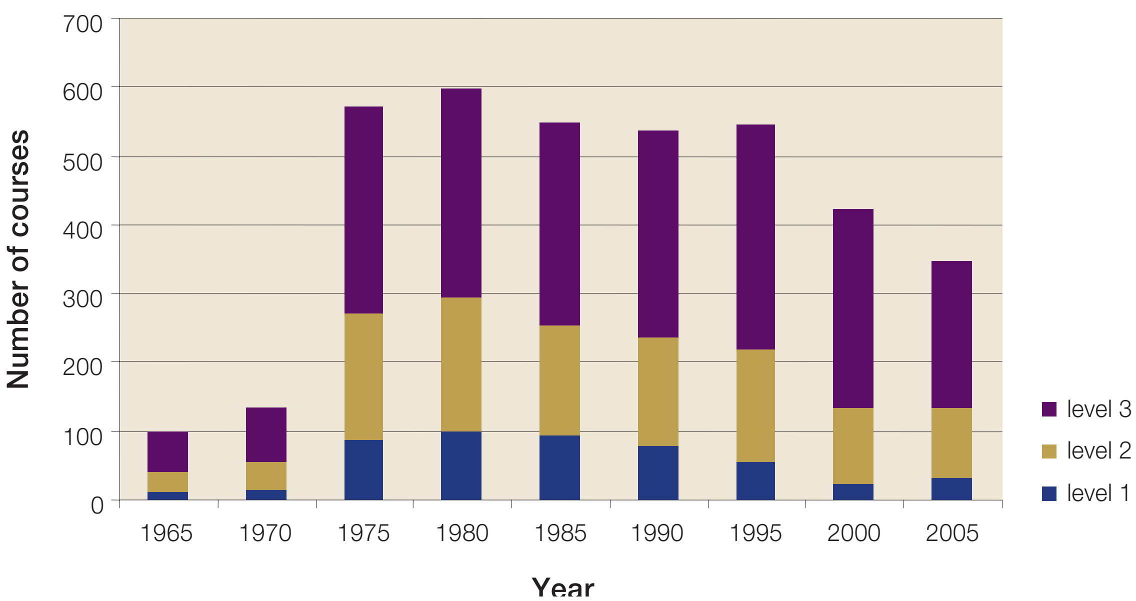
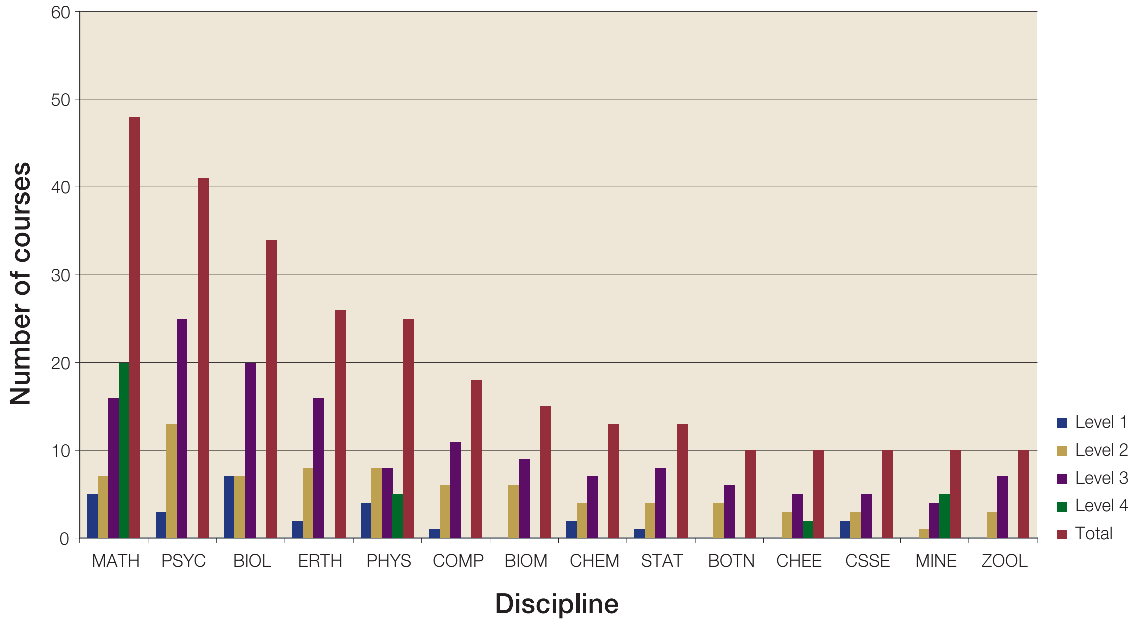


Figure 2.1 (b) Current situation - Disciplines offering 10 or more courses in the BSc



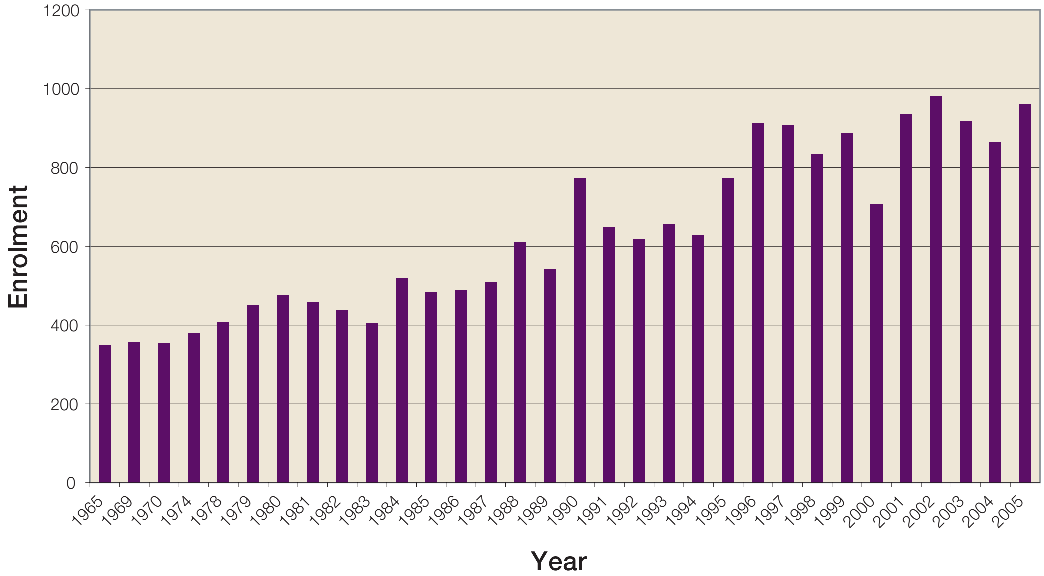
Code	**Discipline**
MATH	Mathematics
PSYC	Psychology
BIOL	Biology
ERTH	Earth Sciences
PHYS	Physics
COMP	Computer Science
BIOM	Biomedical Sciences
CHEM	Chemistry
STAT	Statistics
BOTN	Botany
CHEE	Chemical Engineering
CSSE	Computer Sytems & Software Engineering
MINE	Mining & Materials Engineering
ZOOL	Zoology

Table 2.4 Distribution of BSc Part A courses by subject area and year level for 2005.

Code	Discipline	Year Level 1	Year Level 2	Year Level 3	Year Level 4	Total
		Number of courses by year level				
BIOC	Biochemistry	0	2	4		6
BIOL	Biological Sciences	7	7	20		34
BIOM	Biomedical Sciences	0	6	9		15
BIOT	Biotechnology	0	1	2		3
BOTN	Botany	0	4	6		10
CHEE	Chemical Engineering	0	3	5	2	10
CHEM	Chemistry	2	4	7		13
COGS	Cognitive Science	1	0	2		3
COMP	Computer Science	1	6	11		18
COMS	Communications Engineering & Technology	0	0	2		2
CONS	Conservation Biology	0	0	1		1
CSSE	Computer Systems and Software Engineering	2	3	5		10
DEVB	Developmental Biology	0	0	2		2
EDUC	Education	0	1	0		1
ELEC	Electrical Engineering	0	2	1		3
ENGG	Engineering	1	0	0		1
ENTM	Entomology	0	2	5		7
ENVM	Environmental Management	0	1	6		7
ERTH	Earth Sciences	2	8	16		26
FRST	Forestry Studies	0	0	1		1
GEOM	Mapping Science	1	3	4		8
GEOS	Physical Geography	1	3	2		6
GNET	Genetics	0	0	1		1
HMST	Human Movement Studies	0	3	6		9
HPRM	Health Promotion	0	0	1		1
IENV	Information Environments	0	2	3		5
INFS	Information Systems	1	1	5		7
LAND	Land	0	1	4		5
MARS	Marine Sciences	0	2	7		9
MATE	Materials Engineering	1	0	0		1
MATH	Mathematics	5	7	16	20	48
MECH	Mechanical Engineering	0	1	4		5
MICR	Microbiology	0	1	4		5
MINE	Mining and Minerals Engineering	0	1	4	5	10
MMDS	Multimedia Design	0	0	3		3
NEUR	Neuroscience	0	0	2		2
NUTR	Nutrition	0	0	1		1
PARA	Parasitology	0	0	2		2
PHYS	Physics	4	8	8	5	25
PLNT	Plants	0	0	1		1
PSYC	Psychology	3	13	25		41
STAT	Statistics	1	4	8		13
ZOOL	Zoology	0	3	7		10
Total	44	33	103	223	32	391

Enrolments in the BSc over the period 1965 – 2005 showed large increases, which also impacted on the BSc in a variety of ways, especially on small class teaching. Figure 2.2. shows enrolment changes in the BSc since 1965.

Figure 2.2 Enrolment changes in the BSc, 1965- 2005



A factor influencing enrolments in the stand-alone BSc has been the introduction of some more specialised science degrees; Bachelor of Biotechnology, Bachelor of Marine Studies, Bachelor of Environmental Science, Bachelor of Environmental Management, Bachelor of Information Technology, Bachelor of Psychological Science, and also, from 1999 onwards, dual degrees with the BSc. These allowed students to undertake two degrees concurrently, with generous cross-credit arrangements. The dual degree arrangement also allows students to obtain a Youth Allowance (Austudy) for the period of the dual degree enrolment, which was not possible for two single degrees taken consecutively. First year enrolments in dual degrees and named degrees since 2001 are shown in Table 2.5:

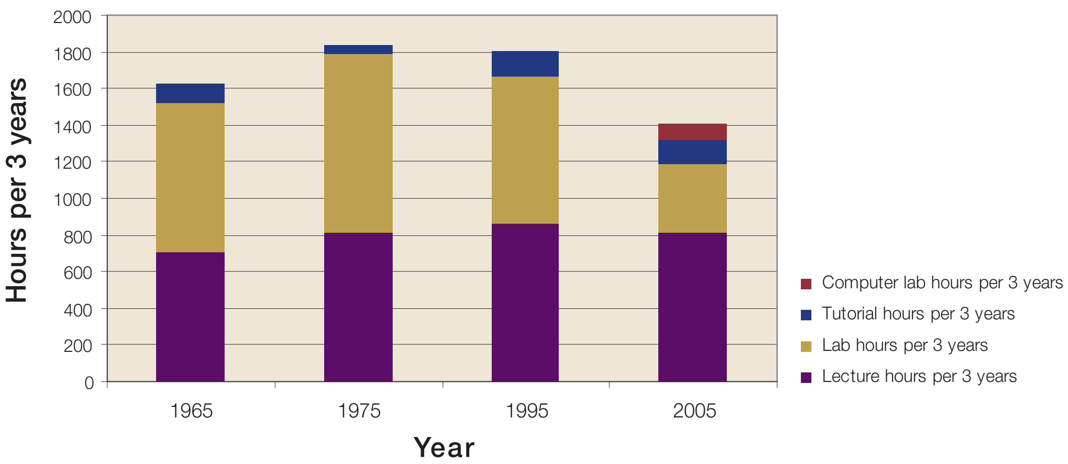
Table 2.5 First Year enrolment in science degrees 2001-2006

	2001	2002	2003	2004	2005	2006
BSc	882	933	870	828	899	**1013**
BBiotech	103	109	87	71	56	**60**
BMarSt		47	48	49	31	**47**
BEnvSc	30	26	16	23	22	**23**
BBusMan/BSc	44	27	22	19	23	**18**
BCom/BSc	48	45	24	25	17	**25**
BEcon/BSc	9	5	9	10	8	**5**
BSc/BA	102	116	90	104	70	**64**
BSc/BEd	37	46	18	23	30	**16**
BSc/BJ			5	5	7	**7**
BSc/LLB	31	44	20	13	12	**29**
BE/BSc	2	40	37	55	49	**33**
BInfT/BSc			12	6	10	**12**
	1288	1438	1258	1231	1234	**1352**

Note: This data is the headcount post semester 1 and therefore takes into account attrition in the first semester.

In order to obtain a snapshot of the changes in class contact which have occurred as described above over the last 40 years, "typical" science programs for years 1-3 of a BSc have been analysed for the years 1965, 1975, 1985, 1995, 2005. In this example the programs are those that would have been taken by a student seeking to specialise in biochemistry. A summary of the data is shown in Figure 2.3 and the detailed year by year analyses can be found in Appendix 2.

Figure 2.3 Class contact hours over the 3 years of the degree for BSc Student 1965 – 2005



The number of lecture hours for the three year degree has remained remarkably constant over entire period since 1965, despite the development of a range of alternative teaching modes, changes to course unit value and semesterisation. On the other hand, the decrease in time spent in wet laboratories is dramatic, especially over the past 10 years and especially at levels 1 and 2.

The net effect of (i) reductions in laboratory teaching, (ii) unlinking of theory and lab based subjects at level 3 and (iii) removal of compulsory prerequisites from all but a small number of courses (2000) is that students may complete a degree program which has a minimal amount of laboratory exposure.

Over the same period of time, the amount of computer-based work in courses has increased. In some cases, e.g. physiology, wet labs have been replaced by computer-simulations. This has been necessitated by the restrictions on using animals in laboratories. In other cases, computer-based work is an integral and necessary part of the teaching, e.g. in bioinformatics.

2.3 Specialisation within the BSc

A feature of the BSc up until 1999 was the absence of a formalised way for students to declare a "major". Prior to semesterisation, the limited range of subjects, the size of later year subjects and the system of compulsory prerequisites meant that students inevitably specialised during the degree. Following semesterisation, and the proliferation of subject choices, the extent to which students specialised was enforced by a complex system of prerequisites. These were subsequently replaced by "recommended prerequisites" except where needed to satisfy OHS requirements as described above.

In 1999, the nomenclature "field of study" was introduced as a non-compulsory option for students, allowing them to graduate with one or two named fields or majors. Fields were specified in all but a few instances by a list of level 3 courses from which a minimum of #8 (4 courses) were required. The BSc currently offers 40 fields of study and the number of courses listed in these fields varies from a minimum of 5 (Biophysics) to 28 (Biomedical Science). Some exceptions such as Computer Science have further requirements for first and second level study, leading to a more structured program. Students are currently not compelled to nominate a field of study, in which case they graduate in an “undeclared” field. Table 2.6 shows the fields of study and numbers graduating in each field since 2001 and the key points are:

(i) as the concept of a field of study has become accepted since its inception in 2001, more students have chosen to graduate with one (or two) fields.

(ii) in 2005, when there were 525 graduates, only 37 students graduated with no declared field.

(iii) the field of Biomedical Science is much more popular than other fields.

Table 2.6 Graduation by field of study in the BSc (2001-2005)

Field	2001	2002	2003	2004	2005
Biomedical Science	135	144	104	144	189
Undeclared - BACS	91	41	45	35	27
Psychology	28	29	20	32	36
Microbiology	38	33	23	29	28
Biochemistry	47	49	29	26	28
Computer Science	42	32	25	25	16
Anatomical Sciences	16	24	43	22	17
Mathematics	19	20	22	22	25
Ecology	21	12	18	21	14
Chemistry	20	17	15	20	23
Genetics	22	23	14	19	17
Marine Biology	32	23	33	16	24
Pharmacology	14	13	13	15	10
Zoology	12	21	27	11	17
Botany	12	8	9	10	2
Molecular Cell Biology	17	13	7	10	4
Neuroscience	4	7	12	10	19
Physics	7	10	2	9	5
Physiology	17	16	24	8	9
Developmental Biology	3	6	10	7	6
Drug Design and Development	5	1	1	7	5
Entomology	4	2	6	7	2
Human Movement Science	6	5	4	6	9
Wildlife Biology	4	6	5	6	8
Earth Sciences	9	7	7	5	10
Geographical Sciences	3	6	5	5	4
Biophysics	1	1		4	1
Parasitology	18	6	2	4	1
Computational Biology		2	1	3	1
Information Technology	28	56	1	3	
Biological Chemistry		4	3	2	2
Evolutionary Biology	1	1	1	2	0
Undeclared - EPSA	4	3	2	2	5
Exploration Geophysics		3	2	1	0
Geographic Information Science				1	0
Geology	3	5	4	1	1
Nanotechnology				1	3
Statistics	1	1	2	1	2
Human Movement Science/Psychology		1		0	0
Anatomy	12	13	14	0	0
Materials Science		1		0	0

2.4 Course Enrolments in the BSc

All Part A courses are able to be accessed by students enrolled in degrees other than the BSc. Two aspects of course enrolments are therefore relevant to the BSc Review :

- The *total* enrolments in each Part A course, and the contributions to those enrolments by degree program;
- The *combinations* of courses taken by BSc students specifically.

In order to analyse the combinations of courses taken by BSc students, a cohort analysis is required. A cohort is defined by commencing year. (A similar approach has been taken to the analysis of progression, retention and lapsed students. See Section 5 of this submission). Enrolments in Part A courses for the cohort who commenced in 2003, by year, are shown in Table 2.7. Consistent with the strong preference for the biomedical science field of study/major are the high enrolments in second and third level BIOM-coded courses.

Table 2.7 Analysis of the 2003 cohort by year and by course enrolment

Year 1 (2003)

Course Code	Enrolment
CHEM1012	650
BIOL1011	609
BIOL1012	543
BIOL1015	529
BIOL1014	489
CHEM1013	465
STAT1201	341
PHYS1170	303
PSYC1020	179
BIOL1013	165
PSYC1030	157
MATH1051	93
BIOL1016	80
MATH1050	72
PHYS1001	62
HMST1023	54
MATH1052	39
PHYS1002	39
PSYC1040	39
CHEM1090	38
BIOL1017	28
ERTH1000	28
HMST1900	28
MATH1061	26
BIOL2009	23
BIOM2007	22
BIOM2019	22
BIOC3002	21
COMP1500	21
BIOL3004	20
MICR3001	20
BIOC3003	19
GEOS1100	18

Year 2 (2004)

Course Code	
BIOM2007	223
BIOM2019	173
BIOM2008	172
BIOC2012	159
BIOM2041	134
BIOL2009	126
BIOL2012	105
BIOL2008	97
BIOM2034	87
BIOM2006	81
MICR2008	76
CHEM2041	60
PSYC1030	60
PSYC1020	59
BIOC2014	46
CHEM2001	46
BIOM2028	40
BIOL2007	39
CHEM1013	32
ZOOL2028	31
CHEM2038	30
ZOOL2029	29
MATH2000	28
STAT1201	28
BIOL2000	24
BIOL2010	23
PSYC2050	23
BIOL2014	22
MATH2100	22
PSYC2020	22
BIOL2011	21
BIOL3044	21
ZOOL2030	21

Year 3 (2005)

Course Code	Enrolment
BIOM3006	116
BIOM3005	112
BIOM3002	100
NEUR3002	95
BIOM3001	90
BIOM3004	85
BIOM3043	69
BIOC3003	53
BIOL3003	51
DEVB3001	43
BIOM3008	42
BIOM3003	40
MICR3001	40
BIOL3012	39
DEVB3002	38
BIOL3004	37
NEUR3001	37
BIOL3002	30
MICR3002	30
PSYC1020	30
BIOL3006	29
PSYC1030	29
BIOM2019	26
ZOOL3001	20
BIOC3002	19
BIOM2007	19
PSYC3102	18
BIOM3009	17
BIOM2028	16
PSYC1040	16
STAT1201	16
BIOL3017	14
CHEM3004	14

Course Code	Enrolment
BIOM2008	16
BIOL2012	15
BIOC2012	14
BIOL2008	14
BIOM2041	14
COMP1501	14
HMST1910	14
MICR3002	14
MICR3004	14
BIOL3002	13
COMM1102	13
ERTH1001	13
MGMT1000	13
MUSC1700	13
DEVB3002	12
MGMT1100	12
ZOOL2028	12

Course Code	
BIOL3012	20
PSYC2030	18
BIOL1015	17
BIOL2017	16
HMST2430	16
PSYC1040	16
PSYC2040	15
BIOL3004	14
MICR3002	14
BIOL1011	13
BIOM3006	13
HMST2730	13
PHYS2020	13
BIOC3003	12
BIOL3006	12
BIOM3043	12
MATH2200	12
PHYS1171	12
PSYC2010	12

Course Code	Enrolment
HMST1023	14
ZOOL3002	14
BIOL3000	13
BIOL3005	13
BIOL3009	13
BIOL3044	13
MICR3003	13
PSYC2020	13
BIOC3001	12
BIOL2000	12
MICR3004	12
ZOOL3010	12
BIOM2008	11
BIOM2041	11
PSYC2050	11
HMST2730	10
MATH3101	10
PARA3002	10
PSYC2040	10
PSYC3232	10
ZOOL3005	10

Tables 2.8 and 2.9 analyse combinations of courses taken at Level 1.

Table 2.8 Enrolments in first level courses, 2005

	Combinations of courses taken by level 1 BSc students														
Course	1	2	3	4											
BIOL1011	X	X	X	X	X	X	X	X	X	X	X		X		
BIOL1012	X	X	X	X	X	X	X		X	X	X				
BIOL1013	X	X	X		X	X									
BIOL1014	X	X	X	X	X	X	X	X		X	X		X		
BIOL1015	X	X		X	X	X	X	X	X	X	X		X		
BIOL1016	X		X		X										
CHEM1012	X	X	X	X						X	X	X	X	X	X
CHEM1013	X	X	X	X						X	X		X	X	X
PSYC1020												X			
STAT1201		X	X	X						X		X			
PHYS117				X											
PSYC1030												X			
MATH1051															X
# of students	15	38	13		26	89	368	419	428	249	305	14	343	452	41

Table 2.9 Percentage of commencing students not taking level 1 courses in various disciplines

Commencing Year	No MATH1	No PHYS1	No STAT1	No BIOL1	No CHEM1
2003	82%	54%	56%	13%	14%
2004	82%	49%	51%	14%	15%
2005	83%	48%	46%	14%	15%
Average	82%	50%	51%	14%	15%

The data show that:

- Very few students took any of the first three "standard" biology/chemistry plans recommended in the First Year Guide;
- Few students took all 6 biology courses;
- ~ 40% of students took the four BIOL courses 1011, 1012, 1014, 1015 (or more), and the majority of these also took two chemistry courses and stat maths;
- ~50% of students did not take both CHEM1012 and CHEM1013.

Further analysis of Table 2.9 reveals that 82% of students take no mathematics, 51% take no statistics, 50% take no physics, 14% take no biology and 15% take no chemistry in First Year. These general trends have remained constant for each of the 2003-5 commencing cohorts.

2.5 Critical Analysis of the Program

2.5.1 Flexibility vs structure: Advantages and disadvantages

The flexibility of the BSc hinders the formation of cohorts with whom students can identify, commencing at level 1. The flexibility, coupled with a lack of compulsory level 1 and 2 courses in the requirements for a major in most disciplines, and the extensive choice amongst courses at level 3 for most majors, also militates against the cohort experience throughout the degree to graduation. The wide choice of courses, especially at levels 2 and 3, means that there are no "standard" study plans. This in turn means that the achievement of the stated graduate attributes for the BSc is not readily measured. Table 2.10 gives the graduate attributes for all the biological and chemical science majors; other majors in the BSc have their own separate statements of graduate attributes. Table 2.11 shows the example of graduate attributes for Computer Science.

Table 2.10 Graduate Attributes for all majors in biological and chemical sciences majors in the BSc

IN-DEPTH KNOWLEDGE OF THE FIELD OF STUDY UQ GRADUATES WILL HAVE:	BSC GRADUATES IN ALL BIOLOGICAL AND CHEMICAL FIELDS OF STUDY WILL HAVE:	BSc HONOURS GRADUATES IN THESE FIELDS WILL HAVE IN ADDITION:
• A comprehensive and well-founded knowledge of the field of study. • An understanding of how other disciplines relate to the field of study • An international perspective on the field of study.	• Knowledge and skills which permit in-depth understanding of science in at least one broad area of specialization (hereafter called fields of study) • Knowledge and skills which permit effective participation in a broad scope of work environments where this basic science finds application. • An appreciation of the central role and the process of rigorous scientific investigation in the chosen field(s) of study • Skills in experimental science in the chosen field(s) of study at a level which prepares them for closely supervised research in an Honours program • Appreciation of the relevance of mathematical/statistical skills relevant to their selected field of study • Broad knowledge and skills across science beyond the chosen field(s) of study and an appreciation of how they relate to each other • An appreciation of science as an international and collegial activity	• In depth understanding of their area of research • The ability to design a research investigation that is scientifically rigorous • Skills in undertaking appropriate mathematical and statistical analyses to scientific data

IN-DEPTH KNOWLEDGE OF THE FIELD OF STUDY UQ GRADUATES WILL HAVE:	BSC GRADUATES IN ALL BIOLOGICAL AND CHEMICAL FIELDS OF STUDY WILL HAVE:	BSc HONOURS GRADUATES IN THESE FIELDS WILL HAVE IN ADDITION:
EFFECTIVE COMMUNICATION		
• The ability to collect, analyse and organise information and ideas and to convey those ideas clearly and fluently, in both written and spoken forms. • The ability to interact effectively with others in order to work towards a common outcome. • The ability to select and use the appropriate level, style and means of communication. • The ability to engage engage effectively and appropriately with information and communication technologies.	• The ability to write and speak on topics in the chosen field of study, at a level appropriate for entry into a supervised industry or research environment • The ability to participate in broad and informed discussion of scientific issues as a contributor to the community, to industry and to government • The ability to choose and use the most effective communication strategies in communicating with these groups	• The skills necessary to prepare a manuscript for publication in a refereed scientific journal • Confidence in making oral presentations at scientific conference level
INDEPENDENCE AND CREATIVITY		
• The ability to work and learn independently. • The ability to generate ideas and adapt innovatively to changing environments. • The ability to identify problems, create solutions, innovate and improve current practices	• A commitment to ongoing intellectual development, building on the foundation of the science degree • A commitment to using scientific skills and knowledge to create and innovate.	• The ability to undertake an independent research investigation within a supervised team • The ability to contribute original ideas to a research team • The ability to use scientific skills and knowledge creatively and innovatively in a research environment
CRITICAL JUDGEMENT		
• The ability to define and analyse problems • The ability to apply critical reasoning to issues through independent thought and informed judgement • The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions	• The ability to critically and constructively analyse scientific problems in the chosen field of study • The ability to apply analytical and reasoning skills developed through the study of science to complex problems in the wider community	• The ability to identify problems worthy of scientific investigation • The ability to critically appraise outcomes of their own research and the interpretations and ideas of others in the field
ETHICAL AND SOCIAL UNDERSTANDING		
• An understanding of social and civic responsibility • An appreciation of the philosophical and social contexts of a discipline • A knowledge and respect of ethics and ethical standards in relation to a major area of study • A knowledge of other cultures and times and an appreciation of cultural diversity	• The ability to take an informed position on the ethical issues generated by scientific research and its applications • An appreciation of the fundamental importance of scientific endeavour to our cultural evolution and to society's health and wellbeing.	

Table 2.11 Graduate attributes for the field of computer science in the BSc

Bachelor of Science (Computer Science) Statement of Graduate Attributes
On completion of the program, graduates will have:

In-Depth Knowledge of the Field of Study	Effective Communication	Independence and Creativity	Critical Judgement	Ethical and Social Understanding
• A comprehensive understanding of the current state of the art of computer science, including a thorough appreciation of programming in high-level languages, of creating and suing information systems and computer systems, and of the technical aspects of information technology. • A thorough understanding of how computer science interacts with society at large, and the effects on society of this interaction. • The ability to understand with depth and accuracy the impact of computer science within an organization. • A detailed appreciation of the impact of computer science on the global scale.	• A clear ability to research, collect, analyse and organise information and ideas effectively in written form. • An ability to analyse and present information and ideas effectively in oral form. • The ability to argue persuasively, based on a solid research and/or analytical foundation • The ability to interact well with others in a group in order to work towards a common goal. • The ability to select and use the appropriate level, style and means of communication, whether in written or oral form, in communicating to a particular audience. • The ability to engage effectively and appropriately with information and communication technologies.	• The ability to work and learn independently • The ability to problem-solve on both individual assignments and group projects. • The ability to identify technical problems and apply appropriate research and analytical strategies to address them. • The ability to be a creative thinker and apply critical reasoning in information system contexts. • The ability to take direction but to also provide additional creative input. • The ability to assume leadership and demonstrate initiative.	• The ability to develop critical judgement skills to enable the analysis of both existing computer systems and those under development • The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions. • The ability to define and analyse problems in relation to arising circumstances • The ability to apply critical reasoning to issues through independent thought and informed judgement, and the use of evidence.	• An understanding of how contemporary society and culture is shaped by computer science, and therefore and awareness of the social and civic responsibility of the computer scientist. • An understanding of the ethical and civic responsibilities regarding interactions with colleagues and clients • An appreciation of the philosophical and social contexts of computer science as a discipline. • A knowledge and respect of ethics and ethical standards in relation to all aspects of the duties and responsibilities of a computer scientist. • An awareness of cultural and social diversity in the workplace.

Several strategies have been implemented which address in part the cohort issue, for example the Peer Assisted Study Sessions (PASS) program and the Advanced Study program in Science (ASinP) (see Section 7 of this document for detailed descriptions). Student feedback indicates there is a strong need for clearer, simpler study pathways, better academic advising and more useful statements of outcomes for these pathways. The existing highly flexible structure with 40 majors, each with different amounts of structure and choice, is not compatible with these requirements.

A detailed critical analysis of the student experience and pedagogy are addressed in Section11 of this document.

2.6 Comparison of the BSc with other Benchmarking Institutions

2.6.1 Comparison of the structure of the UQ BSc with other universities

Table 2.12 below shows information on BSc programs gathered, for 'benchmarking' purposes, from a small selection of Australian and international universities. The universities selected included:

- University of Sydney (Australia)
- University of Melbourne (Australia)
- University of Birmingham (UK)
- University of Edinburgh (UK)
- Purdue University (USA)
- Michigan University (USA)
- University of British Columbia (Canada)

Information was gathered primarily using the freely accessible university websites and some personal communications. Information for comparative use was sought under the following headings:

Table 2.12 Selected benchmarking criteria

Aspect of the degree	Detail
Length of degree	Assuming full time enrolment
UAI (University Admission Index)	An Australian comparative index of university admission scores
Prerequisites for entry	Minimum requirements for student entry into the BSc program
Availability of bridging courses	Availability of bridging /introductory level courses at university to compensate for lack of prior knowledge from school/previous experience
First Year	Amount of structure, choice, study outside science, compulsory components, special programs, interdisciplinarity
Compulsory components within the BSc	Requirements to nominate a major, other requirements
Prerequisites	Compulsory course prerequisites within the BSc
Number and names of majors	
Structure of majors	
Special courses	For very able students, project and industry based work, service learning etc

The objective of this benchmarking exercise was:

- To compare the current structure of the UQ BSc with similar programs at similar institutions;
- To note any marked areas of difference between BSc programs; and
- To gain an understanding of any elements of the programs at other institutions which might inform the Review of the BSc.

It should be noted that this comparative exercise is not straightforward. For example, Australian degrees differ in fundamental philosophy from those in the UK and the US. In the UK, many universities offer three-year on-course Honours degrees with a relatively high degree of specialisation. In the US, four-year degrees are the norm, with the first year being a broadly based generalist year and less specialization overall.

Even the straight forward task of comparing the numbers and names of majors is not simple. For example, it is possible to compare 41 majors (fields of study) at UQ to 26 majors at University of Melbourne, but inappropriate to compare this to 45 majors at Purdue University (which include Engineering combinations) or to 28 BSc degree options at University of Birmingham. Also, names of majors may reflect local specializations, and different names may be used for similar specializations in different institutions. Additional complexity occurs because many universities have science-based degrees in addition to the BSc, and this impacts on the number and names of discrete majors within the BSc. For example, some universities offer a Bachelor of Biomedical Science, and majors in that degree are often not duplicated in the BSc.

Table 2.13 summarises the key findings and data gathered. Below are several key points which can be extracted from this data:

Notes

Table 2.13 Selected Benchmarking Data - BSc only. Australia - United Kingdom - United States of America - Canada

	U of Queensland	U of Sydney	U of Melbourne	Birmingham	Edinburgh	Purdue	Michigan	U British Columbia
Degree length	3 years	3 years	3 years	3 years	4 years (incl Hons)	4 years	4 years	4 years (incl Hons)
UAI	73.65	83	80	na	na	na	na	na
No. of majors	40	29	26	28 BSc options	19 Hons Programmes	45 majors, 24 minors*	26 concentrations*	33
Prerequisites before university	English, Mathematics B, plus one of Chemistry or Physics. Competitive entry rank also required.	The only "Assumed Knowledge" is completion of HSC level mathematics.	English, Mathematics I/Mathematics B and two of Biological Science, Chemistry, an additional Mathematics, or Physics. For applicants with a notional ENTER (UAI) of 92.0 or greater, English, Mathematics I/Mathematics B and one of Biological Science, Chemistry, Physics.	Different BSc options required different subjects: eg Biological Sciences BSc requires Biology/Human Biology and one from Chemistry, Physics, Mathematics, Geography, Geology, Psychology or Sports Science.		Purdue provides a "Calculus Readiness Test". Results from this test determine university math placement and placement in Chemistry, Physics and Computer Science.	Applicants' credentials should include a "B" average or better in a rigorous and appropriate college preparatory program, and standardized test scores comparable to freshman pursuing similar programs in the University. Decisions are made on an individual basis. No specific class rank, grade point average, test score, or other qualification by itself will assure admission.	Compulsory UBC courses exist in Chemistry, Physics, Biology and Maths if not taken at school. (http://www.essential.science.ubc.ca/academic/planning/faculty_requirements.htm#breadth)
Bridging courses	The term "Bridging" is rarely used, however bridging/introductory courses are available for students with no high school experience (or poor grades) in the following: chemistry (CHEM1090), physics (PHYS1000) and mathematics (MATH1040).	Bridging courses are strongly recommended but are not pre-requisites. (Include: Mathematics, Physics, Chemistr, Biology)	Introductory courses are available in Physics, Chemistry and Biology for students with no 'prior learning' in these areas.		Direct Entry into 2nd yr - this is available for students with high grades (3 yr degree).	Advanced placement given from school. Strong emphasis on 'placement exams; to determine student level and obtain credit for previous work and to place students in correct course levels. Exams are free of charge.	Advanced Placement credit for high school work (meaning credit given for an initial Biology and so can enrol in next Biology instead)	Summer courses and correspondence course are mentioned.
1st year	Students study 16 units of first level courses (usually 4x 2 unit courses per semester). Students choose from 40 Fields of Study (majors) and may be guided in course combinations using one of the 16 suggested "Plans" provided.	Students study 48 credit points of junior subjects in 1st year, each subject is typically 6 credit points.	Students choose between four first year packages - guiding students towards particular majors.	Up to a third of student time is spent doing practical work.	Flexible, broad-based.		Course selection is influenced by concentration selected; First-Year Writing Requirement should be completed in the first year.	Science One - a 27 credit point year course integrating Biology, Chemistry, Physics and Maths, 80 students, 8 staff, community of learners, high entry requirements in Chemistry, Physics, Maths and Biology. Coordinated Science Program (CSP): 168 students, is an alternative to standard first year science, suitable for students who have broad scientific interests and want to explore connections between the disciplines. All CSP students attend the same sections of specific core science courses: Biology, Chemistry, Physics, and Math, with an option in Computer Science
Compulsory components within the BSc	No compulsory components.	12 credit points of Maths must be studied.	No compulsory components.	No compulsory components.	No compulsory components.	A minimum compulsory laboratory requirement; plus minimum Mathematics requirement;plus a minimum English Composition course (2) requirement; plus at least 6 'general education' courses (eg Humanities).	Compulsory writing requirements (First-Year Writing Requirement and Upper-Level Writing Requirement) to teach students the discipline and skills needed for college writing; compulsory Quantitative Reasoning course requirement; compulsory Race and Ethnicity course requirement; compulsory proficiency in a language other than English; a minimum compulsory portion of practical experience.	Compulsory courses exist in Chemistry, Physics, Biologyl and Maths if not taken at school.
Prerequisites between years	A system of compulsory prerequisites exists in some of the mathematical and physical sciences; compulsory prerequisites are minimal within the biological and chemical sciences.	A system of compulsory prerequisites exists for all subjects to guarantee prior learning before proceeding to more advanced levels.	A system of compulsory prerequisites exists for all subjects to guarantee prior learning before proceeding to more advanced levels.				Complex prerequisite structure.	Complex prerequisite structure.
Structure of majors	Currently most of the 40 "Fields of Study" in the BSc require #8 units of level 3 courses selected from a specified list. UQ has defined a "Major" to be "a field of disciplinary focus having a value of 12 to 20 units (#12 - #20)". This structure is yet to be implemented in the UQ BSc.	Requires at least 24 credit points of senior subjects (approx one half of subjects in 3rd year).	Guided from 1st year; defines one-half of the subjects at third year.	No mention of "majors": "You can choose to specialise from the outset.... or wait until your second year (or) you may decide not to specialise at all but stay with a broad-based programme."	3rd year is called Junior Honours Year. Students undertake some Advanced Subjects and start to narrow down their fields of study. They select an Honours Program at the end of the year. 3rd year courses contribute to final degree classification.	4 courses in lab science outside of the major.	Majors="concentrations".	#120 credit points minimum for BSc, #132 for Honours or more for double major, at least #48 in upper level courses, (individual courses are #3, approx 5 per semester, 10 per year and so 40 minimum for degree).
Other structure?	Over the three years of the degree, BSc students must complete #48 units (#32 must be in science and #16 may be non-science). In addition, #12 of the #32 of science courses must be at level 3 (advanced level).	48 credit points of intermediate subjects in 2nd year.In third year most students study a total of 48 credit points in one or two major areas of study.	Over the three years of the degree, Bachelor of Science students complete 300 points worth of subjects. A typical first-year workload involves eight subjects, four in each semester. Students are required to take between 75–125 points of first-year level subjects, and a minimum of 50 points of a prescribed science major at the third-year level.	3rd year includes a major research project which makes up one sixth of the final year.	Students must accrue 120 points per annum, with course subjects being either 20 points (1 semester) or 40 points (2 semesters). Each point represents about 10 hours of student effort (contact and self-directed learning), and this points system is standard throughout Europe.	Students must earn a minimum of 124 credit hours to graduate , which is an average of 15 .5 credit hours / semester. 18 credit hours must be from the humanities. 11 credit hours must be mathematics. Of the total 124, 32 credits must be taken at the Junior/Senior level (300+). To accumulate 124 hours in eight semesters, students average 15 1/2 hours a semester. A typical first-year course load is 13 to 16 hours per semester.	Requires a minimum of 120 credits; including all of the compulsory requirements and including 60 credits in physical and natural science and mathematics; highly structured requirement for students to undertake a distribution of courses across Natural Science, Social Science, Humanities, Mathematical and Symbolic Analysis, and Creative Expression.	Integrated Sciences Program (ISP) is an alternative to a traditional Major or Honours program, designed for students whose interests cross disciplinary boundaries within the Sciences. The program gives 3rd and 4th year students the opportunity and the guidance to design their own curriculum.

	U of Queensland	U of Sydney	U of Melbourne	Birmingham	Edinburgh	Purdue	Michigan	U British Columbia
Names of majors	Anatomical Sciences Biochemistry Bioinformatics Biological Chemistry Biomedical Science Biophysics Botany Chemistry Computational Biology Computational Science Computer Science Developmental Biology Drug Design and Development Earth Sciences Ecology Entomology Evolutionary Biology Exploration Geophysics Genetics Geographic Information Science Geographical Sciences Geology Human Movement Science Marine Biology Materials Science Mathematics Microbiology Mineral Science Molecular Cell Biology Nanotechnology Neuroscience Parasitology Pharmacology Physics	Agricultural Chemistry Anatomy & Histology Biology Biochemistry Cell Pathology Chemistry Computer Science Computational Science Environmental Studies Financial Mathematics and Statistics Geography Geology Geophysics History/Philosophy of Science Immunobiology Information Systems Marine Science Mathematics Medicinal Chemistry Microbiology Neuroscience Nanoscience & Technology Pharmacology Physiology Physics Psychology Plant Sciences Soil Science Statistics	Anatomy Biochemistry and Molecular Biology Biotechnology* Botany Cell Biology Chemistry Computer Science Conservation and Australian wildlife Earth Sciences Ecology Environmental Science* Genetics Geography History and Philosophy of Science* Immunology Marine Biology Mathematics and Statistics Microbiology Neuroscience Pathology Pharmacology Physics Physiology Psychology Vision Sciences Zoology	BSc options include: Artificial Intelligence and Computer Science BSc Biochemistry BSc Bioinformatics BSc Biological Sciences BSc Chemistry BSc Computer Science BSc Computer Science with Business Management BSc Environmental Management BSc Environmental Science BSc Geography – Single Honours BSc Geology and Archaeology BSc Geology and Geography BSc Geology BSc Human Biology BSc Mathematical Engineering BSc Mathematical Sciences BSc Mathematics and Computer Science BSc Mathematics and Sports Science BSc Mathematics with Business Management BSc Mathematics with Philosophy BSc Mathematics with Psychology BSc	Honours Program options: Biochemistry Biological Sciences with Management Biotechnology Developmental Biology Ecology Evolutionary Biology Genetics Immunology Medical Biology Microbiology and Infection Molecular Biology Neuroscience Pharmacology Physiology Plant Science Reproductive Biology Zoology Experimental Pathology Pharmacology with Industrial Experience	Actuarial Science Biological Science • General Biology • Biochemistry • Biology Teaching • Cell and Developmental Biology • Ecology, Evolutionary, and Population Biology (Environmental Science option also available) • Genetic Biology • Microbiology • Molecular Biology • Neurobiology and Physiology • Plant Molecular Biology and Physiology Chemistry • Atmospheric Chemistry • Chemistry and Biochemistry • Chemistry and Chemical Engineering • Chemistry and Materials Engineering • Chemistry Education • Chemistry/Materials Chemistry • Computational Chemistry • Environmental Chemistry • General Chemistry • Bioinformatics Computer Sciences	Concentrations include: Anthropology-Zoology, Astronomy and Astrophysics, Biology, Biochemistry, Biophysics, Brain, Behaviour and Cognitive Science, Cell and Molecular Biology, Chemistry, Computer Science, Earth Sciences, Earth Systems Science, Ecology and Evolutionary Biology, Environmental Geosciences, Environment, General Biology, General Physics, Geological Sciences, Mathematics, Microbiology, Neuroscience, Oceanography, Physics, Plant Biology, Psychology, Statistics	Astronomy Atmospheric Science Biochemistry Animal Biology Cell Biology & Genetics Conservation Biology Ecology & Environmental Biology General Biology Marine Biology Plant Biology Chemistry Chemistry, Environmental Chemistry, Materials Cognitive Systems Computer Science Earth and ocean Sciences Environmental Sciences Physical Geography Mathematics Mathematical Sciences Mathematics & Economics Computer Science & Mathematics Microbiology & Immunology Computer Science & Microbiology & Immunology Biotechnology in Microbiology & Immunology Pharmacology Physics Computer Science & Physics Psychology
	Physiology Psychology Statistics Tropical Marine Science Wildlife Biology Zoology			Natural Sciences/Natural Sciences with Study in Continental Europe BSc Physics BSc Psychology BSc Sport and Exercise Sciences BSc Sports Science and Materials Technology BSc Theoretical Physics and Applied Mathematics BSc.		Earth and Atmospheric Science • Atmospheric Science • Environmental Geoscience • Earth/Space Science Teaching • Geology and Geophysics • Marine Science Mathematics • Applied Mathematics • Business Mathematics • Core Mathematics • Mathematics/Computer Science • Mathematics Education • Mathematics/Statistics • Operations Research Physics • Physics • Physics Honors • Applied Physics • Applied Physics - Honours • Applied Physics in Geophysics • Applied Physics in Geophysics Honours • Physics Teaching • Physics and Materials Science Engineering Statistics • Applied Statistics • Statistics/Mathematics Interdisciplinary		Statistics Statistics & Economics Computer Science & Statistics
			Note: * denotes double major necessary to achieve this.			* minors available are >50 but most are non-science.	* non-science concentrations are not listed	
Specialist degrees		"Streams" of the BSc include: BSc (Advanced), BSc (Advanced Mathematics), BSc (Marine Science), BSc (Molecular Biology and Genetics), BSc (Molecular Biotechnology) and BSc (Nutrition).						

Features of the Australian universities which are of interest include the following:

1. Comparison of the minimum entry cutoffs at UQ with those at the University of Melbourne and the University of Sydney indicates significantly lower minimum scores at UQ in 2006. As noted elsewhere (Section 4), the entry cutoff for the BSc at UQ decreased from OP7 to OP12 from 2004 to 2006. Although the number of students in the low OP bands was small, and the median for entry has not changed significantly, it is still a matter for concern. It will be important to analyse the statistics on lapsed students at the end of 2006 in order to determine if students in the OP 10-12 range are able to succeed in their first year of study. Performance data for the 2006 BSc intake is presented elsewhere (Section 4) in the form of semester 1 Grade Point Average verses entry score (OP or rank)
2. Subject entry requirements differ across the three Australian Universities. The University of Sydney is the least stringent, with no compulsory requirements. The only "assumed knowledge" is completion of HSC level mathematics. The University of Melbourne requires english, mathematics I/mathematics B and two of biological science, chemistry, an additional mathematics, or physics. For applicants with a notional ENTER (UAI) [see Section 4 for description of these terms] of 92.0 or greater, english, mathematics I/mathematics B and one of biological science, chemistry, physics is required. UQ requires english, mathematics B, plus one of chemistry or physics. All three universities have to deal with the issue of students' entering university with different levels of preparation, and many students not having a comprehensive background across chemistry, physics and biology on which to build the university curriculum. The University of Queensland offers BSc students bridging physics and chemistry but not biology. The University of Sydney offers bridging courses (strongly recommended) but then also offers "streams" of courses (for example chemistry) for students with differing "prior knowledge". The University of Sydney which may be to compensate for their lack of entry requirements. This university is also the only Australian university found to have compulsory mathematics within the BSc. The University of Melbourne also offers "Fundamentals of Chemistry", and "Mathematics A" as bridging courses for students who have not completed VCE chemistry or specialist maths 3/4 respectively as part of their secondary schooling.
3. It is interesting to note that at the University British Columbia, *compulsory* courses exist in chemistry, physics, biology and mathematics if these have not been taken at school.
4. First year programs exhibit major differences within and beyond Australia. In Australia, a significant feature is the responsibility which is put on students to design their programs from an apparently confusing array of choice. At the University of Sydney, students select from a large selection of subject choices. In chemistry alone, for example, a complex choice exists within first year based on differing levels of prior knowledge and ability. All of these courses are designed differently, with different assessment tasks but all serve as prerequisites for entry into second year. The University of Melbourne appears more structured. Students choose from four first year packages which guide them towards particular majors. The 4 packages are:
   - Life Sciences
   - Physical Science
   - Earth Sciences & Geography
   - Environmental Science
5. A limited range of first year courses are available in each of these plans. Particular note is made of the prescription of only 2 first level biology courses as being necessary to progress to majors in biological, biomedical and biotechnological sciences and second level studies in botany, genetics, zoology, ecology, anatomy, and cell biology, biochemistry and molecular

biology, microbiology and immunology, pharmacology, physiology and pathology. The two first level biology courses are:

- Biology of Cells and Organisms; and
- Genetics and the Evolution of Life.

6. The University of New South Wales also requires only 2 first level courses in biology for students intending to progress to further studies in life sciences areas. There are also 2 chemistry, 2 physics, 2 psychology courses etc in year 1. All year one courses at UNSW have statements of assumed prior knowledge and there are bridging courses offered for those who do not meet these requirements.
7. As noted earlier, UQ provides a large number of course plans for advice to students on suitable selections of courses. However, as also noted earlier, few students appear to be enrolling in these standard plans. One problem at UQ is clearly the number of biology courses, accounting for three quarters of a total year's load in the first year. Students wishing to acquire the full breadth of biology are subsequently limited in their other subject choices based on the small remaining space in their program following selection of biology courses.
8. An additional structural feature of note, when looking at University of Sydney and University of Melbourne, is the existence of a strong system of compulsory prerequisites for all subjects within the BSc to guarantee prior learning before proceeding to more advanced levels. Whilst at UQ, a system of compulsory prerequisites exists in some of the mathematical and physical sciences (EPSA); compulsory prerequisites are minimal within the biological and chemical sciences (BACS).

Features of the overseas universities which are of interest include the following:

1. At the University of Birmingham, up to a third of student time is spent doing practical work.
2. At the University of Michigan, a compulsory first year writing requirement must be completed, as well as an upper-level writing requirement. Other compulsory components also exist, for example, in quantitative reasoning.
3. UBC offers two interesting first year programs:
   i. **"Science One"**: a 27 credit point year course integrating biology, chemistry, physics and mathematics, into a single multidisciplinary course, comprising an elite group of 80 students with high entry scores in chemistry, physics, mathematics and biology, and thus creating a distinct community of high achieving learners; and
   ii. **"Coordinated Science Program"** (CSP): an alternative to standard first year science. The CSP is suitable for students who have broad scientific interests and want to explore connections between the disciplines. All CSP students attend the same sections of specific core science courses: biology, chemistry, physics and maths, with an option in computer science. It is available for 168 students.
4. "Advanced Placement" programs exist at Universities of Michigan and Purdue, where high achieving students can gain credit for high school work and thus enable enrolment in a more advanced course when they arrive at university - in some cases university exams are necessary for qualification for these programs.

While there is a great deal of difference within the structures of the BSc's at the institutions examined, with regards to different rules and regulations, there were some basic overall similarities. The degrees all offered a level of diversity across many disciplines and a breadth of choice. There was also the common theme that within a BSc students should culminate, with time, with a focus on a particular area of science whether that is called a major, or a 'concentration' or some other term.

2.7 The Use of Technology

2.7.1 A short history of e-Learning in BACS - Early Origins

The first known foray into the world now known as e-Learning in the faculty was in 1967 when computer marking of multiple choice questions, combined with item analysis, was introduced into the Department of Physiology and Pharmacology. Written in Fortran and run on a GE225 mainframe this application produced objective analysis of student performance. The data was then used to enhance the question banks.

The first use of computer assisted learning involving direct student interaction was introduced in 1984. The application known as “Human”, was primarily used by medical students as a simulator for some basic physiological properties and used a print only terminal. This package is now available as a web-based simulation[1] which is a prime example of how the technology has evolved in the last 20 years.

The first major forays into e-Learning otherwise referred to as computer based teaching (CBT) or computer managed or assisted learning (CML, CAL), took place in the mid to late 1980’s when the first clusters of personal computers appeared in the departments. Enthusiastic academic staff using relatively crude software tools or coding natively in a number of languages, produced learning materials for a small cohort of students. Specific commercial applications associated with molecular or ecological models or human physiological simulators were used in a small number of classes while histological and anatomical images located on servers were used for class teaching or student revision. HyperCard[2] and Authorware[3] were two key applications used to prepare some of this original material.

The Department of Chemistry also developed a computer managed testing system (CMT) to support progressive assessment in first level classes of more than a 1000. This system was advanced for its time in that questions were randomly generated based on a series of fundamental chemical principles and each student took home a unique paper test. Student responses were then entered online at a later date. This innovative use of resources meant a large number of students could access individualised assessments without the requirement for large computing resources.

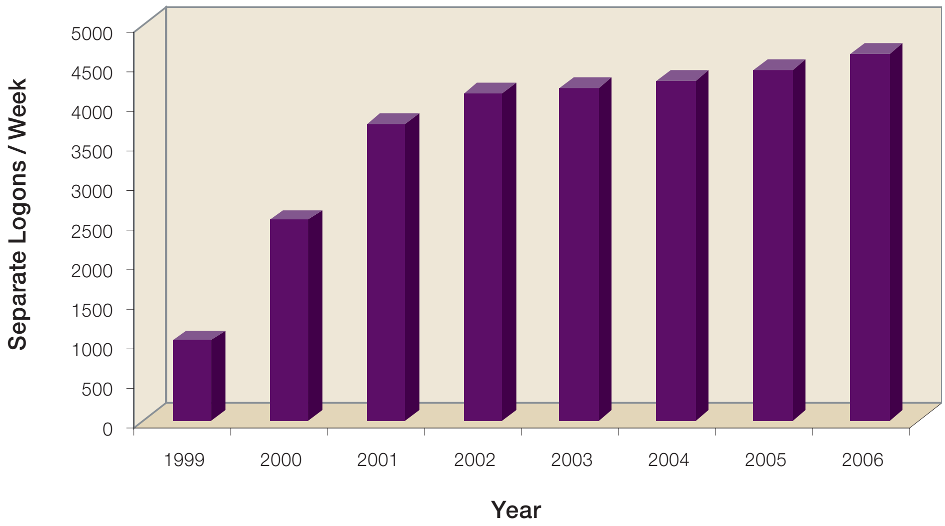
Undergraduate student computer laboratories were located in the Departments of Chemistry, Biochemistry, Physiology and Pharmacology and Anatomy while Zoology had small facility for graduate students. The Department of Physiology and Pharmacology also upgraded three experimental laboratories in 1990 with data acquisition hardware coupled to personal computers. This enabled students to sample data from wet preparations or human subjects for real time or offline analysis of physiological and pharmacological data.

2.7.1.1 The interactive Learning Centre (iLC)

The first faculty wide collaborative approach to e-Learning started with the interactive Learning Centre[4] which opened in March 1999. Existing student computer laboratories located in the departments were combined to form the iLC with two rooms located in the old computer Science Building. The larger of the two rooms (iLC1) had 32 computers with 64 seats while the second, smaller room (iLC2) had 16 workstations with 32 seats. Purpose built, these laboratories were designed to act as a “home” for BSc students, particularly first year students, who were not directly associated with a department in the early years of their program. The iLC was further expanded in 2001 to three rooms (iLC3) with an added capacity of 32 workstations and another 32 computers went online in 2003 (iLC4). A satellite laboratory was also established in the Biochemisty building (iLC5 – 20 workstations) which replaced a laboratory previously managed by the school.

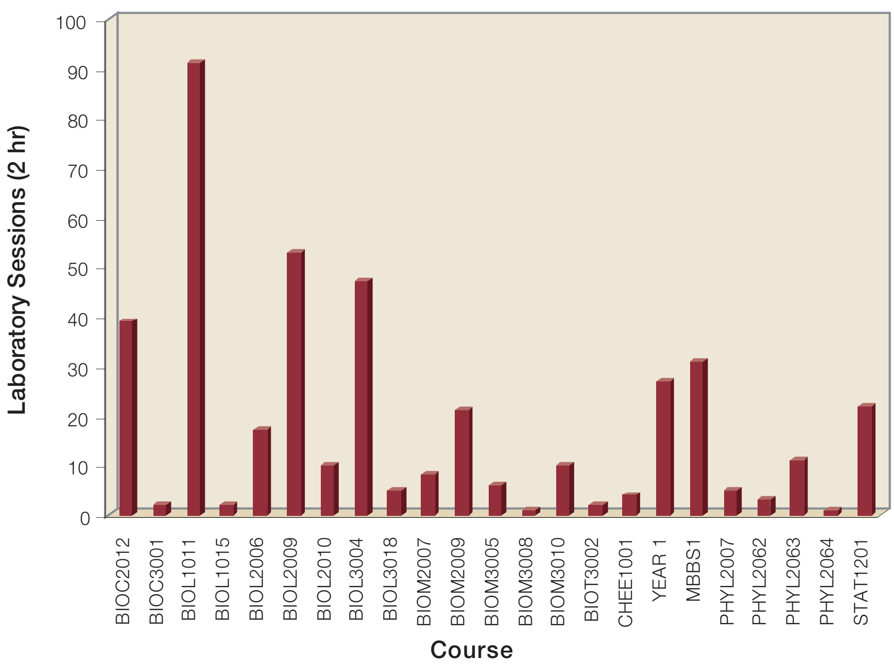
The total capacity of the iLC is 155 workstations which are available to the students from approximately 7.30am to 6pm Monday to Friday. Formal use of the five laboratories has increased from an average of around a thousand logons per week in 1999 to plateau at an average of around 4000 per week over the period 2003 - 2006. Peak periods have seen more that 7000 students a week use the laboratories (Figure 2.4).

Figure 2.4 Weekly use of the interactive Learning Centre (separate logons per week)



The iLC is used by a wide range of courses covering all the disciplines of the faculty. Over the academic year of 26 weeks approximately 50 courses hold computer assisted learning sessions in the laboratories which equates to approximately 30% of all undergraduate courses available. Course contact varies from only a few sessions to some courses where a significant proportion of the total course contact is spent working with computers. A sample of both the courses and their contact time in the iLC for one semester (13 weeks) is seen in Figure 2.5. Based on the official contact periods allocated in the timetable for each course this means for the peak periods of 10am to 1pm and 2pm to 5pm the iLC is running at a capacity of around 83%. Outside these periods the laboratories are purposely kept open for individual student access or special events.

Figure 2.5 Laboratory sessions per course for one semester. Total possible peak time sessions are 650 for the combined laboratories.



2.7.1.2 Learning management systems

To support the e-Learning requirements of the Faculty a basic learning management system was developed over the period 1999 to 2004. Subsequently named iTeach, this system provided a mechanism for staff to upload learning resources to a course home site. The system also provides an online discussion tool a basic announcement system and a series of management tools.

The other major component of the learning management system was the Course Profile. Developed over a period three years, the course profile system, enabled staff to electronically manage individual profiles in a coordinated manner. BACS is still one of the few academic divisions within the university to have all courses online. As of the end of the 2005 academic year approximately 617 undergraduate and graduate courses had an online presence ranging from a simple course profile to a fully managed site with all available course materials online.

2.7.1.3 Teaching & Learning administrative support systems

In addition to the learning management system a number of other major systems were developed to support both the teaching and research programs. iStaff is a major human resource tool for the schools and acts as the repository for all staff information used on school, centre and faculty web sites. iStaff is also used to manage information associated with graduate and honours students. The software is networked so that all information relating to staff and students enrolled in undergraduate and graduate research programs is held in one location. This system is unique since it takes staff related information from university systems and collates this data with school and faculty specific teaching, research and administrative information to provide a comprehensive and unified staff management tool. Other tools include iMark and iQ.

iMark is an assessment management tool which holds student marks. A key feature is its integration with iTeach which significantly reduces the problems of holding the same data in different systems. iMark is also used to record student submission of hardcopies of assignments. Each school has a submission box where bar-coded assignments are scanned and registered automatically against the student entry in iMark and the student is given a printed receipt. This system eliminates many of the problems associated with hard copy assignment submission and creates a fully documented electronic trail.

iQ is a networked exam management system designed to produce formatted hard copy exams or it can export question sets for import to Blackboard for online formative student learning or online summative testing. iQ currently holds approximately 16,000 test items ranging in style from essay to multiple choice questions. A number of unique quality assurance mechanisms are built into iQ including exam performance statistics which can be used to automatically quarantine a question, flags that can be set to minimise common problems associated with developing multiple choice questions and mechanisms to reduce or prevent the use of the same question in succeeding exams.

2.7.1.4 e-Learning coordinators

To facilitate the management of iTeach, iStaff and iMark and to assist academic staff in the management of their courses, e-Learning Coordinators have been nominated by each school. These staff play a vital coordinating role across the faculty and the majority of the teaching and learning systems described above were developed based on “local” practical feedback. e-Learning staff will also play a pivotal role in the faculty transition to Blackboard.

2.7.1.5 Web sites

The first web sites were developed by the individual departments of the faculty around 1996/7 with most sites hosted on local servers. Basic teaching material was made available online but there was no coordinated approach to online delivery of material. With the amalgamation of departments into schools in 2001 and the iLC assuming responsibility for online content delivery, a decision was made to transfer all existing web sites to the universities web-based content management system (OCMPS). A significant amount of the information published on web pages are actively sourced from databases. Faculty-based course web sites will be phased out in 2006 as the faculty moves to university systems.

2.7.2 e-learning in the Faculty of Engineering, Physical Sciences & Architecture (EPSA)

At the same time a number of similar and different developments simultaneously occurred in the EPSA faculty. In 2002 the School of Engineering introduced the electronic course profile system. This is a system that:

- Provides students with all required course information in a consistent yet flexible manner.
- Encourages further adoption of student-centred teaching practices. The e-course profile system assists staff to develop best teaching and learning practices by using a sound pedagogic framework as the basis for course design and delivery.
- Enhances the learning experience for students. The ability to centralise learning resources and coordinate course delivery, including assessment requirements and timetables is seen as a major improvement.
- Map graduate attributes for programs. This assists in the reporting of learning outcomes at program level through aggregation of course learning outcomes and their relationship to graduate attributes.
- Provide better quality assurance and reporting. The School Teaching & Learning Committee can audit course profiles before they are published, thus ensuring best practice and compliance with University policy.

This system is the foundation for the University wide e-course profile system. In 2005 the School of Information Technology &Electrical Engineering participated in the 4 school pilot of the next generation of the system which is intended for deployment across the University in 2006. All EPSA schools are participating the university wide roll out of the system which will replace and centralize the school based systems.

The School of Information Technology & Electrical Engineering is the regional Asia-Pacific hub for the MIT iCampus initiative and as such is involved in profiling and facilitating the development of a number of e-learning initiatives. These include the development of real time experiments which can be accessed on-line by students 24 hour per day, 7 days per week remotely, and the development of additional interfaces which can enhance and further support learning. Staff from physics are working in collaboration with school staff to develop new experiments that will have wide use and appeal.

The School of Physical Sciences also has participated in a number of projects which aim to support learning in mathematics using a variety of resources including virtual resources. A number of small Faculty supported projects have culminated in a successful Carrick Competitive Project grant being awarded to support further development of this work on developing a new enabling technology to support learning and teaching quantitative skills. This project will directly address these issues by creation of a flexible electronic framework through which students have access to a very large number of illustrative examples, problems and questions that cover a wide range of fundamental mathematical, statistical and quantitative skills. The key component of the electronic framework is a system that:

- Automatically generates a suite of random questions and corresponding fully-worked, formatted solutions to every question, clearly and unambiguously reproducing the steps that students would typically take, thus enabling inquiry-based learning;

- Provides students with a mechanism for concentrating on exactly those concepts which cause them difficulties, thus improving their technical and creative abilities;
- Can be used as a powerful learning aid by providing support for both introductory and advanced mathematical concepts and processes;
- Makes use of interactive web-based presentation of solutions, allowing students to work
- in a self-directed manner;
- Allows instructors to efficiently and easily create resources for illustrative examples, practice materials and potentially for individualised assessment; and
- Is directly usable in all discipline areas that require quantitative skill

The following list of e-learning projects are supported by the EPSA Faculty Teaching & Learning Committee for the development of e-learning resources impacting on the BSc.

Projects funded in 2006:

- Development of a compulsory interactive Web-tutorial on Plagiarism
- Development of a Remote Physics Experiment on Radioactivity
- Web-based Document Repository Infrastructure to Support Student Teams
- Engaging students with large-scale research driven problems in computational science
- Embedding team working skills in the curriculum - proactively ensuring student team success
- A new enabling technology for learning and teaching quantitative skills

Projects funded in 2005 are:

- ITEE Research Wiki Project
- Development of a Framework for Online Lab Equipment Access
- Strengthening essential skills of students entering a large introductory statistics course

Projects funded in 2004 are:

- Mathematical Enrichment activities for advanced students
- Strengthening essential skills of students entering key mathematics courses
- Web Log Infrastructure for Student Project Courses
- SMS Infrastructure for Student Communication

Projects funded in 2003 are:

- Development of teaching resources for introductory studies in computational science.

[1] *http://www.skidmore.edu/academics/human/index.php*

[2] *http://en.wikipedia.org/wiki/HyperCard*

[3] *http://www.macromedia.com/software/authorware/?promoid=BINL*

[4] *http://ilc.uq.edu.au/*

Section 3

Effectiveness & Quality of the Program

3.1 Enrolments in the Program

Total enrolments in the BSc over the past 5 years, together with dual degree enrolments, are given in Tables 3.1 and 3.2. The data show that 29% of BSc students in 2006 are enrolled in dual degree programs, with the BSc/BA being the most popular. The BSc/BEd is now one of two alternative pathways for secondary science teachers, with the re-introduction in 2006 of the Postgraduate Diploma in Education. Other indicators relating to the quality of the program (OP/rank cutoffs for entry, attrition, retention and completion, etc) are given in Section 4.

Table 3.1 Student enrolments at the Program level – single degree (2001-2006)

	2001		2002		2003		2004		2005		2006 (Preliminary)	
	EFTSL	# of Students	EFTSL	# of Students	EFTSL	# of Students	EFTSL	# of Students	EFTSL	# of Students	EFTSL	# of Students
BSc	1,867.94	2216	1,890.44	2264	1,873.63	2222	1,778.56	2146	1,872.06	2209	1,876.69	2304
BBiotech	141.63	158	201.81	231	229.44	257	212.00	240	176.69	204	165.63	194
BEnvSc	85.44	91	89.25	96	70.19	81	68.50	81	60.38	75	56.63	70
BMarSt			38.94	47	71.25	82	102.19	115	105.50	121	118.25	136
BSc(Hons)	217.69	279	219.06	279	225.00	283	223.94	288	234.44	299	214.31	275

Table 3.2 Student enrolments at the Program level – dual degree (Science)

	2001		2002		2003		2004		2005		2006 (Preliminary)	
	EFTSL	# of Students	EFTSL	# of Students	EFTSL	# of Students	EFTSL	# of Students	EFTSL	# of Students	EFTSL	# of Students
BBusMan/BSc	96.31	110	86.65	97	88.19	98	82.94	93	80.94	95	67.81	80
BComm/BSc	140.67	147	151.18	161	130.00	138	104.75	116	81.00	92	77.25	88
BEcon/BSc	30.04	31	26.44	28	27.50	31	23.50	26	29.44	33	24.75	30
BEng/BSc	61.85	67	122.56	132	136.57	149	164.92	180	189.13	209	178.23	198
BInfTech/BSc					20.81	24	22.31	27	26.25	31	25.25	30
BSc/BArts	293.33	349	302.42	359	310.23	372	309.68	361	250.70	305	224.22	277
BSc/BEduc	105.59	122	123.26	143	109.53	129	109.49	130	103.00	122	75.19	94
BSc/BJourn					8.50	10	12.75	15	21.00	21	18.63	20
BSc/BLaws	115.84	119	132.63	140	122.21	132	111.92	122	110.91	118	109.04	126

3.2 Aims, Objectives and Graduate Attributes of the Current Program

The University of Queensland has had a statement of graduate attributes since 1996. In 2001 these were revised and a plan to map and embed these into programs of study was devised so that graduate attributes are now an explicit part of the curriculum. University-wide attributes for Bachelors' degrees are given in Table 3.3 below.

Table 3.3 Graduate attributes for Bachelors degrees at UQ

A University of Queensland Bachelor degree graduate will have: • in-depth knowledge in the field(s) studied • effective communication skills • independence and creativity • critical judgement; and • ethical and social understanding.
A Bachelor degree with honours graduate will demonstrate: • in-depth extension of learning in the discipline as well as evidence of research or research training in the discipline.
The following statement outlines the key features of the graduate attributes indicated above.
In-depth knowledge & skills in the field of study • A comprehensive and well-founded knowledge in the field of study. • An understanding of how other disciplines relate to the field of study. • An international perspective on the field of study.
Effective communication • The ability to collect, analyse and organise information and ideas and to convey those ideas clearly and fluently, in both written and spoken forms. • The ability to interact effectively with others in order to work towards a common outcome. • The ability to select and use the appropriate level, style and means of communication. • The ability to engage effectively and appropriately with information and communication technologies.
Independence and creativity • The ability to work and learn independently. • The ability to generate ideas and adapt innovatively to changing environments. • The ability to identify problems, create solutions, innovate and improve current practices.
Critical judgement • The ability to define and analyse problems • The ability to apply critical reasoning to issues through independent thought and informed judgement • The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.
Ethical and social understanding • An understanding of social and civic responsibility • An appreciation of the philosophical and social contexts of a discipline • A knowledge and respect of ethics and ethical standards in relation to a major area of study • A knowledge of other cultures and times and an appreciation of cultural diversity.

When the process of developing a corresponding set of graduate attributes for the BSc was commenced in 2002, there were several impediments to developing a single statement across all fields of study, not the least of which was our inexperience in the area. As a result, and as previously noted in Section 2 of this document, a single statement of graduate attributes was developed (i) separately for all fields of study within BACS; and (ii) each separate field of study offered by EPSA, SBS and Health Sciences. Each of the Faculties also developed their own strategies for mapping these attributes to course goals, activities and assessment. Examples from the three Faculties can be found in Table 3.4 (BACS), Table 3.5 (EPSA), and Table 3.6 (SBS).

Table 3.4 Mapping course goals and assessment to BSc graduate attributes for BACS faculty course BIOM2008 (Integrated Physiology)

BSc attributes applicable to this course	Activities and assessment in this course which leads to development of these attributes
Knowledge and understanding of: - the chosen field - the process of scientific research	• Lectures specific to the discipline with a focus on the integration of cells and systems. • Completion of a self-directed learning exercise as a preparation for additional lecture material. • Learning about the nature of scientific and experimental evidence as the foundation of scientific knowledge in areas of central nervous system, sensory, metabolic and reproductive physiological integration.
Skills and ability: - skills valued in a science-based workplace - experimental skills in chosen field - ability to apply scientific knowledge creatively to solving problems - skills in analysing problems in chosen field - ability to apply analytical and problem solving skills to complex issues - communication skills appropriate for entry into a science based workplace - communication skills appropriate for informed debate on scientific issues - ability to contribute to informed debate on ethical issues	• Learning how to investigate a biological question and identify valid and relevant scientific data. • Preparation of an experimental series designed to investigate an hypothesis. • Acquisition of work flow and motor skills associated with the collection of data. • The use of statistical tools for the validation of experimental data and the development of arguments to support or reject a scientific hypothesis. • Learning to discriminate between peer-reviewed and non-reviewed scientific information sources. • Learning how to access and search databases of scientific information to research a question. • Preparation of a weekly laboratory report in a format consistent with a scientific laboratory notebook. • Developing ideas about solutions to a scientific question outside their current scientific knowledge base. • Answering multiple choice questions in an examination context and being able to produce clear concise responses in the form of an essay or short answer format.
Appreciation of: - the way different science disciplines integrate - the collegial and international aspects of science - the value of science to our culture	• Working as part of a research team containing members from different cultural backgrounds. • Discussing with tutors the practical and theoretical relevance of the experimental project they have designed and how the conclusions they reach are the product of both theoretical knowledge and practical experience.
Effective communication: - communication skills appropriate for informed debate on science issues	• Constructing a group poster summarising the experimental evidence and presenting a conclusion about a specific research project. • Group oral presentation about a considered piece of scientific research. • Responding to questions related to a scientific research project from the student and staff audience. • Formulation of specific science questions for fellow students presenting other group projects.
Independency and creativity: - the ability to work and learn independently - the ability to create solutions, innovate and improve current practice	• Self directed learning module where the student develops the discipline and focus required to complete a substantial piece of scientific literature research.

Table 3.5 Mapping graduate attributes to EPSA faculty course MATH1050 (Mathematical Foundations)

Learning Objectives

After successfully completing this course you should be able to:

1. perform basic operations with vectors and matrices
2. model physical situations using vectors
3. identify arithmetic and geometric sequences and some of their applications
4. represent complex numbers in various ways
5. apply the fundamental theorem of algebra
6. recognise mathematical functions
7. calculate the derivative of many functions
8. apply differentiation to solve applied problems
9. apply a variety of techniques of integration
10. present clear and concise written solutions to a variety of mathematical problems

Successfully completing this course will contribute to the recognition of your attainment of the following UQ (Undergraduate Pass) graduate attributes:

GRADUATE ATTRIBUTE	Learning Objectives
A. IN-DEPTH KNOWLEDGE OF THE FIELD OF STUDY	
A1. A comprehensive and well-founded knowledge in the field of study.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
A4. An understanding of how other disciplines relate to the field of study.	2, 3, 8
A5. An international perspective on the field of study.	
B. EFFECTIVE COMMUNICATION	
B1. The ability to collect, analyse and organise information and ideas and to convey those ideas clearly and fluently, in both written and spoken forms.	2, 3, 8, 10
B2. The ability to interact effectively with others in order to work towards a common outcome.	
B3. The ability to select and use the appropriate level, style and means of communication.	10
B4. The ability to engage effectively and appropriately with information and communication technologies.	
C. INDEPENDENCE AND CREATIVITY	
C1. The ability to work and learn independently.	1, 2, 3, 4, 5, 7, 8, 9
C3. The ability to generate ideas and adapt innovatively to changing environments.	2, 3, 8
C4. The ability to identify problems, create solutions, innovate and improve current practices.	
D. CRITICAL JUDGEMENT	
D1. The ability to define and analyse problems.	2, 3, 8
D2. The ability to apply critical reasoning to issues through independent thought and informed judgement.	2, 3, 8
D3. The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.	
E. ETHICAL AND SOCIAL UNDERSTANDING	
E1. An understanding of social and civic responsibility.	
E2. An appreciation of the philosophical and social contexts of a discipline.	
E4. A knowledge and respect of ethics and ethical standards in relation to a major area of study.	
E5. A knowledge of other cultures and times and an appreciation of cultural diversity.	

Table 3.6 Mapping Graduate Attributes to SBS Faculty Course PSYC2020 Neuroscience for Psychologists

Learning Objectives After successfully completing this course you should be able to	**Graduate Attributes** Successfully completing this course will contribute to the recognition of your attainment of the following UQ (Undergrad Pass) graduate attributes:
1 locate basic brain structures and use anatomical terms	A1, B3
2 identify types of brain cells and their functions	A1, B3
3 identify parts of neurons	A1, B3
4 specify how signals are transmitted through neurons	A1, B3
5 specify the consequences of damage to certain brain regions	A1, A4, A5, B1, B3, D1, D2, D3, E1, E2, E5
6 define some key neurological syndromes (for example, amnesia, agnosia, aphasia)	A1, A4, A5, B1, B3, D1, D2, D3, E1
7 specify the distinctions between several types of key neurological syndromes	A1, A4, B1, B3, D1, D2, D3, E4
8 specify how brains develop, and how brain development has evolved	A1, A4, A5, B1, B3, D1, D2, D3, E2
9 define and explain basic facts about how neurons, neurotransmitters and complex brain systems operate to produce normal and abnormal cognition, emotions and behaviour	A1, A4, B1, B3, D1, D2, D3, E5
10 demonstrate your understanding of these facts in tests, written reports and oral presentations	A1, A4, B1, B2, B3, B4, C1, D1, D2, D3
11 write an empirical report about a behavioural experiment, clearly defining theory, methods, data and results and inferences to be drawn from data and results	A4, B1, B3, B4, C1, C3, C4, D1, D2, D3
12 demonstrate, through role-playing of neuropsychological assessment, a knowledge of some key tests that can differentiate some neurological syndromes	A1, A4, B1, B2, B3, C3, C4, D1, D2, D3, E1
13 demonstrate, through role-playing of neuropsychological assessment and discussion of coping strategies, an understanding of what cognitive deficits would be like from a neurological patient's point of view	A1, A4, B1, B2, B3, C3, C4, D1, D2, D3, E1, E2, E4, E5
14 understand and explain how both low-level abilities, such as perception and motor control, and higher-level abilities, such as language and problem-solving, are organised in the brain	A1, A4, B1, B3, C1, D1, D2, D3
15 Identify and explain the range of research methods used in neuroscience.	A1, A4, B1, B3, C1, D1, D2, D3, E1, E2, E4, E5

Successfully completing this course will contribute to the recognition of your attainment of the following UQ (Undergrad Pass) graduate attributes:

Graduate Attributes	Learning Objectives
A. IN-DEPTH KNOWLEDGE OF THE FIELD OF STUDY	
A1. A comprehensive and well-founded knowledge in the field of study.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15
A4. An understanding of how other disciplines relate to the field of study.	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
A5. An international perspective on the field of study.	5, 6, 8
B. EFFECTIVE COMMUNICATION	
B1. The ability to collect, analyse and organise information and ideas and to convey those ideas clearly and fluently, in both written and spoken forms.	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
B2. The ability to interact effectively with others in order to work towards a common outcome.	10, 12, 13
B3. The ability to select and use the appropriate level, style and means of communication.	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
B4. The ability to engage effectively and appropriately with information and communication technologies.	10, 11
C. INDEPENDENCE AND CREATIVITY	
C1. The ability to work and learn independently.	10, 11, 14, 15
C3. The ability to generate ideas and adapt innovatively to changing environments.	11, 12, 13
C4. The ability to identify problems, create solutions, innovate and improve current practices.	11, 12, 13
D. CRITICAL JUDGEMENT	
D1. The ability to define and analyse problems.	5, 6, 7, 9, 10, 11, 12, 13, 14, 15
D2. The ability to apply critical reasoning to issues through independent thought and informed judgement.	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
D3. The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
E. ETHICAL AND SOCIAL UNDERSTANDING	
E1. An understanding of social and civic responsibility.	5, 6, 12, 13, 15
E2. An appreciation of the philosophical and social contexts of a discipline.	5, 8, 9, 13, 15
E4. A knowledge and respect of ethics and ethical standards in relation to a major area of study.	7, 13, 15
E5. A knowledge of other cultures and times and an appreciation of cultural diversity.	5, 9, 13, 15

The articulation and mapping of graduate attributes is still being refined in many programs and courses at UQ. Issues for the BSc in the future include:

- the agreement on a single set of attributes for the BSc;
- the simplification of these attributes so that they become more useful to staff and students;
- the derivation of useful sets of attributes or outcomes for each major in the BSc, which communicate to students the unique features of the major.

As noted in Section 2, the flexible structure of the current BSc, with the exception of some fields such as Psychology and Computer Science, does not lead readily to mapping of graduate attributes across a three-year program of study. Simplification of the list of majors and better structuring of each major would certainly facilitate this.

3.3 Summary of Survey Data Related to Program Effectiveness

3.3.1 Quantitative feedback from students: Course Experience Questionnaire (CEQ) Data

Quantitative data on the effectiveness of the BSc program related to its stated aims, objectives and graduate attributes may be isolated from specific items in the Course Experience Questionnaire (CEQ). The CEQ is administered to all graduating students at all universities at the end of April (December graduates) and October (August graduates) following graduation. Therefore, it is some time into the following year before results for the previous year's graduates are available.

The report permits (i) comparison across Bachelors' degrees at UQ and (ii) comparison by broad science field with other universities.

The CEQ questions relevant to Graduate Attributes are the Generic Skills Scale and the Graduate Qualities Scale. The specific questions that comprise these scales are listed at the top of Tables 3.7 and 3.8 respectively. The results are displayed as the overall percentage of students who "Broadly Agreed" or "Agreed" with the 6 statements that related to the Generic Skills scale. The statements are distributed throughout the questionnaire to avoid bias in responses. Data from other CEQ scales are reported on in Section 5 of this report.

The relevant questions in the CEQ which relate to the analysis of program quality and effectiveness in the **Generic Skills Scale** include:

Question 3 The course helped me develop my ability to work as a team member.

Question 6 The course sharpened my analytical skills.

Question 14 The course developed my problem-solving skills.

Question 20 The course improved my skills in written communication.

Question 25 As a result of my course, I feel confident about tackling unfamiliar problems.

Question 26 My course helped me to develop the ability to plan my own work.

Table 3.7 CEQ results on program quality and effectiveness of the BSc compared with whole of UQ (2001 – 2004) using the questions in the Generic Skills Scale

Program Description	Year of Graduation	% Broadly Agree	% Agree	Total Responses	Number of Respondents	Total No. of Graduates
B Sc	2001	84%	61%	1704	284	609
	2002	88%	61%	1811	302	586
	2003	91%	70%	1403	234	473
	2004	89%	68%	1308	218	526
Bachelor's Pass (all of UQ)	2001	88%	66%	13400	2239	4971
	2002	90%	68%	15857	2650	5239
	2003	92%	74%	11631	1941	4339
	2004	89%	68%	12918	2156	5345

The relevant questions in the CEQ which relate to the analysis of program quality and effectiveness in the **Graduate Qualities Scale** include:

Question 5 The course provided me with a broad overview of my field of knowledge.

Question 9 The course developed my confidence to investigate new ideas.

Question 18 University stimulated my enthusiasm for further learning.

Question 22 I learned to apply principles from this course to new situations.

Question 24 I consider what I learned valuable for my future.

Question 28 My university experience encouraged me to value perspectives other than my own

Table 3.8 CEQ results on program quality and effectiveness of the BSc compared with whole of UQ (2001 – 2004) using the Graduate Qualities Scale

Program Description	Year of Graduation	% Broadly Agree	% Agree	Total Responses	Number of Respondents	Total No. of Graduates
B Sc	2001	88%	69%	1704	284	609
	2002	90%	68%	1809	302	586
	2003	94%	77%	1401	234	473
	2004	91%	74%	1307	218	526
Bachelor's Pass (all of UQ)	2001	90%	69%	13403	2239	4971
	2002	91%	70%	15843	2649	5239
	2003	93%	77%	11618	1940	4339
	2004	91%	70%	12916	2156	5345

The data indicate that the BSc compares favourably with other Bachelors' degrees at UQ on both the Generic Skills Scale and the Graduate Qualities Scale.

The results for the Generic Skills Scale for the UQ BSc were also compared with other GO8 universities over the period 1998 – 2005, using the following broad fields of science study:

- life sciences (biology, zoology, plant sciences etc)
- chemistry
- psychology
- mathematics
- physical science.

Tables 3.9 to 3.13 show the results of this analysis and it can be seen that in all fields represented in the BSc, UQ scores consistently high in comparison with other Australian universities.

Table 3.9 Comparison of BSc at UQ with GO8 group using CEQ on Generic Skills
Generic Skills Scale responses from students graduating in Life Sciences
N = Number of Participants

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	65% (223)	67% (172)	68% (142)	61% (129)	60% (112)	64% (107)	62% (198)	68% (172)
Australian National University	60% (70)	64% (83)	67% (63)	68% (65)	67% (75)	67% (48)	76% (35)	75% (92)
University of Melbourne	61% (221)	62% (254)	61% (201)	58% (252)	65% (250)	67% (336)	65% (244)	66% (380)
Monash University	60% (150)	63% (178)	60% (52)	61% (111)	59% (138)	70% (114)	69% (185)	69% (167)
University of New South Wales	56% (79)	55% (67)	58% (42)	59% (46)	54% (71)	60% (57)	53% (73)	69% (121)
University of Sydney	58% (246)	65% (228)	66% (188)	69% (217)	70% (166)	69% (197)	68% (306)	64% (241)
The University of Queensland	61% (326)	65% (182)	61% (205)	62% (219)	67% (209)	66% (287)	72% (249)	71% (256)
University of Western Australia	67% (200)	66% (210)	68% (220)	68% (190)	70% (106)	77% (110)	67% (110)	71% (217)

Table 3.10 Comparison of BSc at UQ with GO8 group using CEQ on Generic Skills
Generic Skills Scale responses from students graduating in Chemistry

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	59% (17)	49% (12)	61% (17)	55% (7)	72% (17)	61% (14)	45% (25)	69% (13)
Australian National University	70% (5)	60% (12)	63% (4)	69% (8)	70% (12)	61% (6)		74% (13)
University of Melbourne	64% (43)	62% (34)	57% (16)	50% (43)	68% (30)	66% (27)	60% (14)	64% (31)
Monash University	63% (28)	53% (33)	60% (15)	39% (11)	75% (8)	68% (13)	66% (22)	50% (3)
University of New South Wales	42% (6)	75% (4)	40% (5)	94% (3)		100% (1)		
University of Sydney	45% (41)	63% (24)	70% (27)	53% (20)	66% (26)	71% (29)	69% (34)	67% (34)
The University of Queensland	63% (16)	72% (12)	50% (4)	66% (8)	67% (8)	71% (17)	80% (10)	83% (13)
University of Western Australia	56% (16)	47% (12)	53% (11)	67% (20)	46% (8)	62% (7)	56% (8)	65% (24

Table 3.11 Comparison of BSc at UQ with GO8 group using CEQ on Generic Skills
Generic Skills Scale responses from students graduating in Psychology

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	57% (82)	57% (53)	56% (46)	57% (34)	65% (43)	60% (40)	65% (66)	57% (61)
Australian National University	61% (58)	64% (62)	61% (45)	60% (37)	64% (42)	62% (30)	65% (37)	70% (77)
University of Melbourne	61% (78)	58% (132)	61% (110)	61% (103)	59% (89)	61% (122)	61% (90)	63% (119)
Monash University	69% (169)	67% (182)	68% (74)	67% (104)	62% (129)	66% (97)	65% (179)	70% (63)
University of New South Wales	52% (13)	66% (10)	59% (15)	55% (8)		33% (2)	0% (1)	75% (6)
University of Sydney	59% (148)	56% (164)	57% (109)	58% (75)	66% (91)	66% (119)	66% (81)	70% (97)
The University of Queensland	63% (176)	63% (123)	66% (107)	67% (137)	64% (122)	70% (170)	73% (129)	72% (158)
University of Western Australia	64% (41)	73% (71)	66% (56)	72% (71)	83% (45)	73% (56)	72% (68)	71% (95)

Table 3.12 Comparison of BSc at UQ with GO8 group using CEQ on Generic Skills
Generic Skills Scale responses from students graduating in Mathematics

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	45% (40)	52% (20)	45% (29)	48% (29)	58% (18)	54% (19)	47% (53)	59% (23)
Australian National University	61% (17)	53% (21)	59% (15)	56% (20)	46% (8)	63% (9)	57% (7)	62% (10)
University of Melbourne	61% (29)	60% (19)	58% (24)	53% (47)	64% (36)	58% (52)	65% (39)	60% (66)
Monash University	52% (22)	54% (23)	54% (8)	49% (17)	61% (16)	33% (6)	47% (15)	50% (1)
University of New South Wales	42% (27)	44% (10)	25% (4)	49% (15)				
University of Sydney	48% (69)	53% (55)	48% (41)	45% (19)	61% (29)	52% (56)	52% (41)	57% (48)
The University of Queensland	53% (33)	43% (15)	64% (12)	47% (19)	70% (12)	57% (27)	67% (19)	63% (21)
University of Western Australia	49% (15)	53% (10)	65% (12)	64% (12)	63% (5)	61% (9)	64% (19)	58% (24)

Table 3.13 Comparison of BSc at UQ with GO8 group using CEQ on Generic Skills
Generic Skills Scale responses from students graduating in the Physical Sciences

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	50% (4)	58% (8)	54% (8)	44% (3)	67% (4)	61% (11)	42% (15)	67% (14)
Australian National University	67% (2)	67% (8)	78% (3)	70% (9)	81% (6)	65% (14)	33% (3)	82% (13)
University of Melbourne	60% (8)	62% (18)	45% (13)	59% (28)	50% (17)	58% (32)	65% (29)	64% (35)
Monash University	65% (16)	45% (14)	71% (4)	61% (8)	67% (10)	53% (10)	55% (17)	
University of New South Wales	50% (1)	25% (2)		67% (4)	75% (4)	33% (2)	17% (3)	92% (4)
University of Sydney	71% (8)	72% (12)	52% (16)	62% (15)	56% (17)	76% (26)	68% (25)	64% (25)
The University of Queensland	44% (7)	67% (2)	88% (4)	61% (3)	56% (9)	68% (14)	78% (6)	76% (15)
University of Western Australia	78% (3)	58% (2)	63% (5)	71% (7)	73% (5)	56% (3)	83% (12)	75% (19)

3.3.2 Quantitative feedback from students: UQ Student Experience Survey (UQSES) Data

The University's internal survey instrument, the UQ Student Experience Survey (UQSES) is administered each year to graduating students and to first year students. This permits comparison across all Bachelors' degrees at UQ, under the major Graduate Attribute headings:

- Communication and Problem-Solving;
- Discipline Knowledge and Skills;
- Ethical and Social Sensitivity

The item in this survey relevant to course quality and Graduate Attributes is:

"Thinking about your major area of study or discipline, how much has your experience at UQ contributed to the development of the following skills and outcomes?"

Students were asked to respond to this item in terms of each of the statements below for each of the three graduate attributes:

**Note: These UQSES items were developed at UQ to measure the UQ defined graduate attributes. However, as some of the attributes were covered adequately by items in the Generic Skills Scale of the CEQ, Questions 1-4 were in the list below were are taken from the CEQ questionnaire and included in this analysis.*

(1) Communication and Problem-Solving Scale

Question 1 As a result of my courses, I feel confident about tackling unfamiliar problems*
Question 2 The courses helped me develop my ability to work as a team member*
Question 3 The courses sharpened my analytical skills*
Question 4 The courses improved my skills in written communication*
Question 5 Your ability to think critically

Question 6	Your ability to collect, anlayse and organise information
Question 7	Your ability to generate possible solutions to problems
Question 8	Your ability to use the appropriate style and mode of communication depending on your audience
Question 9	Your ability to use computers to retrieve, process and communicate information
Question 10	Your ability to convey ideas & information clearly in an oral form
Question 11	Your ability to evaluate competing perspectives and bodies of evidence
Question 12	Your appreciation of the importance of scholarship and research
Question 13	Your ability to use research to inform decision making
Question 14	Your ability to work and learn independently
Question 15	Your ability to think in creative and innovative ways

(2) Discipline Knowledge and Skills Scale

Question 1	Your understanding of concepts and principles in your discipline
Question 2	Your knowledge of the methods used in your discipline
Question 3	Your understanding of the different approaches and perspectives in your discipline
Question 4	Your knowledge of the full scope of your discipline
Question 5	Your appreciation of the real world applications of your discipline
Question 6	Your capacity to approach issues from the perspective of your discipline

(3) Ethical and Social Sensitivity Scale

Question 1	Your knowledge of ethical issues and standards in your discipline
Question 2	Your appreciation of the philosophical and social contexts of your discipline
Question 3	Your awareness and understanding of cultures and perspectives other than your own
Question 5	Your ability to evaluate the perspectives and opinions of others
Question 6	Your understanding of social and civic responsibility

Table 3.14 2005 UQSES Data on Graduate Attributes: Results of the BSc survey

		Graduate Attributes		
Cohort Description		**Communication & Problem Solving**	**Discipline Knowledge & Skills**	**Ethical & Social Sensitivity**
First Year	% Agree	57%	72%	55%
	%Broadly Agree	86%	95%	85%
	Number of Respondents.	335	335	335
Final Year	Agree %	73%	76%	55%
	% Broadly Agree	93%	97%	84%
	Number of Respondents.	136	135	136

Table 3.15 UQSES Data on Graduate Attributes: Pooled Results of All Bachelors Degrees at UQ

Cohort Description		Communication & Problem Solving	Discipline Knowledge & Skills	Ethical & Social Sensitivity
First Year	Agree %	60%	69%	60%
	Broadly Agree %	88%	94%	88%
	No. of Resp.	(1513)	(1513)	(1511)
Final Year	Agree %	72%	72%	66%
	Broadly Agree %	93%	94%	90%
	No. of Resp.	(728)	(729)	(728)

The scales reported below are as follows: Communication and Problem-Solving, Discipline Knowledge and Skills, Ethical and Social Sensitivity. Results for first year and final year students are reported separately. Results are reported using percentage agreement and are norm referenced. The norm-referenced results comparing the BSc with all Bachelors' degrees at UQ are shown in Table 3.16 below.

The results show that the BSc exhibits a similar level of satisfaction to all Bachelors' degrees at UQ except for first year students in the "discipline knowledge and skills" domain where the BSc scores in the third quartile (more favourably) than all Bachelors' degrees which score in the second quartile

Table 3.16 Norm referenced results (data as in Table 3.13 and 3.14) comparing the UQSES results for the BSc with all Bachelors degrees at UQ

BSc

Cohort Description	Communication and Problem Solving	Discipline Knowledge and Skills	Ethical and Social Sensitivity
First Year	2nd Quartile	3rd Quartile	2nd Quartile
Final Year	3rd Quartile	3rd Quartile	2nd Quartile

All UQ Bachelors degrees UQ

Cohort Description	Communication and Problem Solving	Discipline Knowledge and Skills	Ethical and Social Sensitivity
First Year	2nd Quartile	2nd Quartile	2nd Quartile
Final Year	3rd Quartile	3rd Quartile	2nd Quartile

Section 4

Entry scores – OP Cut-Offs and First Preferences

4.1 Entry Scores and OP Cut-Offs

Entry into a university degree program in Queensland is based on a student's Overall Position (OP)/Interstate Transfer Index (ITI). An OP score is a ranking on a scale of 1-25 (where 1 is the highest) according to the student's academic performance during their Queensland senior studies. Interstate Year 12 students are considered based on their Universities Admission Index (UAI)/Equivalent National Tertiary Entrance Rank (ENTER)/Tertiary Entrance Rank (TER) awarded in other states and territories of Australia (referred to as Interstate Transfer Index (ITI). Therefore, interstate students receive an ITI score which is used to equate their state's high school results to Queensland's OP system. The ITI score is a ranking on a scale from 1-99 where 99 is the highest score. Non Year 12 applicants have a rank determined on the basis academic qualifications or through alternative entry schemes that recognise other qualifications and test results (Table 4.1).

Table 4.1 The relationship between OP, Queensland Rank and ITI scores

Equivalence Scale for comparison of 2005 Queensland OP Scores and Ranks with tertiary entrance scores reported for school leavers in other Australian States using the common index that has been agreed to by MCEETYA (NSW: UAI; SA and NT: TER; Vic: ENTER; WA: TER)

ITI	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74
Qld Rank	99	98	97	96	95	94	93	92		91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75
Qld OP	1	2	3		4		5			6		7			8		9			10		11			12	

ITI	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
Qld Rank		74	73	72	71	70	69	68	67	66	65	64	63	62		61	60		59	58		57	56		55	
Qld OP		13			14			15		16			17			18			19			20			21	

ITI	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22
Qld Rank		54	53		52				51					50												
Qld OP		22			23				24					25												

QSA information on OPs in comparison with Queensland Ranks and Interstate Translation Index equivalents for 2005 Year 12 results
Data based on median OAI for each OP Band

ITI	99.40	98.09	96.50	94.60	92.62	90.38	87.96	85.40	82.74	80.12	77.50	74.82	71.98	69.24	66.38	63.60	60.82	58.04	55.16	52.28	49.45	46.34	43.22	39.23	33.91
Rank	99.42	98.12	96.64	94.95	93.00	90.91	88.67	86.27	83.80	81.26	78.72	76.17	73.54	70.84	68.18	65.68	63.25	60.94	58.78	56.82	55.05	53.54	52.37	51.46	50.85
OP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

The separate OP and Rank distributions for the UQ BSc from 2001 to 2006 are given in Figures 4.1 and 4.2. The corresponding mean, median, mode and cut off score for OP and rank for 2001 – 2006 is given in Tables 4.2 and 4.3.

Figure 4.1 Number and distribution of students entering the UQ BSc by OP 2001 - 2006

Figure 4.2 Number and distribution of students entering the UQ BSc by Rank 2001 - 2006

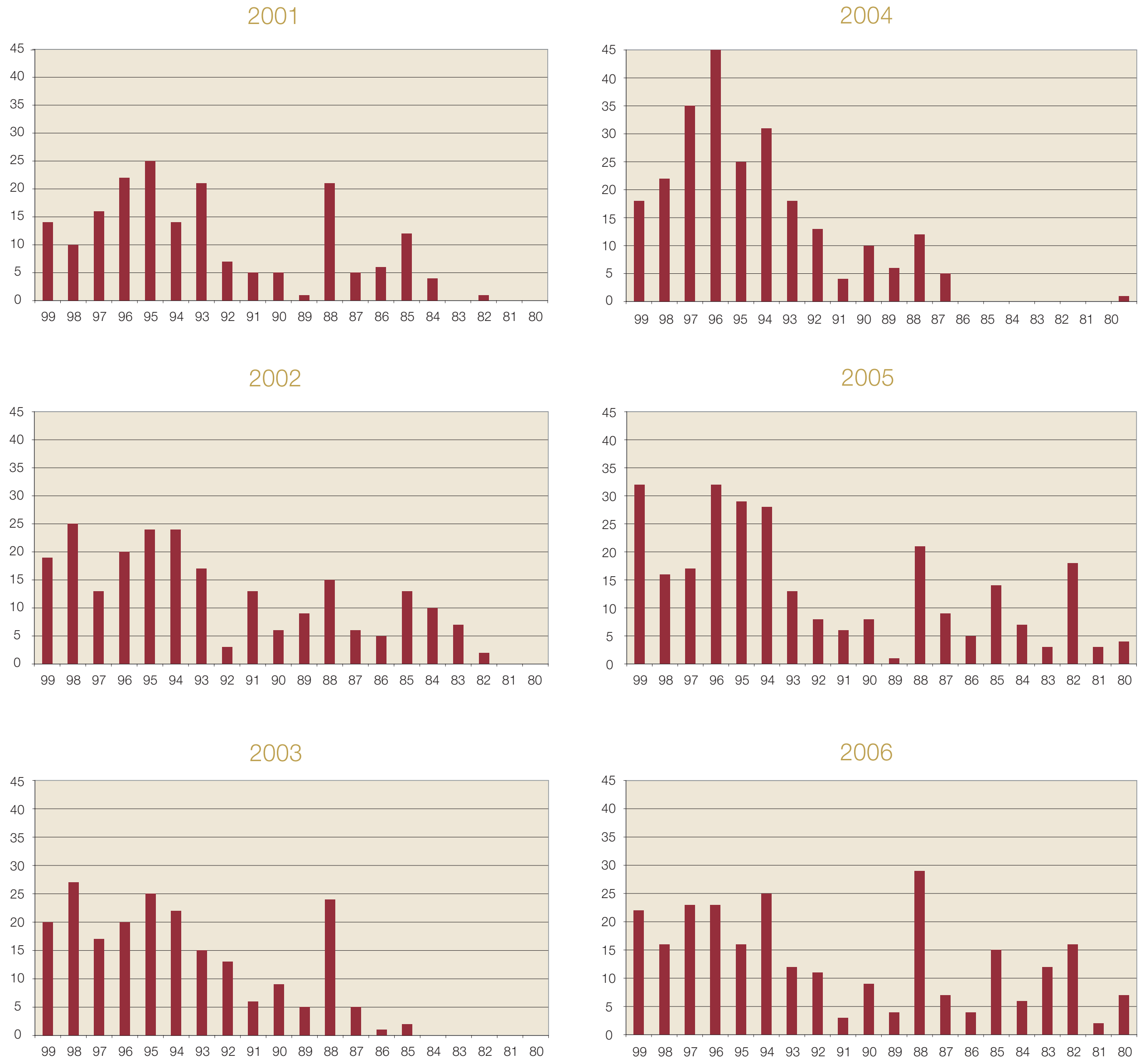


Table 4.2 Summary of OP entry data for the BSc quota 2001-2006

	Year					
	2001	2002	2003	2004	2005	2006
Mean	4.8	5.0	4.0	3.2	4.3	6.2
Median	6.5	7.0	6.0	6.5	5.5	7.0
Mode	4.0	5.0	4.0	5.0	3.0	6.0
Cut off	9.0	9.0	7.0	7.0	10.0	12.0

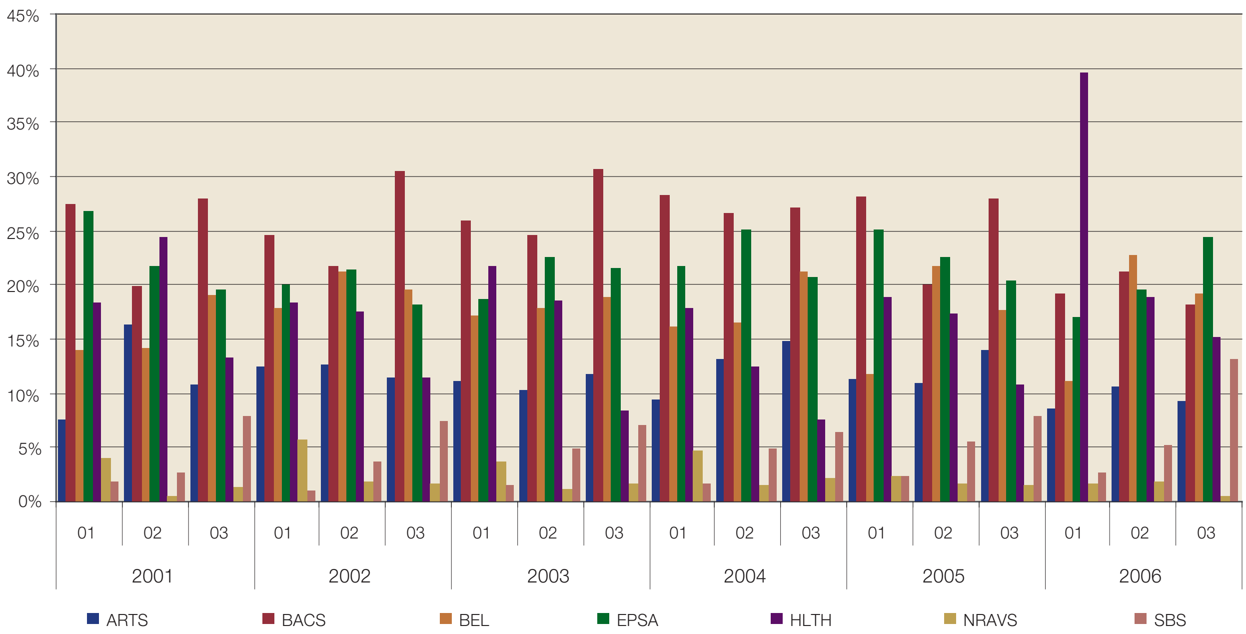
Table 4.3 Summary of Rank entry data for the BSc quota 2001-2006

	Year					
	2001	2002	2003	2004	2005	2006
Mean	92.9	92.6	97.7	97.0	92.2	91.3
Median	90.5	90.5	93.0	89.5	89.5	89.5
Mode	95.0	98.0	95.0	96.0	96.0	88.0
Cut off	84.0	83.0	87.0	88.0	80.0	75.0

It is evident that the OP/Rank cutoffs decreased significantly in 2005-6. This trend is a concern, although as the median values and distributions indicate, the demand at the high end of the OP/Rank range have been maintained and the median scores have not decreased significantly.

Analysis of the percentage of OP 1-3 students (all UQ programs) by Faculty (Figure 4.3) further demonstrates this demand in the OP 1-3 range. Note however that these are Faculty-wide data, not program specific. For BACS they are a good reflection of the BSc demand since the BSc is the major program offered. For EPSA the demand for Engineering in particular will have an influence.

Figure 4.3 Percentages of OP 1-3 students (all UQ programs) by Faculty, 2001 - 2006



4.2 Comparison of the Average and Median Scores for the BSc

Comparisons of average and median scores for the BSc with other Bachelors degrees at UQ St Lucia are shown in Tables 4.4 and 4.5. Science falls under “Natural and Physical Sciences”. The percentage of first preferences for Bachelors degrees in the natural and physical sciences at UQ is compared with other Queensland institutions in Table 4.6. This Table shows that despite the increase in OP cutoff for science, UQ continues to attract the largest percentage of first preferences. Comparison of *minimum* ITI scores for the BSc with other Bachelors degrees at St Lucia is shown in Table 4.7.

Table 4.4 Median ITI score for the BSc compared with whole of UQ (St Lucia)

Program description		2002	2003	2004	2005	2006
UQ St Lucia	Average ITI score	92.5	92.9	93.9	92.7	91.2
All Bachelors degrees	Median ITI Score	94.0	94.0	95.0	95.0	93.0
	Number of QTAC Entrants	5337	4870	4739	5397	6076
Bachelor of Science or Bachelor of Biotechnology - full-time or part-time	Average ITI score	92.9	93.6	94.7	92.9	90.9
	Median ITI Score	93.0	94.0	95.0	95.0	93.0
	Number of QTAC Entrants	957	892	806	870	955

Table 4.5 Median ITI scores at UQ by field of education

Course/Program Description	Application Year	2002	2003	2004	2005	2006
All Fields of Ed	Average ITI score	89.7	89.6	90.7	90.0	89.0
	Median ITI Score	93.0	92.0	94.0	93.0	93.0
	Number of QTAC Entrants	6608	6230	6072	6587	7008
Natural and Physical Sciences	Average ITI score	92.2	92.4	93.6	92.3	90.7
	Median ITI Score	93.0	94.0	95.0	94.0	93.0
	Number of QTAC Entrants	1044	1015	919	940	1017
Agriculture, Environmental & Related Studies	Average ITI score	80.0	80.7	81.7	81.1	79.3
	Median ITI Score	80.0	80.0	83.0	82.0	81.0
	Number of QTAC Entrants	669	563	531	402	347
Architecture and Building	Average ITI score	91.9	92.5	93.9	93.3	92.2
	Median ITI Score	93.0	94.0	95.0	95.0	95.0
	Number of QTAC Entrants	118	96	91	127	151
Creative Arts	Average ITI score	93.9	92.1	87.7	88.8	81.5
	Median ITI Score	95.0	94.0	93.0	93.0	83.0
	Number of QTAC Entrants	147	184	255	288	495
Engineering and Related Technologies	Average ITI score	94.2	94.8	95.6	93.8	92.6
	Median ITI Score	95.0	96.0	97.0	95.0	94.0
	Number of QTAC Entrants	459	441	475	538	730
Health	Average ITI score	96.0	96.4	96.1	94.9	93.5
	Median ITI Score	97.0	98.0	97.0	97.0	96.0
	Number of QTAC Entrants	775	722	774	971	1077
Information Technology	Average ITI score	88.9	86.4	85.1	81.8	81.1
	Median ITI Score	88.0	88.0	85.0	81.0	81.5
	Number of QTAC Entrants	187	190	163	139	120
Management and Commerce	Average ITI score	87.1	84.9	88.4	88.5	91.7
	Median ITI Score	91.0	89.0	94.0	93.0	93.0
	Number of QTAC Entrants	904	931	868	929	723
Society and Culture	Average ITI score	89.1	89.1	90.2	88.7	87.6
	Median ITI Score	89.0	90.0	93.0	91.0	88.0
	Number of QTAC Entrants	2305	2088	1996	2253	2348

Table 4.6 Percentage of first preferences by Institution - Bachelor Degrees in Natural and Physical Sciences

Percentage by Institution	2002	2003	2004	2005	2006
Bond University			0%	0%	1%
Central Queensland University	6%	5%	5%	6%	5%
Griffith University	17%	16%	25%	18%	19%
James Cook University	15%	13%	11%	12%	8%
Queensland University of Technology	19%	20%	17%	21%	20%
University of New England	0%	1%	0%	0%	1%
The University of Queensland	34%	38%	35%	36%	37%
University of Southern Queensland	3%	3%	3%	3%	3%
University of the Sunshine Coast	5%	4%	4%	4%	6%

Table 4.7 Minimum entry scores for students applying through QTAC for UQ Bachelors Degrees, OP based entry

QTAC course	2002	2003	2004	2005	2006
Ag Sci - Animal Sci and Plant & Soil Sci	11	10	9	10	12
Applied Health Science (Oral Health)	9	7	5	7	3
Applied Science - Food Sci & Nut	14	11	10	12	12
Applied Science in Human Movement Studies	6	6	6	7	8
Architecture	7	7	5	5	5
Arts	10	8	7	10	12
Business Management	6	5	4	5	6
Business Man (Real Estate and Development)	8	7	5	7	9
Commerce	6	5	4	5	6
Communication		8	8	10	12
Dental Science					1
Economics	7	6	5	7	7
Engineering	8	7	6	9	9
Information Technology	9	8	8	10	12
International Hotel and Tourism Management			8	9	10
Journalism	5	5	4	6	6
Laws (b)	3	2	2	2	2
Marine Studies	9	8	8	10	12
Natural Resource Economics	11	10	9	11	12
Occupational Therapy	3	3	3	4	4
Pharmacy	2	2	2	2	2
Physiotherapy	2	2	1	2	2
Psychological Science (year 1 entry)	4	3	3	4	3
Regional & Town Planning	10	8	7	9	10
Science	9	7	7	10	12
Social Science	10	8	8	10	12
Social Work - Undergraduate	9	8	7	9	12
Speech Pathology	3	3	3	4	5
Veterinary Science	2	1	1	2	2

The correlation between the semester 1 Grade Point Average (GPA) score for BSc students and OP (Figure 4.4) or entry Rank (Figure 4.5). This gives an indication of how students perform as a function of their entry scores and it is it is interesting to note the bigger scatter in those who come in with a rank, as opposed to an OP. The diversity of age, background, and possibly associated increased responsibilities of Rank entrants, may partially explain this result. However, the scatter is wider with lower entry rank and more comparable to the OP spread at the higher end.

Figure 4.4 Semester 1 BSc Grade Point Average Vs entry score 2006

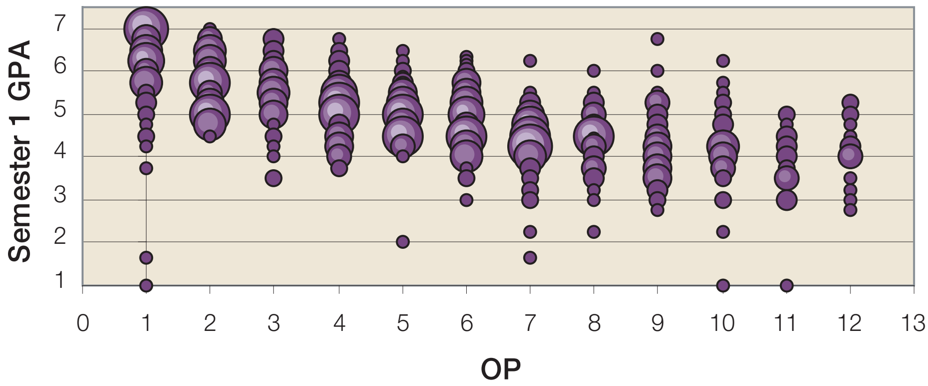
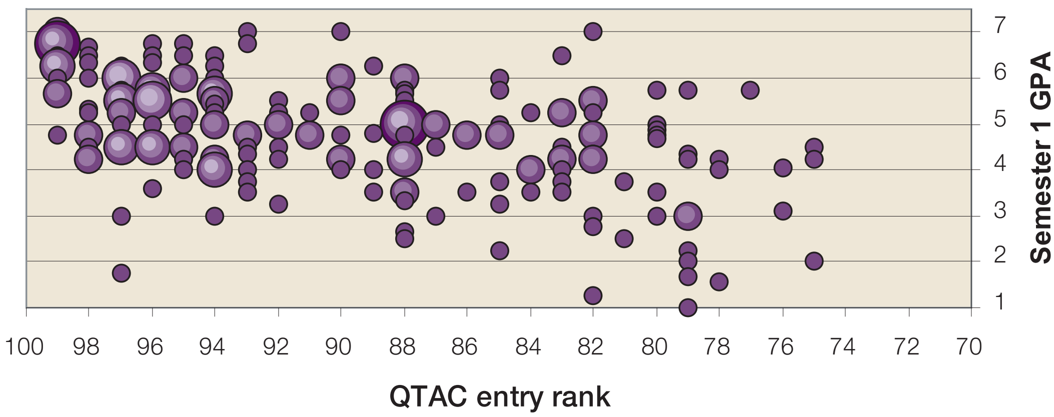


Figure 4.5 Semester 1 BSc Grade Point Average Vs entry rank 2006



Section 5

Core Data and Benchmarking

This section brings together all relevant data on the BSc. Some of it has been included elsewhere in this report, but for completeness and continuity of contents it may be repeated in this section. The data are grouped as follows:

- Student survey data
  - > National Graduate Destinations Survey (GDS)
  - > Course Experience Questionnaire (CEQ)
  - > UQ Student Experience Survey (UQSES) Quantitative Data
  - > UQ Student Experience Survey (UQSES) Qualitative Data
  - > UQ Internal Course (subject) Evaluation Instrument (iCEVAL) Data
- Student numbers and demographics by program, field of study and course
- Progression, graduation, transfer and lapse data
- Equivalent Full Time Student Load (EFTSL)

Note: Up until 2004 EFTSL was called Equivalent Full-time Student Unit (EFTSU)

5.1 Student Survey Data

5.1.1 National Graduate destinations survey

The National Graduate Destination Survey (GDS) is conducted on April 30 each year and results are compiled by each Institute and sent to the Graduate Careers Council of Australia (GCCA) for analysis. The survey is conducted so that the 2003 graduates are assessed in April 2004 and the results published late in 2004 after a reasonable response time. Thus, each survey examines the graduate destinations approximately 6 months after graduation. The analysis presented has been restricted to only Pass and Honours graduates of the BSc and does not include data on graduates from dual undergraduate degrees (Table 5.1).

Approximately 60% of respondents in either the BSc or BSc (Hons) program continue on into full time study after graduation. About one-fifth of respondents with a BSc qualification are seeking full time employment at the time of the survey. This is slightly higher for respondents with a BSc (Hons) degree (30%). About 14% of respondents with a BSc degree are in full time work while this is significantly higher for BSc (Hons) graduates (23%). Part of this difference may be due to the higher proportion of BSc students remaining in full-time study.

The data in Table 5.1 was compiled into 11 broad categories and reported for the period 2001-2004. In most cases the percentage distribution of occupations within each degree program was very similar across the four years. The five principal areas of employment for BSc graduates are (i) Professions; (ii) Hospitality; (iii) Education / Childcare (iv) Science, and (v) Retail/Sales/Customer Service, which together account for 74% of all graduate destinations. Of note is that only 18% of BSc graduates were employed in jobs directly related to Science (Science and IT).

There is an interesting shift in employment dynamics for BSc (Hons) graduates. While 80% of Honours graduates find employment within the same 5 principal areas as for the Pass graduates, 66% of the Honours graduates are employed solely in Science and Education/Childcare. The largest shift is for jobs in Science, which increased from 18% for Pass graduates to 46% for Honours graduates.

The Australian Council of Deans of Science 2000 report on employment outcomes from 6 Australian Universities indicated that 50% of BSc (Hons) graduates end up in science-related jobs. This data indicates that the employment outcomes for UQ graduates, at least within 6 months of graduation, are consistent with national trends.

In summary, about 60% of either BSc or BSc (Hons) graduates continue on to further full-time study in the year following their graduation. Of those BSc graduates who are employed in the year after graduation, 18% are in science-related jobs. Of those BSc (Hons) graduates who are employed in the year after graduation, 46% are in science-related jobs.

Table 5.1 National graduate destinations survey (GDS) results

BSc					
			Year		
Occupation	**2001**	**2002**	**2003**	**2004**	**Mean**
Administration	7%	8%	5%	7%	7%
Hospitality	8%	12%	14%	17%	13%
Education, childcare	17%	13%	12%	15%	14%
Healthcare	7%	3%	6%	9%	6%
IT	3%	4%	1%	3%	3%
Managerial	4%	3%	3%	4%	4%
Professions*	9%	16%	9%	6%	10%
Retail, Sales, customer services	21%	20%	25%	23%	22%
Science	17%	12%	21%	11%	15%
Trade, Services	3%	3%	5%	1%	3%
Other	4%	5%	1%	5%	4%
BSc (Hons)					
Administration	9%	7%	9%	4%	7%
Hospitality	0%	1%	2%	4%	2%
Education, childcare	24%	23%	14%	20%	20%
Healthcare	5%	3%	2%	6%	4%
IT	0%	0%	0%	0%	0%
Managerial	2%	0%	7%	4%	3%
Professions*	3%	3%	2%	8%	4%
Retail, Sales, customer services	5%	12%	7%	8%	8%
Science	50%	49%	49%	37%	46%
Trade, Services	0%	0%	5%	2%	2%
Other	5%	3%	2%	6%	4%

** includes consultants, accountancy/finance-related jobs, engineers, insurance, librarians*

5.1.2 Course experience questionnaire (CEQ) data

As noted in Section 3, the Course Experience Questionnaire (CEQ) is a national survey administered at the end of April (December graduates) and October (August graduates) following graduation. Therefore, it is sometime into the following year before results for the previous year's graduates are available. In this context, "course" refers to a sequence of study (eg. major) or a degree program. Results are reported against each program level and program within the university. Analysis of the results can show comparisons of courses both *within* an institution and *between* other Australian institititions. In these reports, broad agreement represents a response of 3, 4 or 5 on a five point scale, while agreement represents a response of 4 or 5 on a five point scale.

The CEQ survey comprises three core scales (Overall Satisfaction Scale, Good Teaching Scale and Generic Skills Scale) which must be used by all participating Universities in Australia. The remaining three scales (Graduate Qualities Scale, Learning Community Scale and Student Support Scale) have been chosen by The University of Queensland from a range of possible scales provided by the GCCA. The items used for each scale are given in Table 5.2. Agreement rates are only shown for programs with at least 5 respondents to the CEQ, although the totals for each program level include all responses.

Additional information on CEQ Data collection:

- The total number of responses received for a course may not be a multiple of the number of questions in the category due to students failing to respond to specific questions.
- For Good Teaching and Generic Skills, a student must have answered at least four out of the six questions for their response to be included in the analysis.
- The year for the indicator refers to the year in which the survey was conducted.

5.1.2.1 Comparison of the UQ BSc with other Bachelors degrees at UQ (6 scales)

Table 5.2 shows the results of the CEQs for students who graduated from the University of Queensland for the years 2001–2004. The data indicate that the BSc compares favourably with other Bachelors' degrees at UQ on all of the above 6 scales listed above.

Table 5.2 Quantitative feedback from students (CEQ data): Comparison of UQ data for BSc with other Bachelors degrees at UQ (6 scales)

The questions which comprise each of the scales are set out above each results table.

(i) Overall Satisfaction Scale (in UQ CEQ)

Question 29 Overall, I was satisfied with the quality of this course

Program Description	Graduation Year	% Broadly Agree	% Agree	Total Responses	No. of Respondents	No. of Graduates
B Sc	2001	89%	67%	283	283	609
	2002	88%	67%	291	291	586
	2003	93%	81%	234	234	473
	2004	93%	75%	218	218	526
Bachelor's Pass (all of UQ)	2001	88%	68%	2233	2233	4971
	2002	89%	69%	2585	2585	5239
	2003	92%	80%	1937	1937	4339
	2004	90%	70%	2153	2153	5345

(ii) Good Teaching Scale (in UQ CEQ)

Question 1 The staff put a lot of time into commenting on my work

Question 2 The teaching staff normally gave me helpful feedback on how I was going

Question 4 The teaching staff of this course motivated me to do my best work

Question 7 My lecturers were extremely good at explaining things

Question 8 The teaching staff worked hard to make their subjects interesting

Question 17 The staff made a real effort to understand difficulties I might be having with my work

Program Description	Graduation Year	% Broadly Agree	% Agree	Total Responses	No. of Respondents	No. of Graduates
BSc	2001	77%	42%	1700	284	609
	2002	78%	42%	1809	302	586
	2003	83%	50%	1403	234	473
	2004	81%	49%	1308	218	526
Bachelor's Pass (all of UQ)	2001	81%	45%	13400	2241	4971
	2002	83%	47%	15857	2650	5239
	2003	85%	55%	11631	1941	4339
	2004	82%	48%	12918	2155	5345

(iii) Generic Skills Scale (in UQ CEQ)

Question 3 The course helped me develop my ability to work as a team member

Question 6 The course sharpened my analytic skills

Question 14 The course developed my problem-solving skills

Question 20 The course improved my skills in written communication

Question 25 As a result of my course, I feel confident about tackling unfamiliar problems

Question 26 My course helped me to develop the ability to plan my own work

Program Description	Graduation Year	% Broadly Agree	% Agree	Total Responses	No. of Respondents	No. of Graduates
BSc	2001	84%	61%	1704	284	609
	2002	88%	61%	1811	302	586
	2003	91%	70%	1403	234	473
	2004	89%	68%	1308	218	526
Bachelor's Pass (all of UQ)	2001	88%	66%	13400	2239	4971
	2002	90%	68%	15857	2650	5239
	2003	92%	74%	11631	1941	4339
	2004	89%	68%	12918	2156	5345

(iv) Graduate Qualities Scale (in UQ CEQ)

Question 5 The course provided me with a broad overview of my field of knowledge

Question 9 The course developed my confidence to investigate new ideas

Question 18 University stimulated my enthusiasm for further learning

Question 22 I learned to apply principles from this course to new situations

Question 24 I consider what I learned valuable for my future

Question 28 My university experience encouraged me to value perspectives other than my own

Program Description	Graduation Year	% Broadly Agree	% Agree	Total Responses	No. of Respondents	No. of Graduates
B Sc	2001	88%	69%	1704	284	609
	2002	90%	68%	1809	302	586
	2003	94%	77%	1401	234	473
	2004	91%	74%	1307	218	526
Bachelor's Pass (all of UQ)	2001	90%	69%	13403	2239	4971
	2002	91%	70%	15843	2649	5239
	2003	93%	77%	11618	1940	4339
	2004	91%	70%	12916	2156	5345

(v) Learning Community Scale (in UQ CEQ)

Question 10 I felt part of a group of students and staff committed to learning

Question 11 Students' ideas and suggestions were used during the course

Question 13 I learned to explore ideas confidently with other people

Question 19 I felt I belonged to the university community

Question 27 I was able to explore academic interests with staff and students

Program Description	Graduation Year	% Broadly Agree	% Agree	Total Responses	No. of Respondents	No. of Graduates
B Sc	2001	82%	50%	1418	284	609
	2002	81%	50%	1506	302	586
	2003	87%	58%	1170	234	473
	2004	84%	56%	1089	218	526
Bachelor's Pass (all of UQ)	2001	83%	52%	11168	2238	4971
	2002	84%	54%	13189	2645	5239
	2003	87%	60%	9683	1941	4339
	2004	84%	54%	10746	2156	5345

(vi) Student Support Scale (in UQ CEQ)

Question 12 I was able to access information technology resources when I needed them

Question 15 Relevant learning resources were accessible when I needed them

Question 16 Health, welfare and counselling services met my requirements

Question 21 The library services were readily accessible

Question 23 I was satisfied with the course and careers advice provided

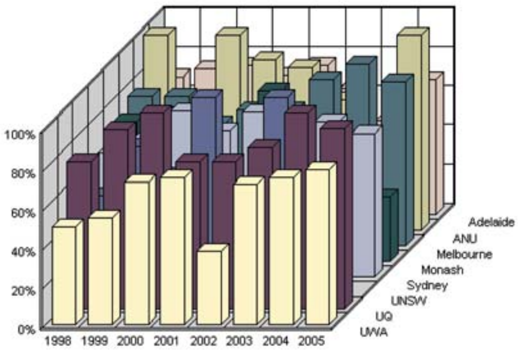
Program Description	Graduation Year	% Broadly Agree	% Agree	Total Responses	No. of Respondents	No. of Graduates
B Sc	2001	83%	60%	1412	284	609
	2002	86%	59%	1501	302	586
	2003	89%	69%	1167	234	473
	2004	89%	69%	1083	218	526
Bachelor's Pass (all of UQ)	2001	85%	59%	11091	2238	4971
	2002	87%	62%	13125	2646	5239
	2003	90%	68%	9676	1941	4339
	2004	88%	64%	10692	2155	5345

Overall there is no significant difference in feedback between BSc and all Bachelors' degrees at UQ and there is a high degree of student satisfaction on all scales.

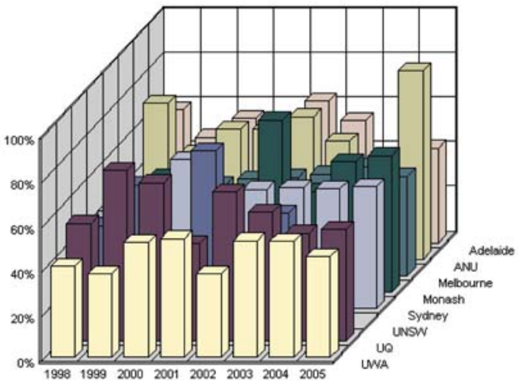
5.1.2.2 Comparison of the UQ BSc with the GO8 group

Figures 5.1 – 5.5 show the results of the National Course Experience Surveys for the years 1998 - 2005 for the Group of Eight (GO8) Universities. Results are reported against 40 aggregated fields of study as defined by the Graduate Careers Council of Australia (GCCA). The fields of study relevant to, but not exclusive to, the BSc are: Chemistry, Life Sciences, Mathematics, Physical Sciences, and Psychology. Detailed data are given in Table 5.3.

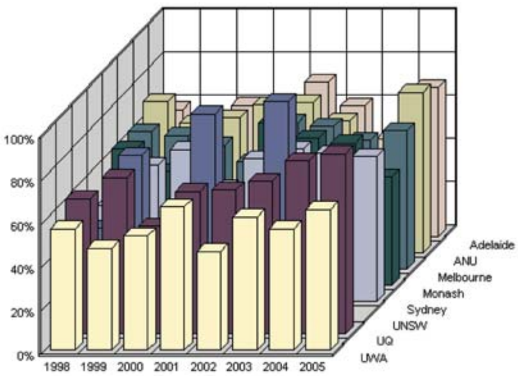
Figure 5.1 Comparison of the UQ BSc with the GO8 group using CEQ data: Chemistry



Overall Satisfaction

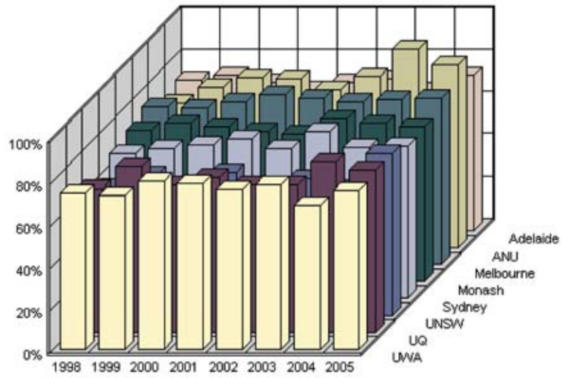


Good Teaching

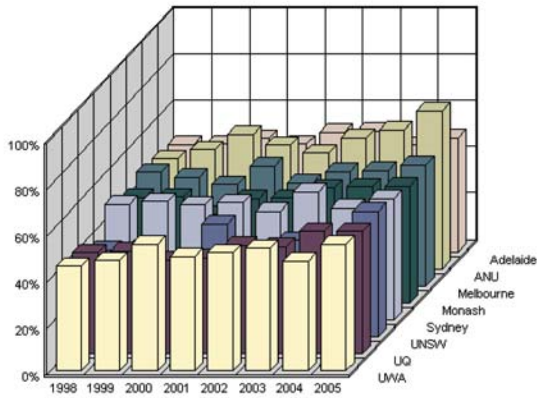


Generic Skills

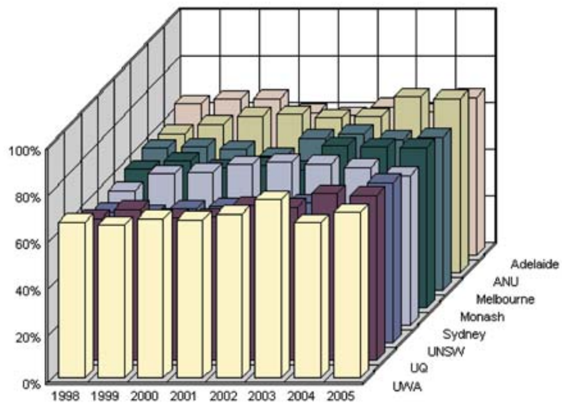
Figure 5.2 Comparison of the UQ BSc with the GO8 group using CEQ data: Life Sciences



Overall Satisfaction

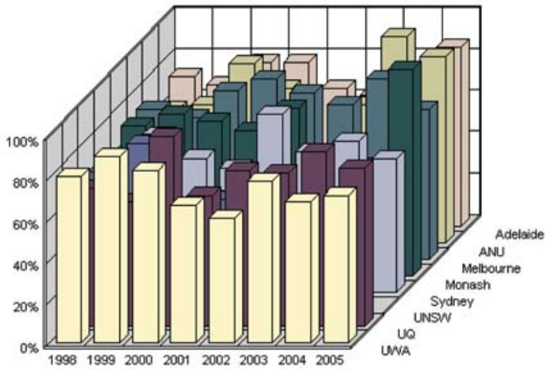


Good Teaching

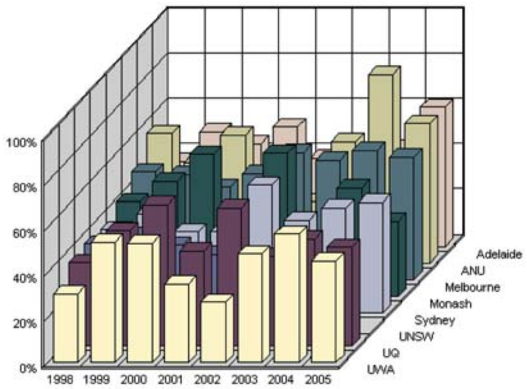


Generic Skills

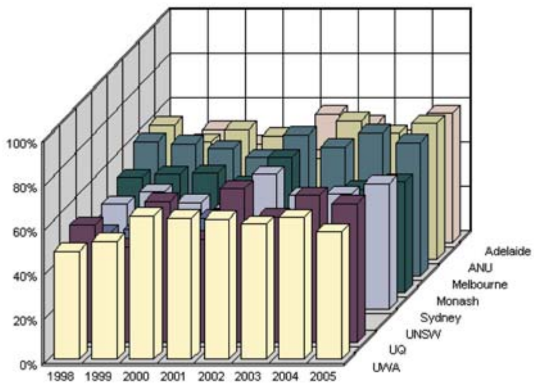
Figure 5.3 Comparison of the UQ BSc with the GO8 group using CEQ data: Mathematics



Overall Satisfaction

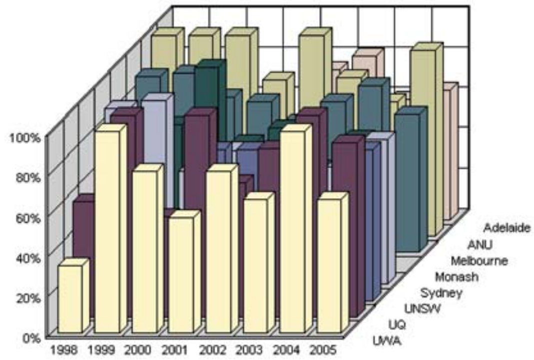


Good Teaching

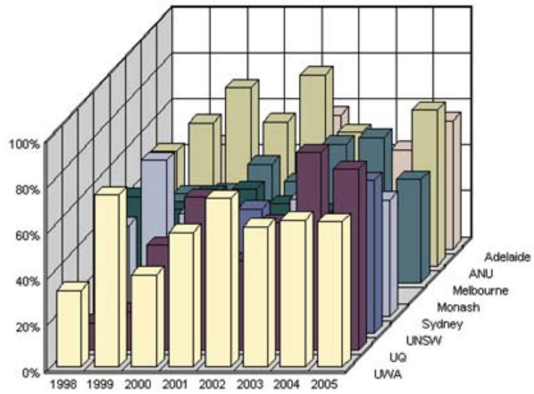


Generic Skills

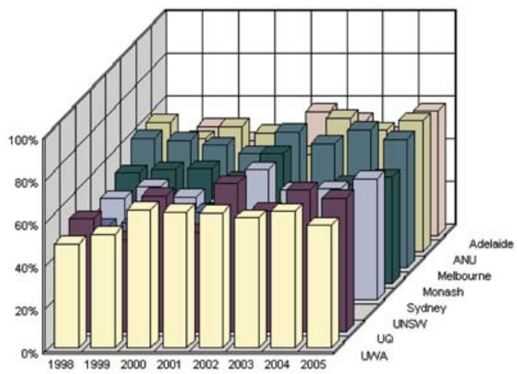
Figure 5.4 Comparison of the UQ BSc with the GO8 group using CEQ data: Physical Sciences



Overall Satisfaction

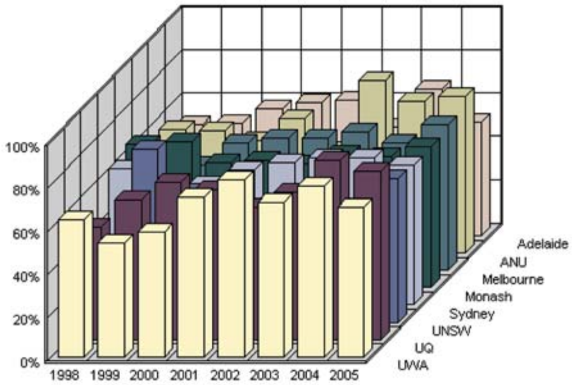


Good Teaching

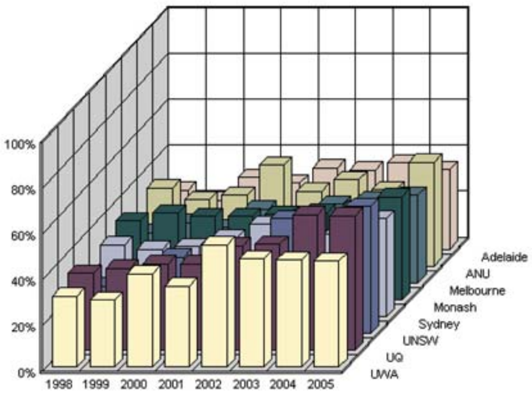


Generic Skills

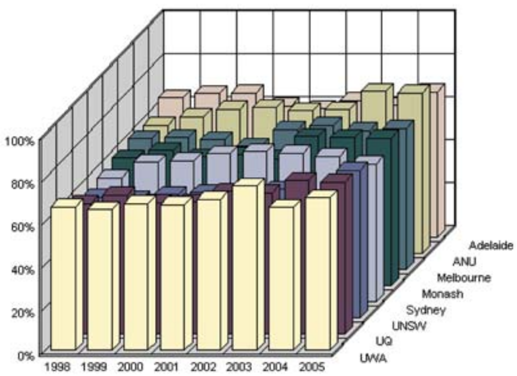
Figure 5.5 Comparison of the UQ BSc with the GO8 group using CEQ data: Psychology



Overall Satisfaction



Good Teaching



Generic Skills

Analysis of these data reveal the following trends and comparisons with other universities:

- the high standing of chemistry at UQ in overall satisfaction and generic skills domains, and the steady increase in scores over the past years;
- the premier standing of psychology at UQ in all three domains;
- the high standing of the physical sciences at UQ in all three domains, but notably in the Good Teaching domain;
- the generally high scoring in the generic skills domain across all five science fields of study at UQ;
- the consistent high standing of life sciences in all three domains; and
- the high standing of mathematics especially in 'overall satisfaction' and 'generic skills'.

Table 5.3 Quantitative feedback from students (CEQ data): Comparison of BSc at UQ with GO8 group

The questions which comprise each of the scales are set out below and the results follow.

Overall Satisfaction Scale (in UQ CEQ)

Question 29 Overall, I was satisfied with the quality of this course.

Good Teaching Scale (in UQ CEQ)

Question 1 The staff put a lot of time into commenting on my work.

Question 2 The teaching staff normally gave me helpful feedback on how I was going.

Question 4 The teaching staff of this course motivated me to do my best work.

Question 7 My lecturers were extremely good at explaining things.

Question 8 The teaching staff worked hard to make their subjects interesting.

Question 17 The staff made a real effort to understand difficulties I might be having with my work.

Generic Skills Scale (in UQ CEQ)

Question 3 The course helped me develop my ability to work as a team member.

Question 6 The course sharpened my analytic skills.

Question 14 The course developed my problem-solving skills.

Question 20 The course improved my skills in written communication.

Question 25 As a result of my course, I feel confident about tackling unfamiliar problems.

Question 26 My course helped me to develop the ability to plan my own work.

Item 1 Overall satisfaction, Life Sciences

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	71%	74%	70%	67%	70%	72%	66%	74%
	(223)	(172)	(142)	(127)	(110)	(107)	(198)	(172)
Australian National University	69%	76%	81%	80%	75%	81%	94%	87%
	(70)	(83)	(63)	(65)	(75)	(47)	(35)	(91)
University of Melbourne	75%	75%	77%	81%	79%	77%	78%	79%
	(221)	(254)	(201)	(252)	(250)	(336)	(242)	(380)
Monash University	71%	75%	73%	71%	70%	77%	75%	73%
	(150)	(176)	(52)	(111)	(138)	(114)	(185)	(167)
University of New South Wales	61%	67%	59%	67%	60%	65%	60%	77%
	(79)	(66)	(42)	(46)	(70)	(57)	(73)	(121)
University of Sydney	69%	71%	72%	76%	71%	79%	71%	72%
	(246)	(228)	(188)	(221)	(166)	(196)	(305)	(239)
The University of Queensland	68%	79%	70%	73%	70%	70%	81%	77%
	(326)	(182)	(205)	(218)	(210)	(283)	(249)	(256)
University of Western Australia	74%	73%	80%	78%	76%	78%	68%	75%
	(200)	(209)	(220)	(190)	(106)	(110)	(110)	(217)

Item 2 Good teaching, Life Sciences

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	46%	47%	49%	47%	52%	52%	46%	49%
	(223)	(172)	(142)	(129)	(112)	(107)	(198)	(172)
Australian National University	48%	51%	58%	53%	50%	57%	60%	68%
	(70)	(83)	(63)	(65)	(75)	(48)	(35)	(93)
University of Melbourne	49%	47%	44%	52%	45%	49%	50%	52%
	(221)	(253)	(201)	(252)	(250)	(336)	(243)	(379)
Monash University	46%	46%	38%	45%	45%	50%	50%	50%
	(150)	(178)	(52)	(111)	(138)	(114)	(185)	(167)
University of New South Wales	38%	39%	31%	49%	30%	42%	36%	54%
	(79)	(67)	(42)	(46)	(71)	(57)	(73)	(121)
University of Sydney	50%	51%	50%	51%	47%	55%	48%	52%
	(246)	(228)	(188)	(217)	(166)	(197)	(306)	(241)
The University of Queensland	44%	45%	41%	42%	47%	46%	53%	53%
	(326)	(182)	(205)	(219)	(209)	(287)	(249)	(256)
University of Western Australia	45%	48%	55%	49%	51%	53%	47%	55%
	(200)	(210)	(220)	(190)	(106)	(110)	(110)	(217)

Item 3 Generic skills, Life Sciences

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	65% (223)	67% (172)	68% (142)	61% (129)	60% (112)	64% (107)	62% (198)	68% (172)
Australian National University	60% (70)	64% (83)	67% (63)	68% (65)	67% (75)	67% (48)	76% (35)	75% (92)
University of Melbourne	61% (221)	62% (254)	61% (201)	58% (252)	65% (250)	67% (336)	65% (244)	66% (380)
Monash University	60% (150)	63% (178)	60% (52)	61% (111)	59% (138)	70% (114)	69% (185)	69% (167)
University of New South Wales	56% (79)	55% (67)	58% (42)	59% (46)	54% (71)	60% (57)	53% (73)	69% (121)
University of Sydney	58% (246)	65% (228)	66% (188)	69% (217)	70% (166)	69% (197)	68% (306)	64% (241)
The University of Queensland	61% (326)	65% (182)	61% (205)	62% (219)	67% (209)	66% (287)	72% (249)	71% (256)
University of Western Australia	67% (200)	66% (210)	68% (220)	68% (190)	70% (106)	77% (110)	67% (110)	71% (217

Item 1 Overall satisfaction, Chemistry

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	71% (17)	75% (12)	76% (17)	72% (7)	76% (17)	64% (14)	48% (25)	69% (13)
Australian National University	100% (5)	50% (12)	100% (4)	88% (8)	83% (12)	67% (6)		100% (13)
University of Melbourne	77% (43)	76% (34)	63% (16)	70% (43)	70% (30)	85% (27)	93% (14)	84% (31)
Monash University	71% (28)	76% (33)	47% (15)	45% (11)	88% (8)	62% (13)	52% (21)	33% (3)
University of New South Wales	50% (6)	75% (4)	60% (5)	100% (3)		100% (1)		
University of Sydney	64% (41)	71% (24)	85% (27)	75% (20)	85% (26)	79% (29)	79% (34)	74% (34)
The University of Queensland	75% (16)	92% (12)	100% (4)	75% (8)	75% (8)	82% (17)	100% (10)	92% (13)
University of Western Australia	50% (16)	55% (11)	73% (11)	75% (20)	38% (8)	72% (7)	75% (8)	79% (24)

Item 2 Good Teaching, Chemistry

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	60%	47%	56%	26%	64%	55%	34%	42%
	(17)	(12)	(17)	(7)	(17)	(14)	(25)	(13)
Australian National University	70%	47%	58%	58%	64%	53%		85%
	(5)	(12)	(4)	(8)	(12)	(6)		(13)
University of Melbourne	36%	40%	41%	43%	44%	45%	49%	44%
	(43)	(34)	(16)	(43)	(30)	(27)	(14)	(31)
Monash University	46%	51%	39%	33%	77%	45%	58%	61%
	(28)	(33)	(15)	(11)	(8)	(13)	(22)	(3)
University of New South Wales	45%	63%	7%	78%		50%		
	(6)	(4)	(5)	(3)		(1)		
University of Sydney	44%	49%	67%	49%	53%	54%	54%	54%
	(41)	(24)	(27)	(20)	(26)	(29)	(34)	(34)
The University of Queensland	53%	76%	71%	44%	67%	58%	48%	50%
	(16)	(12)	(4)	(8)	(8)	(17)	(10)	(13)
University of Western Australia	41%	38%	51%	53%	38%	52%	52%	45%
	(16)	(12)	(11)	(20)	(8)	(7)	(8)	(24)

Item 3 Generic Skills, Chemistry

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	59%	49%	61%	55%	72%	61%	45%	69%
	(17)	(12)	(17)	(7)	(17)	(14)	(25)	(13)
Australian National University	70%	60%	63%	69%	70%	61%		74%
	(5)	(12)	(4)	(8)	(12)	(6)		(13)
University of Melbourne	64%	62%	57%	50%	68%	66%	60%	64%
	(43)	(34)	(16)	(43)	(30)	(27)	(14)	(31)
Monash University	63%	53%	60%	39%	75%	68%	66%	50%
	(28)	(33)	(15)	(11)	(8)	(13)	(22)	(3)
University of New South Wales	42%	75%	40%	94%		100%		
	(6)	(4)	(5)	(3)		(1)		
University of Sydney	45%	63%	70%	53%	66%	71%	69%	67%
	(41)	(24)	(27)	(20)	(26)	(29)	(34)	(34)
The University of Queensland	63%	72%	50%	66%	67%	71%	80%	83%
	(16)	(12)	(4)	(8)	(8)	(17)	(10)	(13)
University of Western Australia	56%	47%	53%	67%	46%	62%	56%	65%
	(16)	(12)	(11)	(20)	(8)	(7)	(8)	(24

Item 1 Overall Satisfaction, Psychology

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	51% (82)	52% (52)	59% (46)	62% (34)	63% (43)	50% (40)	68% (66)	53% (61)
Australian National University	57% (58)	57% (62)	52% (45)	62% (37)	48% (42)	80% (30)	70% (37)	73% (77)
University of Melbourne	49% (78)	48% (130)	59% (110)	61% (103)	61% (88)	64% (122)	59% (90)	67% (119)
Monash University	67% (169)	67% (180)	58% (74)	59% (103)	57% (129)	62% (97)	61% (179)	65% (63)
University of New South Wales	31% (13)	80% (10)	60% (15)	63% (8)		50% (2)	0% (1)	67% (6)
University of Sydney	63% (148)	56% (163)	56% (109)	63% (75)	66% (91)	68% (119)	68% (81)	65% (97)
The University of Queensland	52% (176)	65% (123)	73% (107)	70% (135)	61% (122)	68% (168)	83% (129)	78% (158)
University of Western Australia	63% (41)	53% (70)	58% (56)	74% (69)	82% (45)	71% (56)	79% (67)	69% (95)

Item 2 Good Teaching, Psychology

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	26% (82)	21% (52)	31% (46)	29% (34)	36% (42)	35% (40)	38% (66)	35% (61)
Australian National University	34% (58)	29% (62)	31% (45)	44% (37)	33% (42)	38% (30)	33% (37)	45% (77)
University of Melbourne	22% (78)	26% (132)	24% (110)	32% (103)	30% (89)	34% (122)	36% (90)	38% (118)
Monash University	35% (169)	38% (182)	37% (74)	36% (104)	37% (129)	38% (97)	39% (179)	45% (63)
University of New South Wales	21% (13)	25% (10)	33% (15)	15% (8)		50% (2)	0% (1)	56% (6)
University of Sydney	31% (148)	29% (164)	31% (109)	34% (75)	40% (91)	38% (119)	36% (81)	43% (97)
The University of Queensland	34% (176)	36% (123)	38% (107)	38% (136)	45% (122)	46% (170)	59% (129)	59% (158)
University of Western Australia	31% (41)	29% (71)	41% (56)	35% (71)	53% (45)	47% (56)	47% (68)	46% (95)

Item 3 Generic Skills, Psychology

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	57%	57%	56%	57%	65%	60%	65%	57%
	(82)	(53)	(46)	(34)	(43)	(40)	(66)	(61)
Australian National University	61%	64%	61%	60%	64%	62%	65%	70%
	(58)	(62)	(45)	(37)	(42)	(30)	(37)	(77)
University of Melbourne	61%	58%	61%	61%	59%	61%	61%	63%
	(78)	(132)	(110)	(103)	(89)	(122)	(90)	(119)
Monash University	69%	67%	68%	67%	62%	66%	65%	70%
	(169)	(182)	(74)	(104)	(129)	(97)	(179)	(63)
University of New South Wales	52%	66%	59%	55%		33%	0%	75%
	(13)	(10)	(15)	(8)		(2)	(1)	(6)
University of Sydney	59%	56%	57%	58%	66%	66%	66%	70%
	(148)	(164)	(109)	(75)	(91)	(119)	(81)	(97)
The University of Queensland	63%	63%	66%	67%	64%	70%	73%	72%
	(176)	(123)	(107)	(137)	(122)	(170)	(129)	(158)
University of Western Australia	64%	73%	66%	72%	83%	73%	72%	71%
	(41)	(71)	(56)	(71)	(45)	(56)	(68)	(95)

Item 1 Overall Satisfaction, Mathematics

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	73%	69%	79%	79%	67%	63%	55%	87%
	(40)	(19)	(29)	(29)	(18)	(19)	(51)	(23)
Australian National University	65%	67%	87%	75%	38%	67%	100%	90%
	(17)	(21)	(15)	(20)	(8)	(9)	(7)	(10)
University of Melbourne	72%	68%	82%	87%	81%	75%	87%	73%
	(29)	(19)	(24)	(47)	(36)	(52)	(39)	(66)
Monash University	73%	78%	75%	71%	81%	33%	53%	100%
	(22)	(23)	(8)	(17)	(16)	(6)	(15)	(1)
University of New South Wales	67%	80%	50%	53%				
	(27)	(10)	(4)	(15)				
University of Sydney	65%	76%	65%	60%	86%	68%	73%	65%
	(69)	(55)	(41)	(20)	(29)	(56)	(41)	(48)
The University of Queensland	67%	60%	92%	63%	75%	74%	84%	76%
	(33)	(15)	(12)	(19)	(12)	(27)	(19)	(21)
University of Western Australia	80%	90%	83%	67%	60%	78%	68%	71%
	(15)	(10)	(12)	(12)	(5)	(9)	(19)	(24)

Item 2 Good Teaching, Mathematics

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	38%	51%	45%	53%	39%	41%	43%	62%
	(40)	(20)	(29)	(29)	(18)	(19)	(53)	(23)
Australian National University	57%	44%	57%	40%	27%	54%	83%	62%
	(17)	(21)	(15)	(20)	(8)	(9)	(7)	(10)
University of Melbourne	48%	47%	41%	47%	56%	53%	57%	54%
	(29)	(19)	(24)	(47)	(36)	(52)	(39)	(66)
Monash University	42%	51%	63%	36%	63%	22%	48%	33%
	(22)	(23)	(8)	(17)	(16)	(6)	(15)	(1)
University of New South Wales	38%	42%	37%	33%				
	(27)	(10)	(4)	(15)				
University of Sydney	37%	44%	36%	36%	56%	41%	46%	49%
	(69)	(55)	(41)	(19)	(29)	(56)	(41)	(48)
The University of Queensland	37%	51%	63%	42%	61%	40%	47%	44%
	(33)	(15)	(12)	(19)	(12)	(27)	(19)	(21)
University of Western Australia	31%	53%	53%	35%	27%	48%	57%	45%
	(15)	(10)	(12)	(12)	(5)	(9)	(19)	(24)

Item 3 Generic Skills, Mathematics

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	45%	52%	45%	48%	58%	54%	47%	59%
	(40)	(20)	(29)	(29)	(18)	(19)	(53)	(23)
Australian National University	61%	53%	59%	56%	46%	63%	57%	62%
	(17)	(21)	(15)	(20)	(8)	(9)	(7)	(10)
University of Melbourne	61%	60%	58%	53%	64%	58%	65%	60%
	(29)	(19)	(24)	(47)	(36)	(52)	(39)	(66)
Monash University	52%	54%	54%	49%	61%	33%	47%	50%
	(22)	(23)	(8)	(17)	(16)	(6)	(15)	(1)
University of New South Wales	42%	44%	25%	49%				
	(27)	(10)	(4)	(15)				
University of Sydney	48%	53%	48%	45%	61%	52%	52%	57%
	(69)	(55)	(41)	(19)	(29)	(56)	(41)	(48)
The University of Queensland	53%	43%	64%	47%	70%	57%	67%	63%
	(33)	(15)	(12)	(19)	(12)	(27)	(19)	(21)
University of Western Australia	49%	53%	65%	64%	63%	61%	64%	58%
	(15)	(10)	(12)	(12)	(5)	(9)	(19)	(24)

Item 1 Overall Satisfaction, Physical Science

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	50%	63%	50%	0%	75%	82%	60%	64%
	(4)	(8)	(8)	(3)	(4)	(11)	(15)	(14)
Australian National University	100%	100%	100%	78%	100%	79%	67%	92%
	(2)	(8)	(3)	(9)	(6)	(14)	(3)	(13)
University of Melbourne	88%	89%	77%	75%	65%	75%	83%	69%
	(8)	(18)	(13)	(28)	(17)	(32)	(29)	(35)
Monash University	56%	72%	100%	63%	70%	50%	65%	
	(16)	(14)	(4)	(8)	(10)	(10)	(17)	
University of New South Wales	0%	0%		75%	75%	50%	33%	75%
	(1)	(2)		(4)	(4)	(2)	(3)	(4)
University of Sydney	88%	92%	56%	67%	53%	73%	58%	72%
	(8)	(12)	(16)	(15)	(17)	(26)	(24)	(25)
The University of Queensland	57%	100%	50%	100%	67%	83%	100%	87%
	(7)	(2)	(4)	(3)	(9)	(12)	(6)	(15)
University of Western Australia	33%	100%	80%	57%	80%	67%	100%	67%
	(3)	(2)	(5)	(7)	(5)	(3)	(12)	(18)

Item 2 Good Teaching, Physical Science

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	21%	46%	19%	11%	58%	46%	43%	56%
	(4)	(8)	(8)	(3)	(4)	(11)	(15)	(14)
Australian National University	50%	63%	78%	63%	83%	58%	28%	68%
	(2)	(8)	(3)	(9)	(6)	(14)	(3)	(13)
University of Melbourne	38%	39%	40%	52%	44%	60%	63%	45%
	(8)	(18)	(13)	(27)	(17)	(32)	(29)	(35)
Monash University	45%	39%	46%	48%	42%	38%	47%	
	(16)	(14)	(4)	(8)	(10)	(10)	(17)	
University of New South Wales	0%	0%		50%	54%	8%	17%	67%
	(1)	(2)		(4)	(4)	(2)	(3)	(4)
University of Sydney	40%	68%	45%	44%	36%	51%	39%	51%
	(8)	(12)	(16)	(15)	(17)	(26)	(25)	(25)
The University of Queensland	12%	17%	46%	67%	39%	55%	86%	79%
	(7)	(2)	(4)	(3)	(9)	(14)	(6)	(15)
University of Western Australia	33%	75%	40%	59%	73%	61%	64%	63%
	(3)	(2)	(5)	(7)	(5)	(3)	(12)	(19)

Item 3 Generic Skills, Physical Science

GO8 University	1998 Agree % (N)	1999 Agree % (N)	2000 Agree % (N)	2001 Agree % (N)	2002 Agree % (N)	2003 Agree % (N)	2004 Agree % (N)	2005 Agree % (N)
University of Adelaide	50% (4)	58% (8)	54% (8)	44% (3)	67% (4)	61% (11)	42% (15)	67% (14)
Australian National University	67% (2)	67% (8)	78% (3)	70% (9)	81% (6)	65% (14)	33% (3)	82% (13)
University of Melbourne	60% (8)	62% (18)	45% (13)	59% (28)	50% (17)	58% (32)	65% (29)	64% (35)
Monash University	65% (16)	45% (14)	71% (4)	61% (8)	67% (10)	53% (10)	55% (17)	
University of New South Wales	50% (1)	25% (2)		67% (4)	75% (4)	33% (2)	17% (3)	92% (4)
University of Sydney	71% (8)	72% (12)	52% (16)	62% (15)	56% (17)	76% (26)	68% (25)	64% (25)
The University of Queensland	44% (7)	67% (2)	88% (4)	61% (3)	56% (9)	68% (14)	78% (6)	76% (15)
University of Western Australia	78% (3)	58% (2)	63% (5)	71% (7)	73% (5)	56% (3)	83% (12)	75% (19)

5.1.3 UQ Student Experience Survey (UQSES) quantitative data

As noted in Section 3, the University's internal survey instrument, the UQ Student Experience Survey (UQSES) is administered each year to graduating students and to first year students. Table 5.4 lists the reports available through the UQSES for the years 2001 – 2005. Those indicated by X have been analysed for this report since they provide data specifically at the program level.

Table 5.4 Complete list of UQSES reports (2001-2005)

UQSES Summary for UQ, Faculty and School	
UQSES Agreement Rates and Means by Faculty and School	
UQSES Agreement Rates and Means by Program and FOE	X
UQSES Norm Referenced All Scales by Faculty and School	
UQSES Norm Referenced All Scales by Program and FOE	X
UQSES Demographics UQ Wide	
UQSES Item Data	
UQSES by Field of Education	

The scales used are as follows:

- Teaching Quality
- Course Quality
- Communication and Problem-Solving

- Discipline Knowledge and Skills
- Ethical and Social Sensitivity
- Physical and Social Aspects

Items for each scale of the UQSES 2005 survey are listed below:

Teaching Quality Scale

"Thinking about the majority of the lecturing staff in your major area of study or discipline, how much would you agree that they:"

1. Were experts in their fields
2. Were enthusiastic and committed to their teaching
3. Drew on current research and developments in their teaching
4. Taught in a way that increased your understanding of the discipline
5. Treated you with courtesy and respect
6. Were available for consultation
7. Taught in a way that stimulated your interest in the discipline
8. Intellectually challenged and extended you
9. Encouraged you to think in new ways

Course Quality Scale

"Thinking about the majority of courses you have studied in your major area of study or discipline, please indicate how much you agree with the following statements:"

1. The learning objectives of the courses were made clear
2. Where it was used, information technology was well integrated into the courses
3. The workload was appropriate
4. The course covered the breadth of the discipline
5. There was a clear sequence of well integrated courses available
6. The courses were well-structured and administered
7. Students' knowledge, understanding, and skills were adequately assessed
8. The spread of assessment tasks was appropriate
9. Assessment requirements and marking criteria were made clear at the beginning of each course
10. Helpful feedback on assessment was given within a reasonable time
11. Course materials could be easily accessed
12. First-year courses were adequately designed to help new students adapt to university study*

Graduate Attributes

These items were developed at UQ to measure the UQ defined graduate attributes. However, as some of the attributes were covered adequately by items in the Generic Skills Scale (GSS) of the CEQ, items were not developed for these attributes and the GSS items were included (marked by * in the list below). These items were the same for all three forms of the survey.

"Thinking about your major area of study or discipline, how much has your experience at UQ contributed to the development of the following skills and outcomes?"

Communication and Problem-Solving Scale

1. As a result of my courses, I feel confident about tackling unfamiliar problems*
2. The courses helped me develop my ability to work as a team member*
3. The courses sharpened my analytic skills*
4. The courses improved my skills in written communication*
5. Your ability to think critically
6. Your ability to collect, anlayse and organise information
7. Your ability to generate possible solutions to problems
8. Your ability to use the appropriate style and mode of communication depending on your audience
9. Your ability to use computers to retrieve, process and communicate information
10. Your ability to convey ideas & information clearly in an oral form
11. Your ability to evaluate competing perspectives and bodies of evidence
12. Your appreciation of the importance of scholarship and research
13. Your ability to use research to inform decision making
14. Your ability to work and learn independently
15. Your ability to think in creative and innovative ways

Discipline Knowledge and Skills Scale

1. Your understanding of concepts and principles in your discipline
2. Your knowledge of the methods used in your discipline
3. Your understanding of the different approaches and perspectives in your discipline
4. Your knowledge of the full scope of your discipline
5. Your appreciation of the real world applications of your discipline
6. Your capacity to approach issues from the perspective of your discipline

Ethical and Social Sensitivity Scale

1. Your knowledge of ethical issues and standards in your discipline
2. Your appreciation of the philosophical and social contexts of your discipline
3. Your awareness and understanding of cultures and perspectives other than your own
4. Your openess to new ideas and perspectives
5. Your ability to evaluate the perspectives and opinions of others
6. Your understanding of social and civic responsibility

Facilities, Resources and Services

These items were developed at UQ to cover the range of facilities, resources and services provided by the university, which were not covered by other sections of the survey. These were the same for all three forms of the survey, except for item 6 in the Physical and Social Aspects scale (see * below) that was included only in the First Year Undergraduate form. Results of factor analysis of the survey data showed that 3 items from the Learning Community Scale (Extended CEQ) helped to form the Learning Support Scale, and therefore they are also included in this scale (marked by * in the Learning Support Scale below).

"How would you rate the quality of the following aspects of The University of Queensland?"

Physical and Social Aspects of UQ Scale

1. The opportunities for a stimulating and varied life for students on-campus
2. The university's physical environment
3. The university's academic and intellectual environment
4. The general facilities on your campus (eg. places to eat, shops, student union, facilities. etc.)
5. Sporting and recreational facilities (including UQ Sport)
6. Opportunities for extra-curricular activities (including clubs and societies)
7. Orientation activities for new students (including opportunities for academic advising and course planning)*

Learning Support Scale

1. The teaching facilities (eg. lecture theatres, laboratories, etc.)
2. Library facilities and resources
3. Library services (including AskIT) and assistance from library staff
4. On-campus IT facilities
5. Off-campus internet access
6. The Student Centre (St Lucia, Herston, Gatton or Ipswich)
7. Faculty/School offices and student centres
8. The library services were readily accessible*
9. I was able to access information technology resources when I needed them*
10. Relevant learning resources were accessible when I needed them*

Results for first year and final year students are reported separately. Results are reported using percentage agreement (Table 5.5) and norm referenced against all Bachelors' degrees at UQ (Table 5.6).

The data indicate that the BSc scores in higher quartiles (more favourably) with UQ Bachelors degrees overall, in terms of: teaching quality (final year), course quality (first year), physical and social aspects (final year), discipline knowledge and skills (first year). On all other scales scores are in the same quartile for both.

Table 5.5 UQSES Agreement rates by program: UQ scale (questions grouped as above)

Cohort Description		Teaching Quality	Course Quality	Communi-cation and Problem Solving	Discipline Knowledge and Skills	Ethical and Social Sensitivity	Physical and Social Aspects of UQ	Learning Support
BSc First Year	Agree %	72%	72%	57%	72%	55%	83%	73%
	Broadly Agree %	93%	91%	86%	95%	85%	97%	86%
	No. of Respondents	(338)	(336)	(335)	(335)	(335)	(335)	(331)
Bachelors pass First Year (all of UQ)	Agree %	74%	69%	60%	69%	60%	81%	73%
	Broadly Agree %	94%	90%	88%	94%	88%	96%	87%
	No. of Respondents	(1520)	(1517)	(1513)	(1513)	(1511)	(1507)	(1492)
BSc Final Year	Agree %	78%	69%	73%	76%	55%	85%	76%
	Broadly Agree %	96%	90%	93%	97%	84%	97%	89%
	No. of Respondents	(136)	(136)	(136)	(135)	(136)	(135)	(135)
Bachelors pass, Final Year (all of UQ)	Agree %	76%	67%	72%	72%	66%	80%	74%
	Broadly Agree %	95%	88%	93%	94%	90%	96%	89%
	No. of Respondents	(732)	(731)	(728)	(729)	(728)	(724)	(722)

Table 5.6 Norm referenced results by program:

(i) BSc

Cohort Description	Teaching Quality	Course Quality	Communication & Problem Solving	Discipline Knowledge & Skills	Ethical & Social Sensitiviity	Physical & Social Aspects	Learning Support
First Year	2nd Quartile	3rd Quartile	2nd Quartile	3rd Quartile	2nd Quartile	3rd Quartile	2nd Quartile
Final Year	3rd Quartile	2nd Quartile	3rd Quartile	3rd Quartile	2nd Quartile	3rd Quartile	2nd Quartile

(ii) All UQ Bachelors degrees

Cohort Description	Teaching Quality	Course Quality	Communication & Problem Solving	Discipline Knowledge & Skills	Ethical & Social Sensitiviity	Physical & Social Aspects	Learning Support
First Year	2nd Quartile	2nd Quartile	2nd Quartile	2nd Quartile	2nd Quartile	3rd Quartile	2nd Quartile
Final Year	2nd Quartile	2nd Quartile	3rd Quartile	3rd Quartile	2nd Quartile	2nd Quartile	2nd Quartile

The UQSES questions have also been re-grouped using the scales employed by the CEQ: Generic skills, Good teaching, Student support, Learning communities. Results are again reported using percentage agreement (Table 5.7) and norm-referenced (Table 5.8). The data at this level of precision do not point to any major differences between the BSc and all Bachelors degrees at UQ.

"Thinking about the courses in your major area of study or discipline, please indicate how much you agree with the following statements:"

Generic Skills Scale (CEQ)

1. As a result of my courses, I feel confident about tackling unfamiliar problems*
2. The courses helped me develop my ability to work as a team member*
3. The courses sharpened my analytic skills*
4. The courses developed my problem-solving skills*
5. The courses improved my skills in written communication*
6. My courses helped me to develop the ability to plan my own work

Good Teaching Scale (CEQ)

1. The teaching staff of this program motivated me to do my best work
2. The staff put a lot of time into commenting on my work
3. The staff made a real effort to understand difficulties I might be having with my work
4. The teaching staff normally gave me helpful feedback on how I was going
5. My lecturers were extremely good at explaining things
6. The teaching staff worked hard to make their courses interesting

Overall Satisfaction Item (CEQ)

Overall, I was satisfied with the quality of these courses

Learning Community Scale (Extended CEQ)

1. I felt part of a group of students and staff committed to learning
2. I was able to explore academic interests with staff and students

3. 3. I learned to explore ideas confidently with other people**
4. 4. Students' ideas and suggestions were used during the degree program**
5. 5. I felt I belonged to the university community**

Student Support Scale (Extended CEQ)

1. The library services were readily accessible
2. I was able to access information technology resources when I needed them
3. I was satisfied with the degree program and careers advice provided
4. Health, welfare and counselling services met my requirements
5. Relevant learning resources were accessible when I needed them

Table 5.7 BSc compared to All Bachelors degrees at UQ (CEQ scales)

Cohort Description		Generic Skills	Good Teaching	Overall Satisfaction	Learning Community	Student Support
BSc Final Year	Agree %	71%	50%	86%	58%	70%
	Broadly Agree %	93%	81%	96%	88%	92%
	No. of Respondents	(136)	(136)	(136)	(136)	(136)
All Bachelors degrees Final Year	Agree %	72%	51%	77%	60%	67%
	Broadly Agree %	93%	82%	94%	88%	90%
	No. of Respondents	(726)	(725)	(725)	(726)	(726)

Table 5.8 Norm referenced results by program: CEQ scales

(i) BSc

Cohort Description	Generic Skills	Good Teaching	Student Support	Learning Community
First Year	1st Quartile	4th Quartile	2nd Quartile	2nd Quartile
Final Year	2nd Quartile	2nd Quartile	2nd Quartile	3rd Quartile

(ii) All of UQ Bachelors degrees

Cohort Description	Generic Skills	Good Teaching	Student Support	Learning Community
First Year	1st Quartile	4th Quartile	2nd Quartile	2nd Quartile
Final Year	2nd Quartile	2nd Quartile	2nd Quartile	3rd Quartile

The UQSES questions have also been re-grouped to consider the "first year perception" using three scales: Program quality, Teaching quality, Appropriate workload. Results are again reported using percentage agreement (Table 5.9) and norm-referenced (Table 5.10). Once again, the results do not point to any major differences between the BSc and all Bachelors degrees at UQ.

"Please indicate the extent to which you agree or disagree with the following statements about your degree program and the teaching within it:"

Perception of Program Quality Scale

1. I am finding my degree program intellectually stimulating
2. I have a clear idea of where my degree program is going
3. The teaching staff are good at explaining things
4. Staff made it clear from the start what they expect from students
5. Teaching staff here usually give helpful feedback on my progress
6. Staff are enthusiastic about the courses they teach
7. Overall, I am really enjoying my degree program
8. Overall, I am very satisfied with my university experience so far

Perception of Teaching Scale

1. Most of the academic staff are approachable
2. Staff are usually available to discuss my work
3. Most academic staff in my courses take an interest in my progress
4. Staff try hard to make the courses interesting
5. The staff make a real effort to understand difficulties students may be having with their work
6. The quality of teaching in my degree program in generally good

Perception of Appropriate Workload Scale

1. My degree program workload is too heavy
2. The volume of work to be got through in this degree program of study means that I can't comprehend it all thoroughly
3. The number of contact hours make it difficult for me to complete the tasks set for classes
4. The workload is not challenging enough for me
5. It seems to me that the syllabus tries to cover too many topics

Table 5.9 First year perception (questions grouped as above)

Cohort Description		Program Quality	Teaching Quality	Appropriate Workload
BSc First Year	Agree %	64%	57%	36%
	Broadly Agree %	87%	86%	66%
	No. of Responses	(336)	(336)	(336)
All Bachelors' degrees First Year	Agree %	67%	61%	40%
	Broadly Agree %	89%	87%	70%
	No. of Resp.	(1512)	(1510)	(1512)

Table 5.10 Norm referenced results by program: First year perception scale

(i) BSc

Cohort Description	Program Quality	Teaching Quality	Appropriate Workload
First Year	2nd Quartile	2nd Quartile	2nd Quartile

(ii) All of UQ

Cohort Description	Program Quality	Teaching Quality	Appropriate Workload
First Year	2nd Quartile	2nd Quartile	2nd Quartile

5.1.4 UQ Student Experience Survey (UQSES): qualitative data

Two open ended questions were posed to students:

(i) What have been the best aspects of your experience at the University of Queensland?

(ii) What aspects of your experience at The University of Queensland are most in need of improvement?

Answers were then grouped according to whether they were positive or negative, then by domain or topic, then by cohort (BACS or EPSA). Domains were: assessment, course design, outcomes, staff, and support.

(i) BACS UQSES qualitative feedback 2005

Domain/Topic	Likes	Dislikes
Assessment	• Scored few positive comments	• Many "in need of improvement" comments, overwhelmingly based on the need for better feedback on assessment.
Course Design	• Lab work, practical work, research opportunities eg Intro to Research , field trips, field studies, lectures based on "real research" not text books, hands on activities (first year) • Amount of choice in courses • Tutorials and PASS sessions • Lectures from enthusiastic experts in their field	• More prac work, field work • Better structuring and organisation of some subjects • Timetable problems • Excessive workload
Outcomes	• Developing my skills, getting confidence in a field, involvement in a research environment, hands on learning in the field, learning from researchers in a field, learning interesting things	• Not enough basic practical knowledge • Info on job opportunities • Not enough emphasis on understanding vs rote learning
Staff	• Enthusiasm, dedication, friendly, accessible, motivated, highly skilled	• Some lecturers not interested in teaching • Not interesting to listen to • Not enough interaction with academic staff, staff availability • More support for teaching staff • Not enough feedback on work • Control and engagement in big classes
Support	• Library • Meeting new people • Physical environment	• Parking and parking fees • Computer access • Better lab equipment • Condition of some lecture theatres • Timetables

(ii) EPSA UQSES qualitative feedback 2005

Domain/Topic	Likes	Dislikes
Assessment	• Group projects • Real world associations • Thesis • Field trips.	• Lack of feedback • Multiple choice exams • Limited practical work • Lack of coordination of assessment tasks • Exams based on past papers • Pointless assessment • Lack of clear marking criteria and standards.
Course Design	• Team projects, • Field work • Real world relevance • Real issues • Structured courses • On-line content available, • Encouraging environment • Practicals.	• Not enough practicals • High student staff ratios in class • More tutors needed • Boring lectures • Timetables • Lack of external or mixed delivery modes • Continually changing and inconsistent course structures • Poor teachers, • Lack of teaching resources • Lack of assistance with choosing courses • Outdated content • Declining number and breadth of mathematics courses offered • Dull lifeless lecture rooms.
Outcomes	• Real world learning • Real world skills • Problem solving and critical thinking development • Confidence • Communications • Independence • Building • Employment prospects • Meeting and interacting with interesting people • Learning environments	• Not enough real world experiences • More practical experience • More careers and academic advice.

Staff	• Passion, enthusiasm • Inspiring lectures • Lecturers with real world experience • Lecturers who have been in industry • Lecturers with obvious expertise, • Small classes which enable interaction with staff • Being treated as an equal by teaching staff in mathematics • Good vibes from staff • Patient tutors.	• Lack of access to staff & little or no availability for consultation including academic advising • Lack of staff with real world experience • More case based teaching needed, more commitment to course integration within a program needed • Teachers who can't communicate • Staff who don't give feedback • Lecturers who are not interested in students and their progress • Poor teachers • Teachers reading off lecture notes • Attitudes of some staff and tutors • Web-sites not updated from one year to the next • More training of lecturers to teach as well as research • More interaction with staff on real world stuff • More awareness by course coordinators of student circumstances.
Support	• The campus • 24 h access to computer labs • Computer facilities • Library facilities • Study environment and exposure to other cultures • Clubs, societies and social opportunities • Sporting facilities • Union facilities	• Parking • Extend library opening hours • Better training of staff re teaching innovations • Too much PowerPoint • More people at the student centre, • Laboratories and lab equipment • More librarycomputers • Administration errors • Library staff attitudes • Bus transport to university • Academic advisers • Old and cramped lecture theatres with uncomfortable seating • Computer labs in the maths building, buildings that aren't air conditioned • Too large classes • Chemistry laboratories.

5.1.5 Course Evaluation Instrument (iCEVAL) data

5.1.5.1 BACS iCEVAL data

The University of Queensland's Institutional course (subject) evaluation instrument (iCEVAL) is tailored at the Faculty/School level. Questions used by BACS are given in Table 5.11. Students are asked to rate their response to the questions according to the following scale:

- Strongly Agree (SA - 5)
- Agree (A - 4)
- Undecided (U - 3)
- Disagree (D - 2)
- Strongly Disagree (SD - 1)
- Not Applicable (NA - 0) scale)

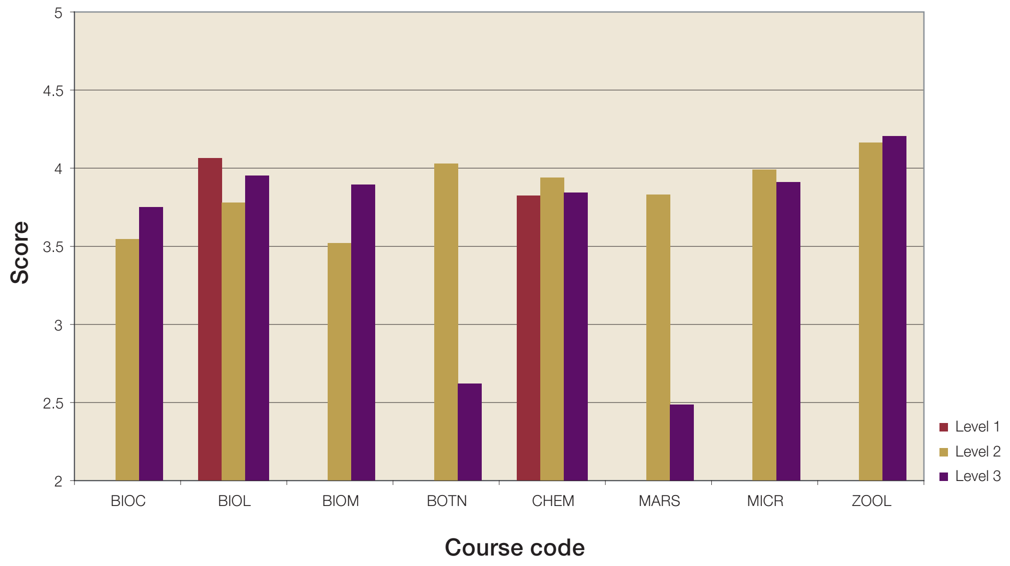
Results for Question 20 “Overall, how would you rate this course?” are given in Figure 5.6. As a guide to evaluating these results, it is generally accepted that scores higher than 4 are good, and scores lower than 3.5 merit attention. A full explanation of course codes can be found in the glossary under “Course Codes.

Table 5.11 Questions used for BACS iCEVALs

1. The learning objectives of the course were clear
2. My knowledge, understanding and skills were adequately assessed
3. Helpful feedback on assessment was give within a reasonable time to facilitate further learning
4. Assessment was spread appropriately across the semester, rather than being concentrated at the end of the course
5. Assessment requirements and marking criteria were made clear at the beginning of the course
6. There was an appropriate match between the learning objectives and various assessments
7. The course was intellectually stimulating
8. I felt I belonged to a group of students and staff engaged in inquiry and learning in this course
9. I have achieved the graduate attributes which the course aimed to develop (eg oral/ written communication, team work, critical thinking, problem solving, ethical sensitivity)
10. Course materials and resources (readings, lab manuals, websites, etc.) helped me to learn in this course
11. The learning activities (e.g. lectures, labs, tutorials, pracs, fieldwork, etc.) helped me to learn in this course
12. Teaching staff were available for consultation
13. The course was well administered (eg., sufficient resources were available when needed)
14. The teaching facilities (e.g., labs, lecture theatres, tutorial rooms) were adequate for this course
15. The workload in this course was too high given the unit value of the course
16. *
17. *
18. *
19. *
20. Overall, how would you rate this course

* *Note. Questions 16 - 19 are open ended question place holders and are only used occasionally for specific course related questions.*

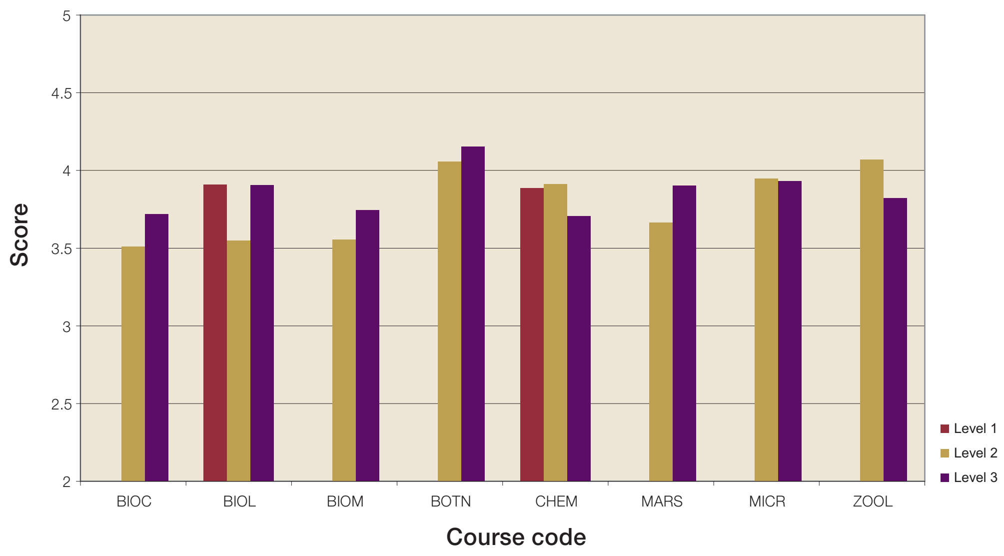
Figure 5.6 Most recent iCEVAL data for BACS courses (2004-2005)



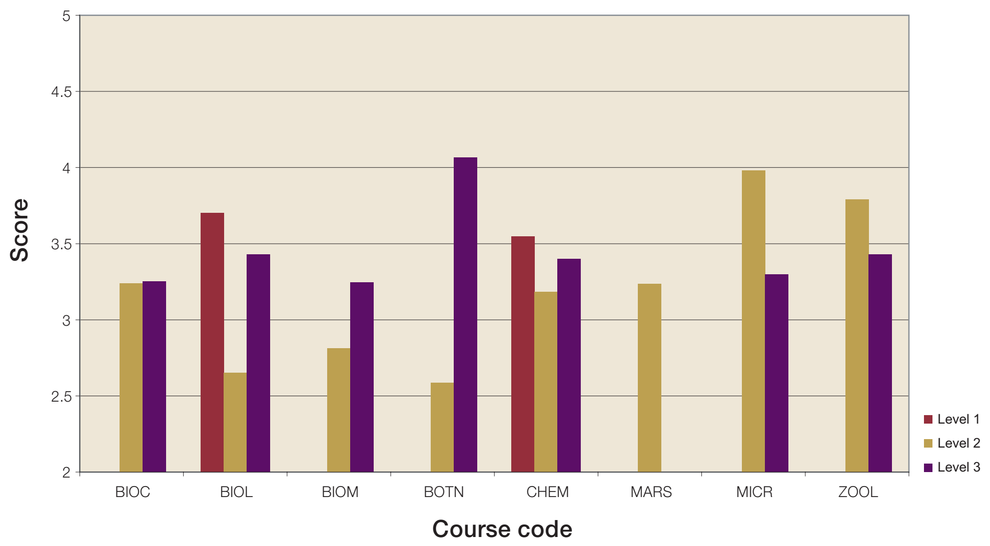
Detailed iCEVAL data for BSc Part A courses from BACS are provided in Figure 5.7. It is grouped by course code and level, for each of the 16 questions in the survey.

Figure 5.7 Scores for individual questions used for BACS course iCEVALs

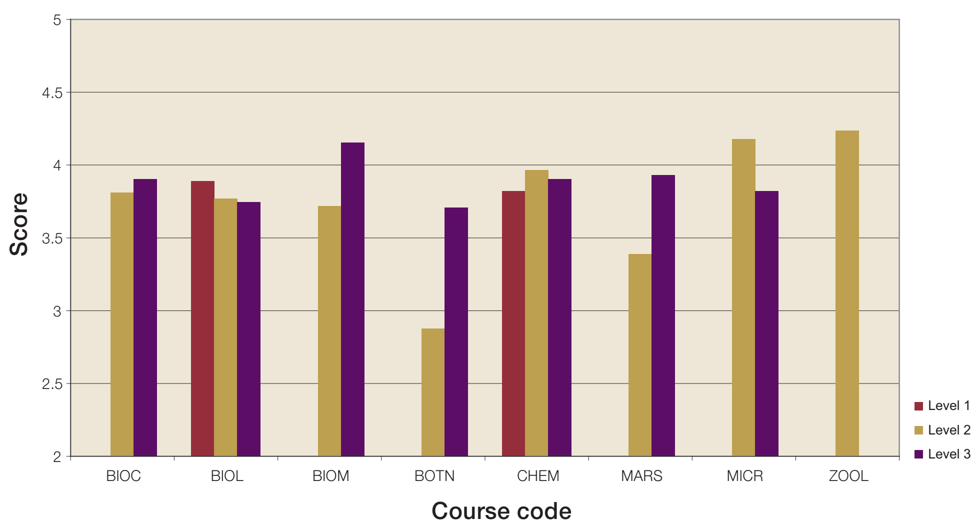
Q2. My knowledge, understanding and skills were adequately assessed



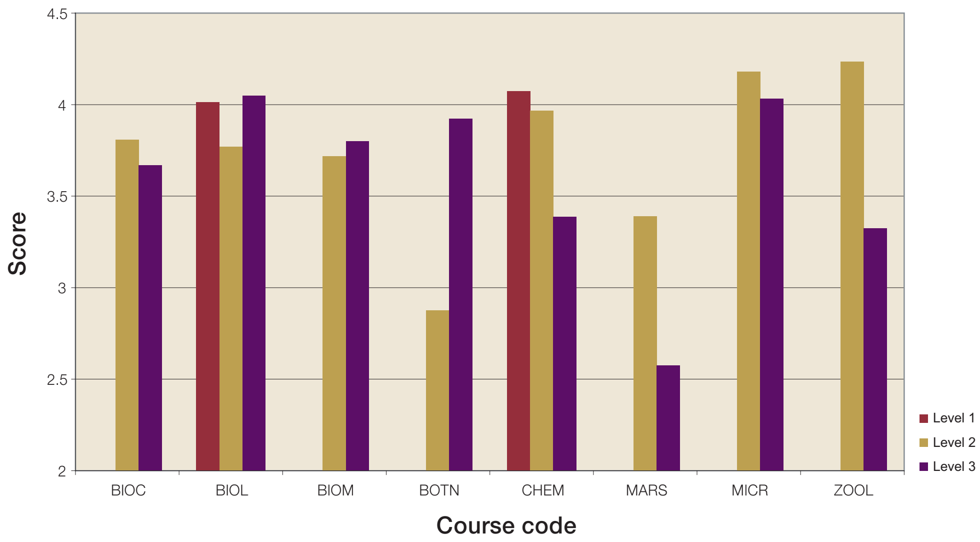
Q3. Helpful feedback on assessment was give within a reasonable time to facilitate further learning



Q4. Assessment was spread appropriately across the semester, rather than being concentrated at the end of the course

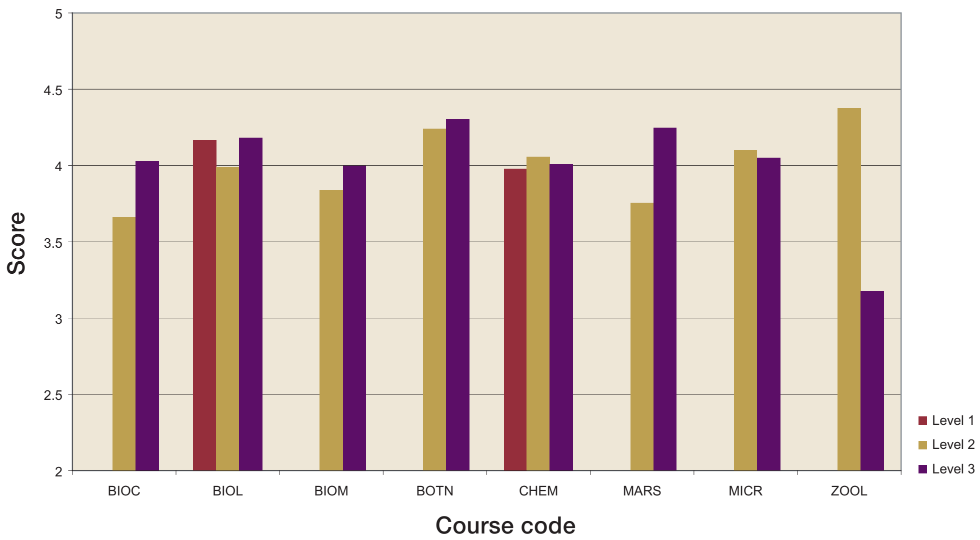


Q5. Assessment requirements and marking criteria were made clear at the beginning of the course

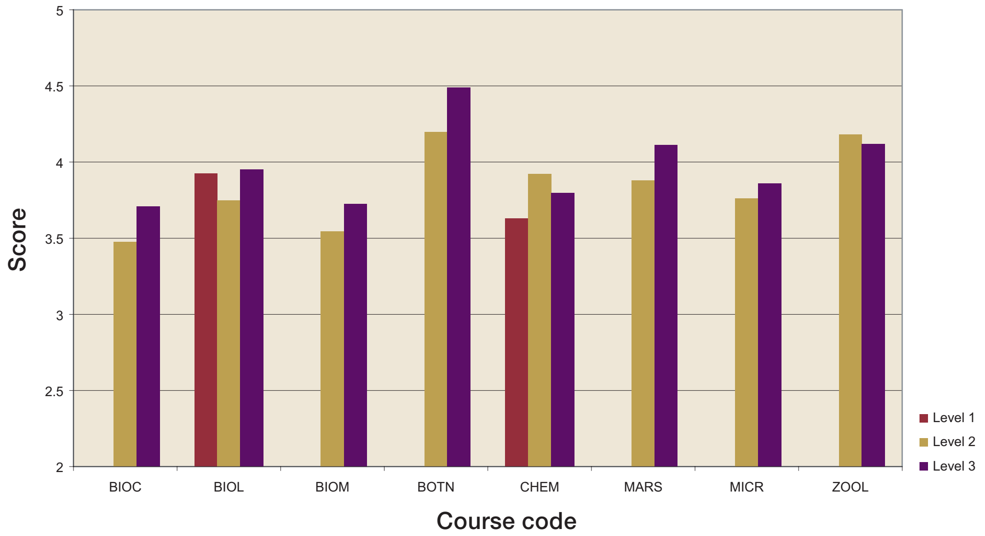


Q6. There was an appropriate match between the learning objectives and various assessments

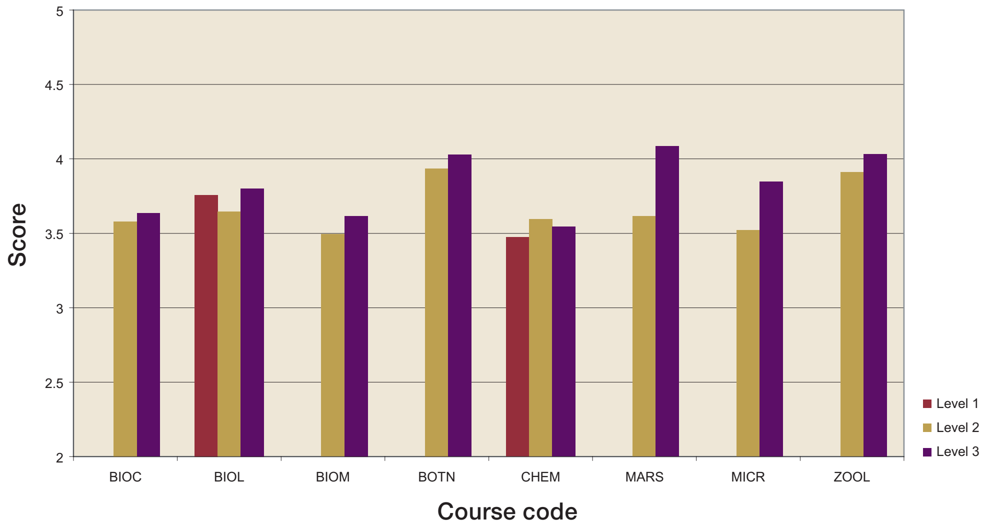
Q7. The course was intellectually stimulating



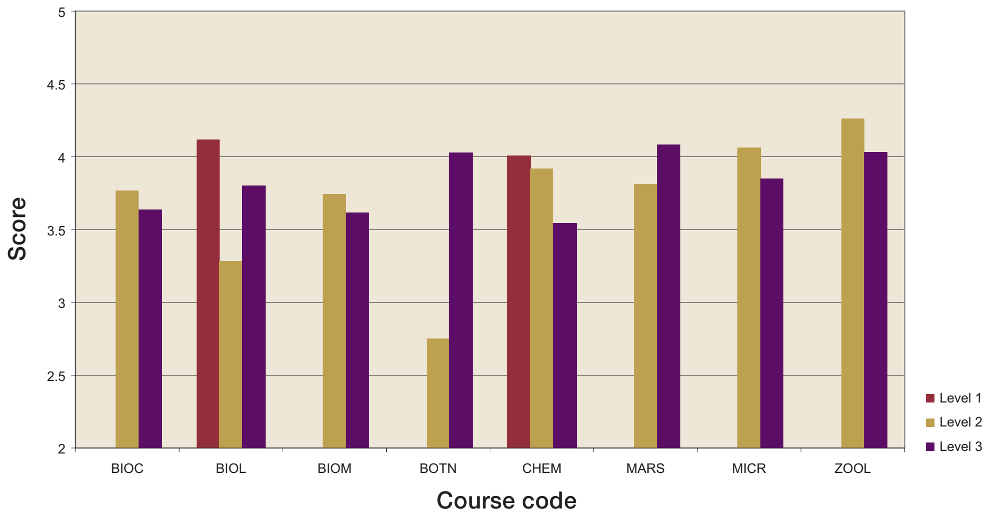
Q8. I felt I belonged to a group of students and staff engaged in inquiry and learning in this course



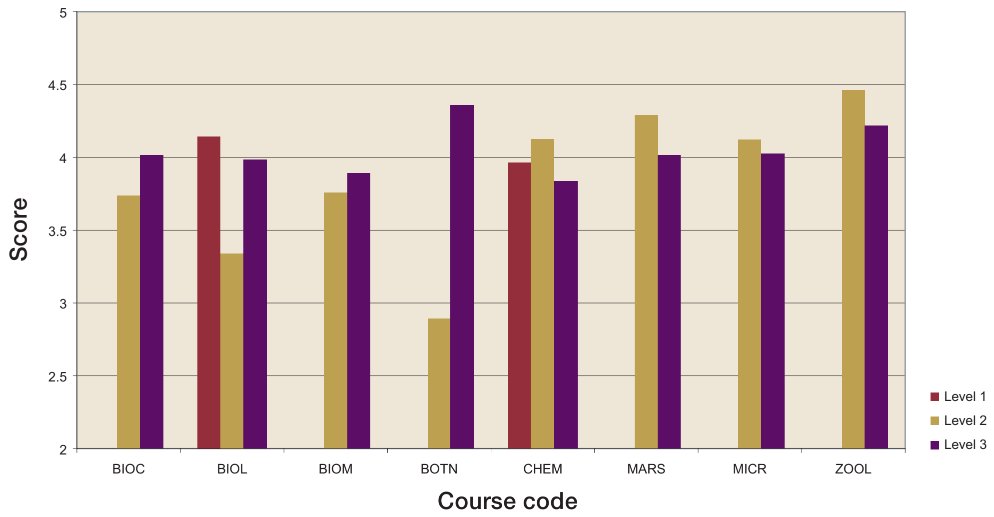
Q9. I have achieved the graduate attributes which the couse aimed to develop (e.g. oral/written commuication, team work, critical thinking, problem solving, ethical sensitivity)



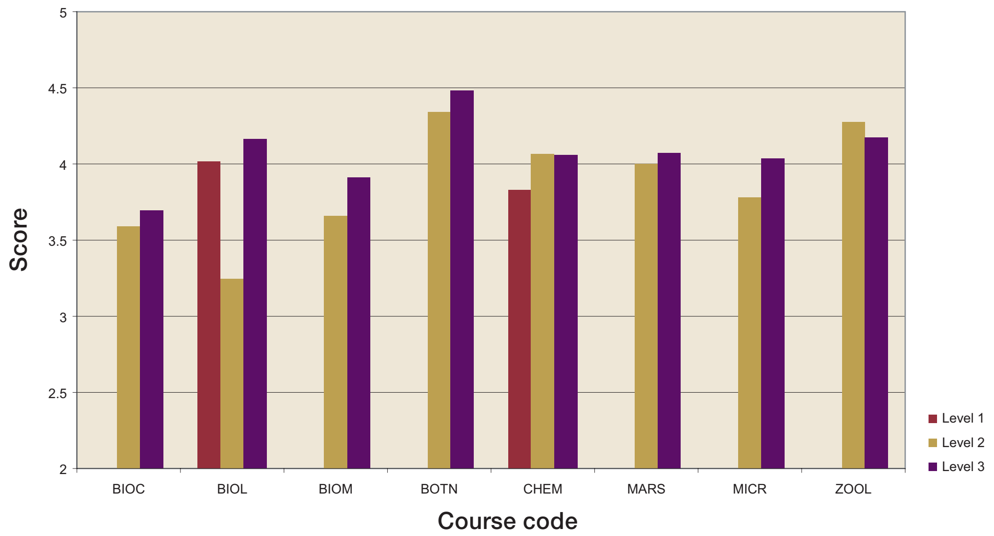
Q10. Course materials and resources (readings, lab manuals, websites, etc.) helped me to learn in this course



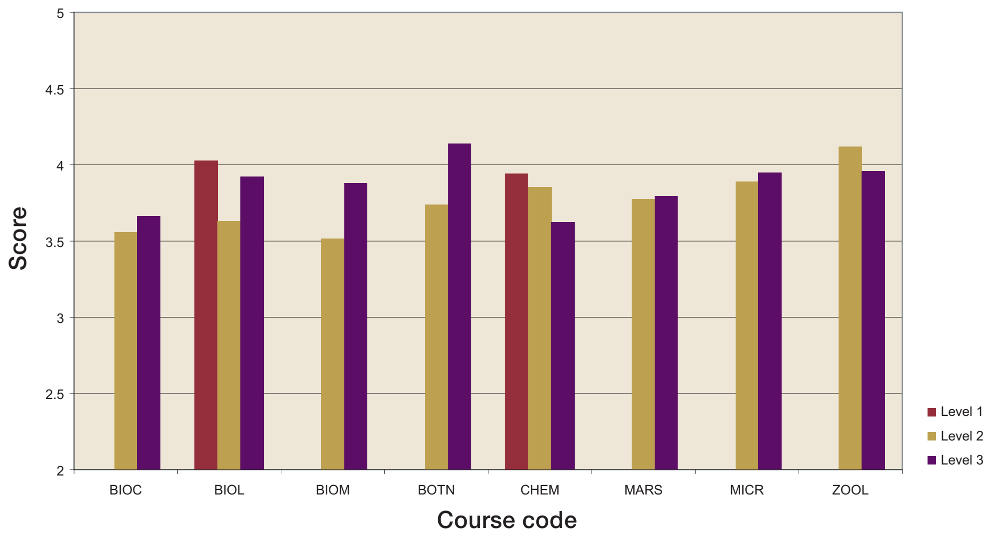
Q11. The learning activities (e.g. lectures, labs, tutorials, pracs, fieldwork, etc.) helped me to learn in this course



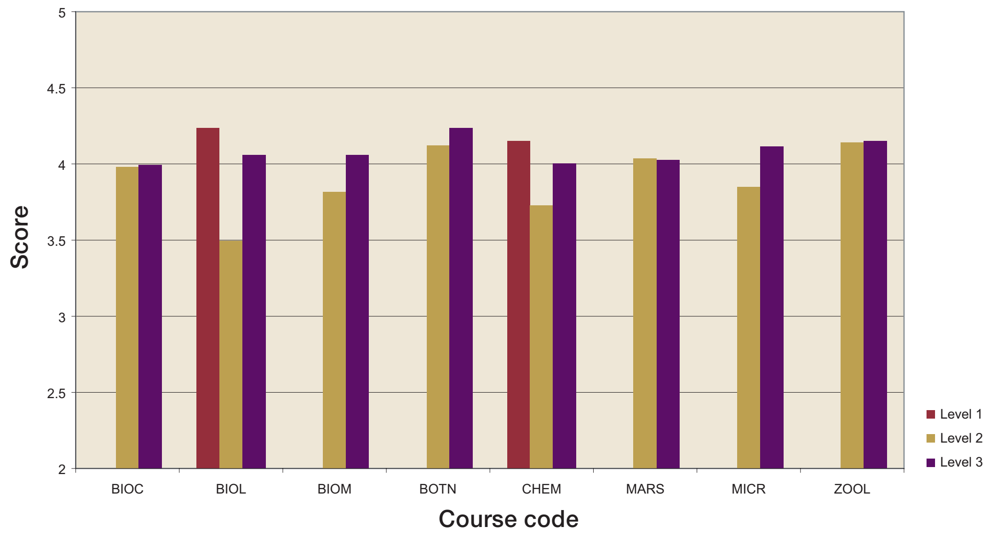
Q12. Teaching staff were available for consultation



Q13. The course was well administered (eg., sufficient resources were available when needed)



Q14. The teaching facilities (e.g. labs, lecture theatres, tutorial rooms) were adequate for this course



Q15. The workload in this course was too high given the unit value of the course

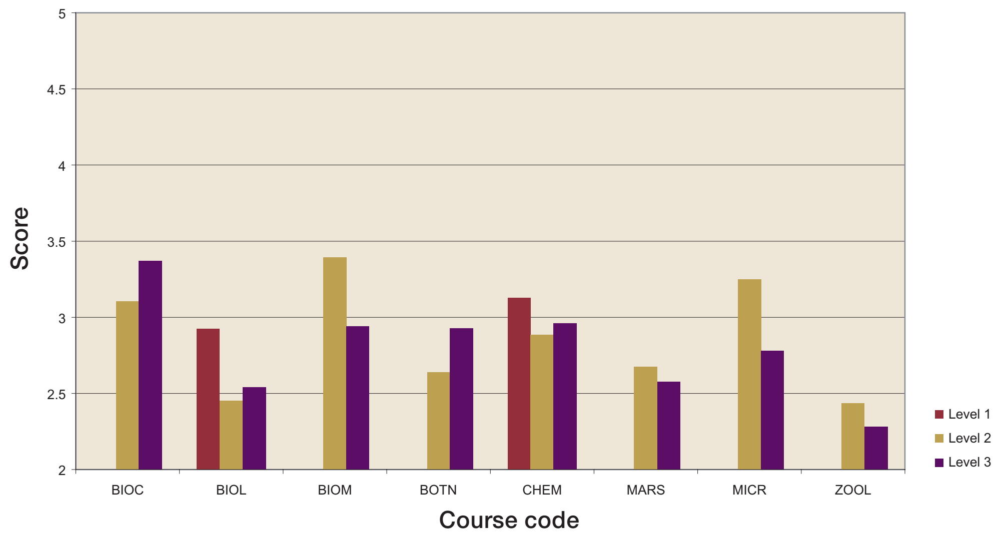
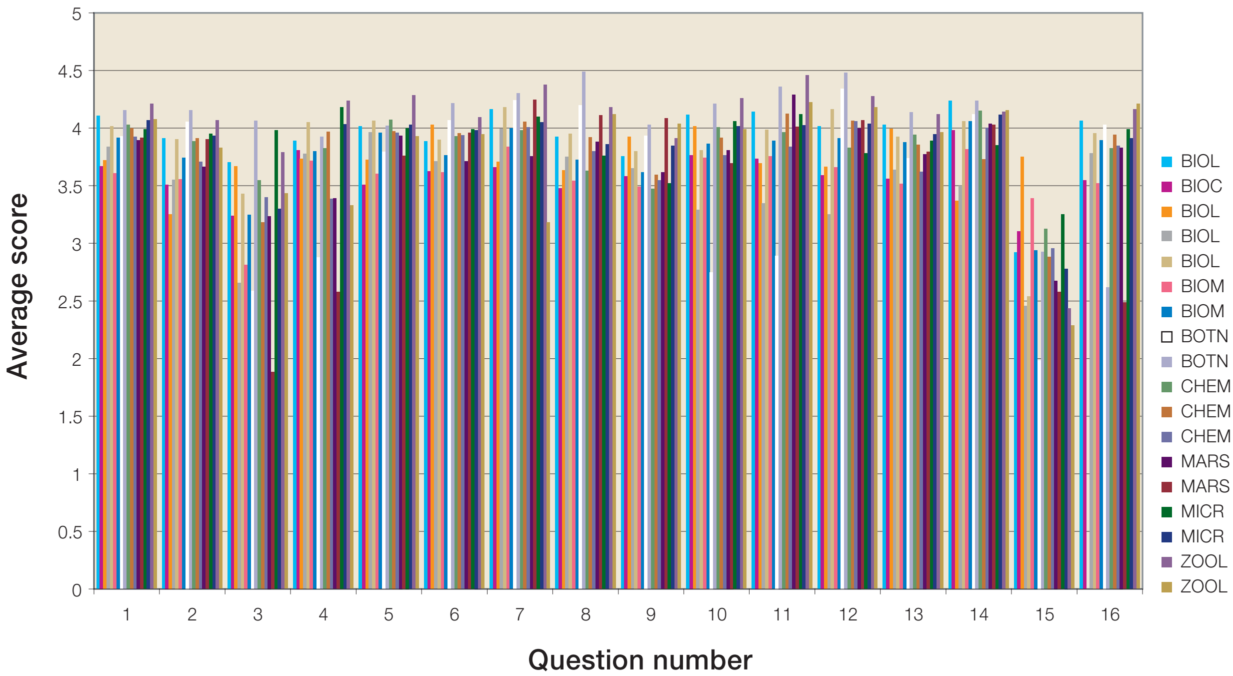


Figure 5.8 below shows aggregated responses to all 16 questions for all BACS courses. This figure is a useful indicator of any broad issues raised in all courses across the BACS Faculty. It indicates Q15 to be the lowest scoring question across all courses. Question 15 is related to workload: "The workload in this course was too high given the unit value of the course". Question 3 also scored relatively low in many courses: "Helpful feedback on assessment was give within a reasonable time to facilitate further learning".

Figure 5.8 Summary of BACS iCEVALs 2004-05



Note: For the purposes of this summary the results for Q20 – "Overall how would you rate this course?" has been displayed in position 16 on Figure 5.8.

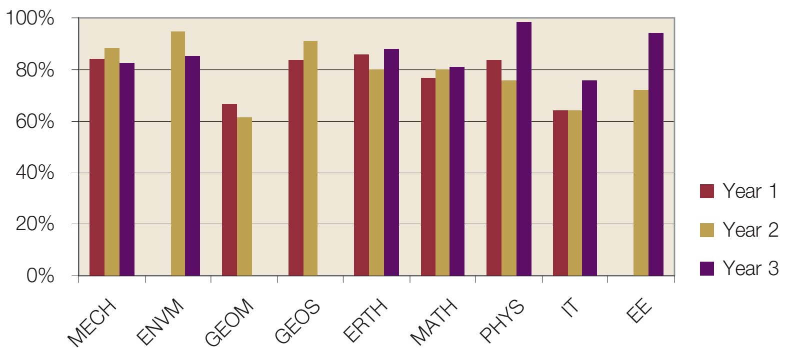
5.1.5.2 EPSA iCEVAL data

The iCEVAL questions used by EPSA are the same as those used for BACS (see Table 5.11) with the exception of Question 15 "The workload in this course was *not* too high given the unit value of the course which has been changed to include the word "not", so that the trend would match the other questions.

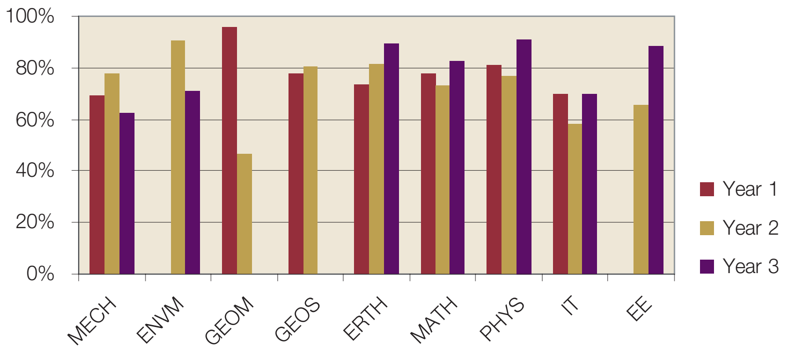
Although the questions are similar, EPSA iCEVAL results have been analysed differently. They have analysed their results as "percentage of students agreeing and strongly agreeing" to a question or statement, rather than the 1-5 scale as in the BACS analysis. As a guide to evaluating these results, it is generally accepted that scores higher than 70% are good, and scores lower than 60% merit attention. It should be noted that some of these courses have a majority of non-BSc students enrolled, for example in some MATH courses where the cohort includes a large percentage of engineering students. There is currently no mechanism for segregating responses from BSc students in these courses. Items relating to feedback on assessment and workload again scored relatively low. Detailed data for all questions are given in the Figure 5.9. A full explanation of course codes can be found in the glossary.

Figure 5.9 Scores for individual questions for EPSA course iCEVALs

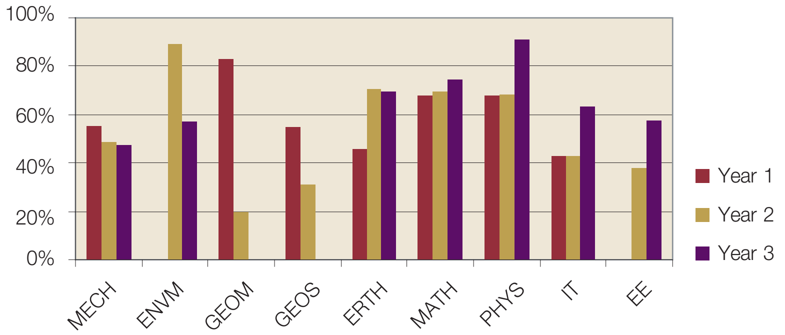
Q1 The learning objectives of the course were clear



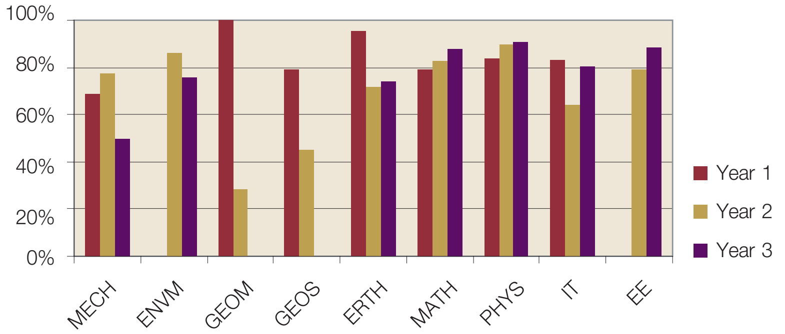
Q2 My knowledge, understanding and skills were adequately assessed



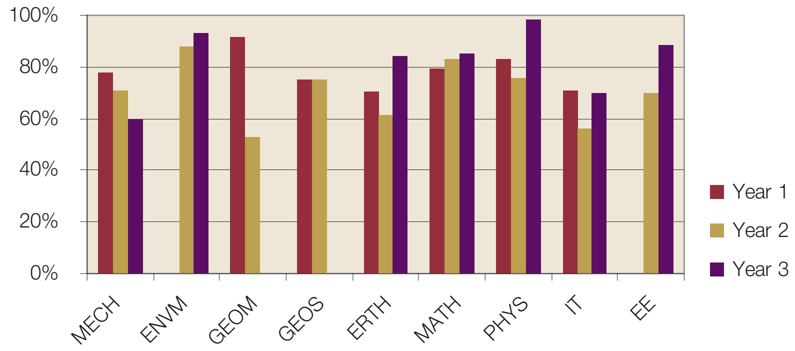
Q3 Helpful feedback on assessment was given within a reasonable time to facilitate further learning



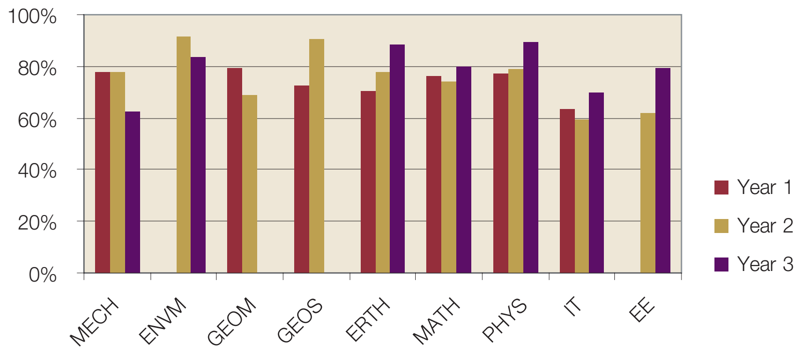
Q4 Assessment was spread appropriately across the semester, rather than being concentrated at the end of the course



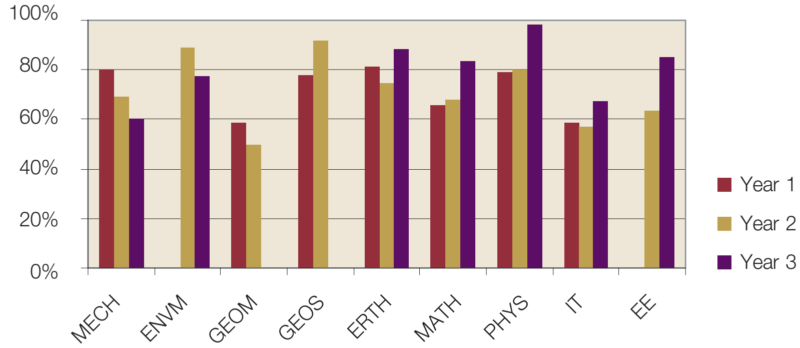
Q5 Assessment requirements and marking criteria were made clear at the beginning of the course



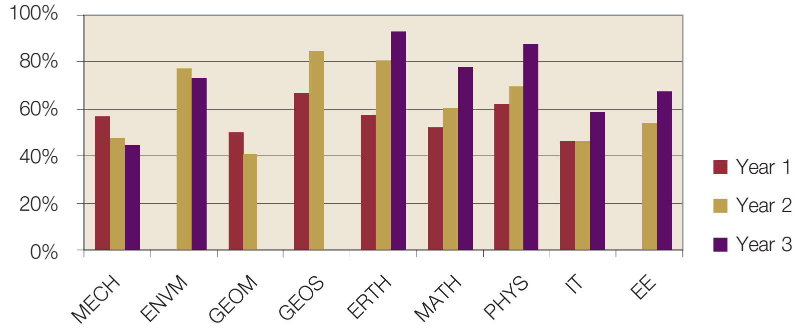
Q6 There was an appropriate match between the learning objectives and various assessments



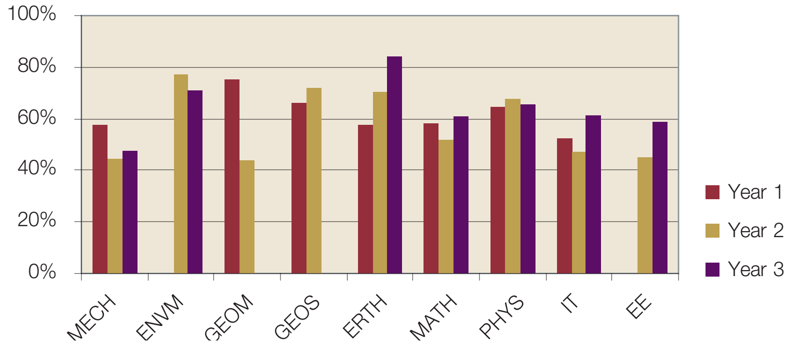
Q7 The course was intellectually stimulating



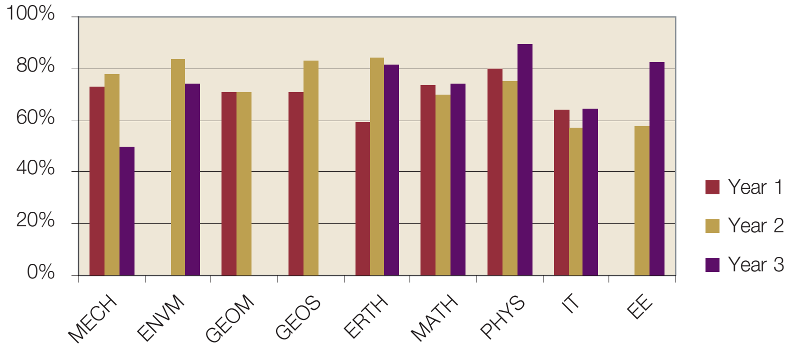
Q8 I felt I belonged to a group of students and staff engaged in inquiry and learning in this course



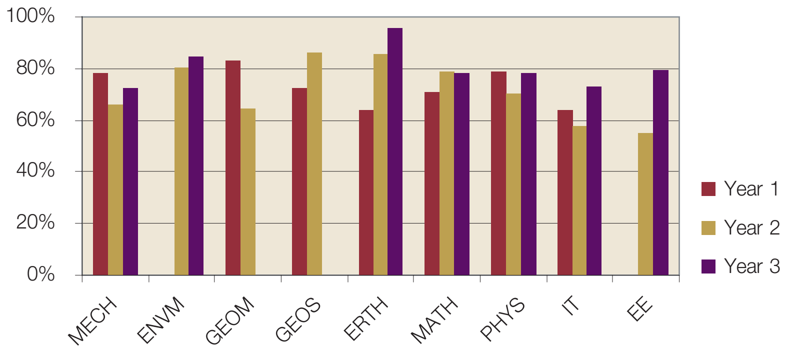
Q9 I have achieved the graduate attributes which the course aimed to develop



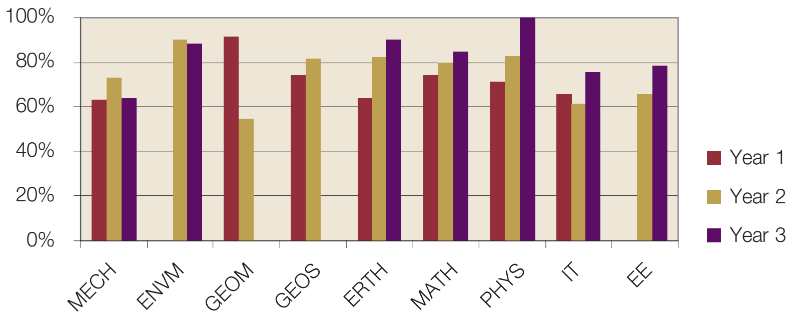
Q10 Course material and resources helped me to learn in this course



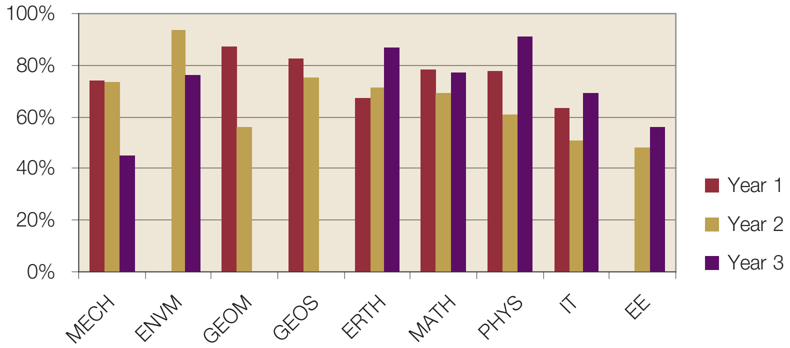
Q11 The learning activities helped my to learn in this course



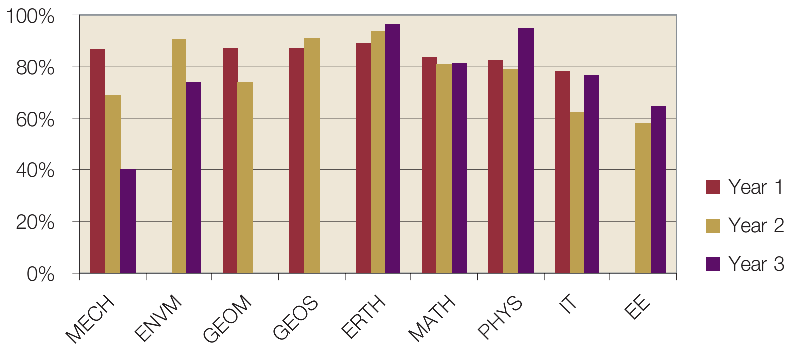
Q12 Teaching staff were available for consultation



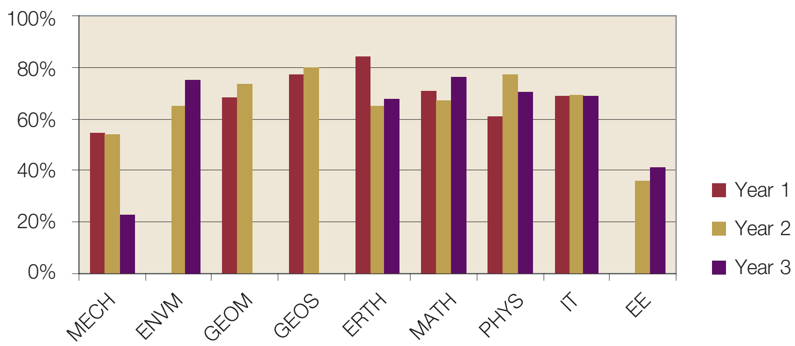
Q13 The course was well administered



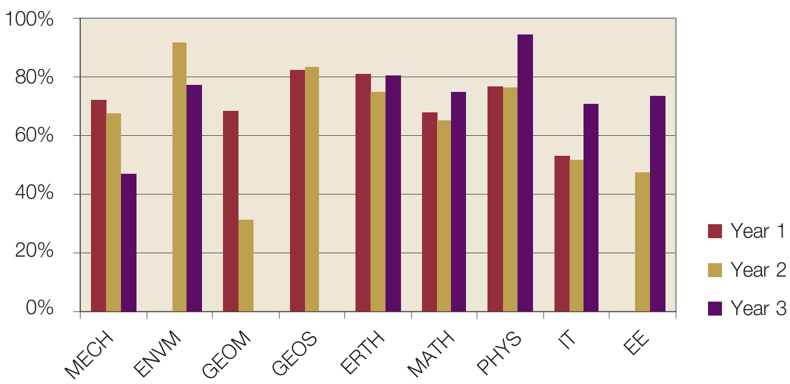
Q14 The teaching facilities were adequate for this course



Q15 The workload in this course was *not* too high given the unit value of the course



Q20 Overall rating



5.2 Student Numbers and Demographics by Program, Field of Study and Course

5.2.1 Numbers of students in science related programs and demographics

Numbers of commencing students in the BSc and related science degrees are given in Table 5.12.

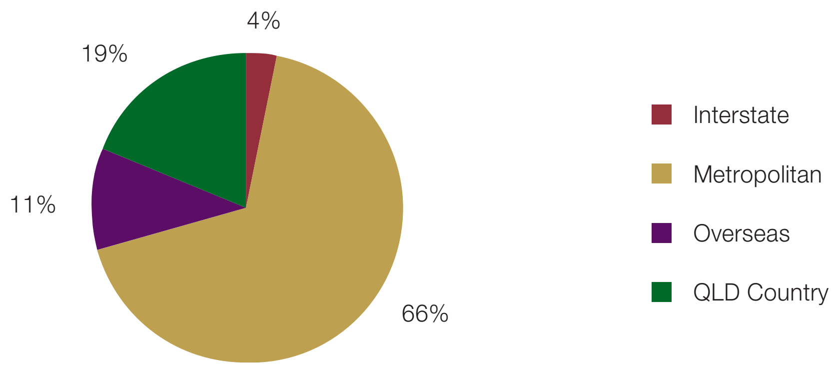
Table 5.12 First Year enrolment in science degrees 2001-2006

	2001	2002	2003	2004	2005	2006
BSc	882	933	870	828	899	1013
BBiotech	103	109	87	71	56	60
BMarSt		47	48	49	31	47
BEnvSc	30	26	16	23	22	23
BBusMan/BSc	44	27	22	19	23	18
BCom/BSc	48	45	24	25	17	25
BEcon/BSc	9	5	9	10	8	5
BSc/BA	102	116	90	104	70	64
BSc/BEd	37	46	18	23	30	16
BSc/BJ			5	5	7	7
BSc/LLB	31	44	20	13	12	29
BE/BSc	2	40	37	55	49	33
BInfT/BSc			12	6	10	12
	1288	1438	1258	1231	1234	**1352**

Note: This data is the headcount post semester 1 and therefore takes into account attrition in the first semester.

The distribution of BSc students by home address (2004 data) is shown in Figure 5.10 below:

Figure 5.10 2004 Commencing students' home address



The Schools from which these commencing students came in 2004 (top 25) is shown in Figure 5.11.

Figure 5.11 2004 Commencing students' secondary school

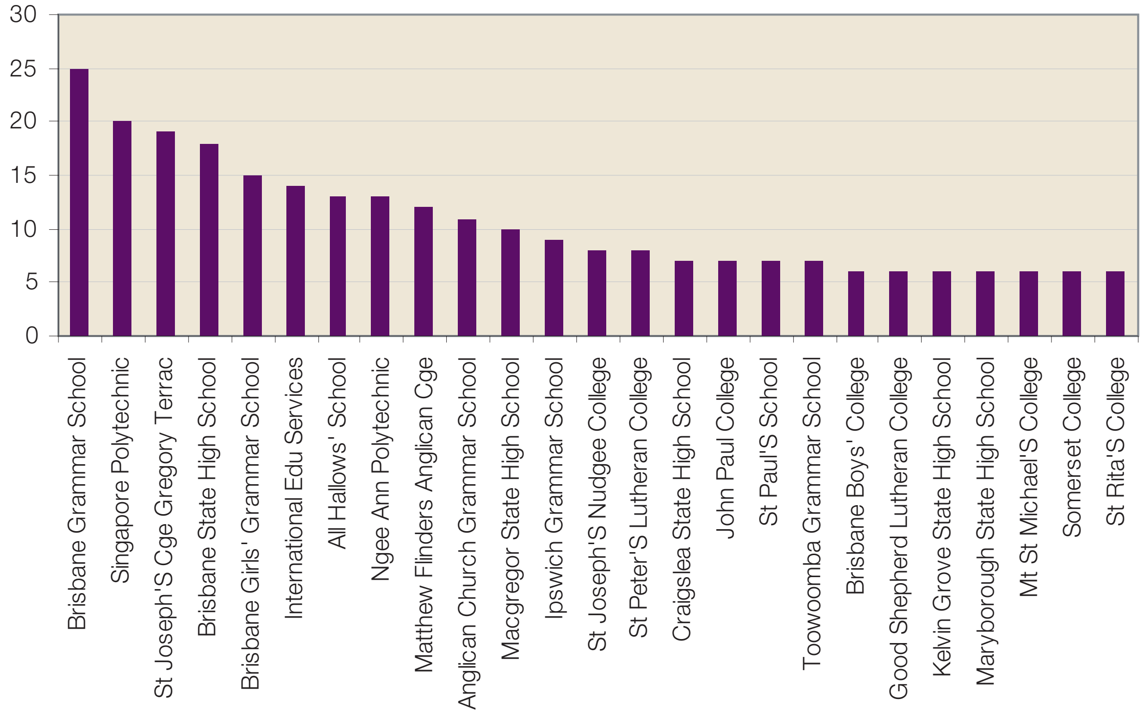
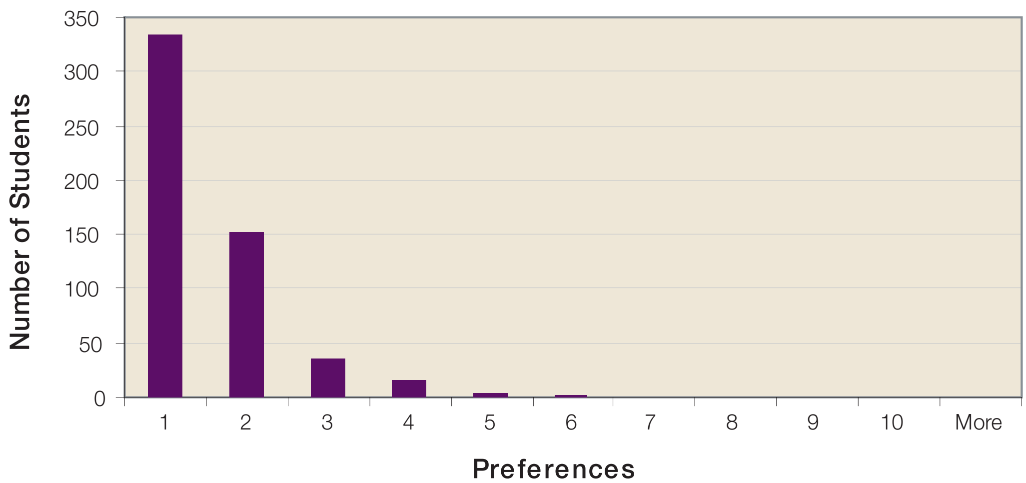


Figure 5.12 shows the distribution of students in the 2004 cohort according to their QTAC preference. The same general pattern is observed across the past 5 years. The number of students who entered the BSc by OP with Science as their second or lower preference corresponded to ~50% of the total intake.

Figure 5.12 2004 Commencing students' QTAC preferences



Figures 5.13 and 5.14 below indicate the age and gender mix of the 2005 cohort.

Figure 5.13 2004 Commencing students' age distribution

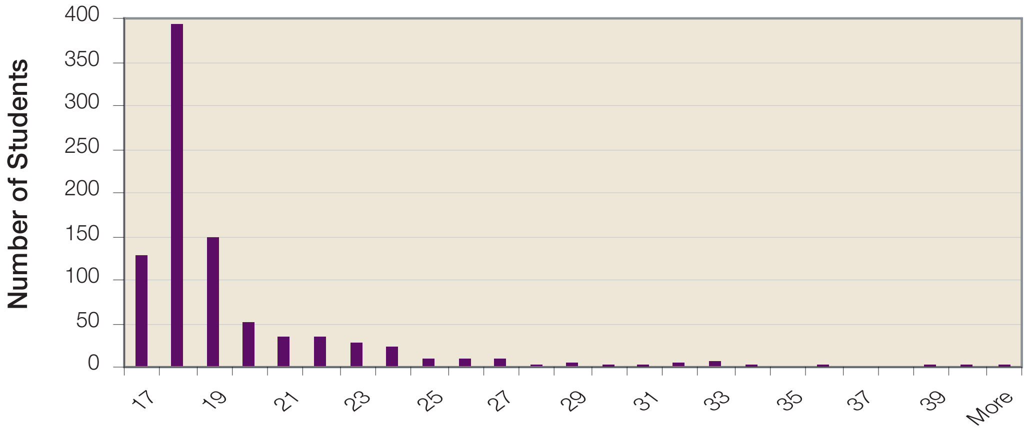
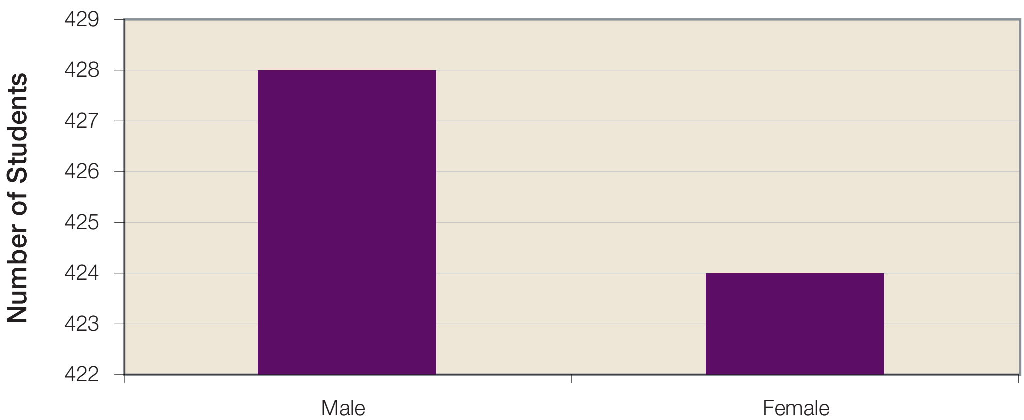


Figure 5.14 2004 commencing students' gender distribution



5.2.2 Numbers of students graduating by field of study

Table 5.13 below shows the number of students graduating in 2001-2004 by field of study. This data has previously been presented in Section 2 but has been repeated here for completeness.

The data shows that:

(i) As the concept of a field of study has become accepted since its inception in 2001, more students have chosen to graduate with one (or two) fields;

(ii) In 2005, when there were 525 graduating students, only 37 students graduated with no declared field; and

(iii) The field of Biomedical Science is much more popular than other fields.

Table 5.13 Graduation by field of study

Field	2001	2002	2003	2004	2005
Biomedical Science	135	144	104	144	
Undeclared - BACS	91	41	45	35	
Psychology	28	29	20	32	
Microbiology	38	33	23	29	
Biochemistry	47	49	29	26	
Computer Science	42	32	25	25	
Anatomical Sciences	16	24	43	22	
Mathematics	19	20	22	22	
Ecology	21	12	18	21	
Chemistry	20	17	15	20	
Genetics	22	23	14	19	
Marine Biology	32	23	33	16	
Pharmacology	14	13	13	15	
Zoology	12	21	27	11	
Botany	12	8	9	10	
Molecular Cell Biology	17	13	7	10	
Neuroscience	4	7	12	10	
Physics	7	10	2	9	
Physiology	17	16	24	8	
Developmental Biology	3	6	10	7	
Drug Design and Development	5	1	1	7	
Entomology	4	2	6	7	
Human Movement Science	6	5	4	6	
Wildlife Biology	4	6	5	6	
Earth Sciences	9	7	7	5	
Geographical Sciences	3	6	5	5	
Biophysics	1	1		4	
Parasitology	18	6	2	4	
Computational Biology		2	1	3	
Information Technology	28	56	1	3	
Biological Chemistry		4	3	2	
Evolutionary Biology	1	1	1	2	
Undeclared - EPSA	4	3	2	2	
Exploration Geophysics		3	2	1	
Geographic Information Science				1	
Geology	3	5	4	1	
Nanotechnology				1	
Statistics	1	1	2	1	
Human Movement Science/Psychology		1		0	
Anatomy	12	13	14	0	
Materials Science		1		0	

Table 5.14 summarises the highest enrolment courses for BSc students by Faculty (science (Part A) and non-science) and Table 5.15 shows the total BSc student enrolments in all Part A courses.

Table 5.14 Highest enrolment courses for BSc students 2005

BACS Faculty (top 20) 2005

Course Code	Course Title	No. BSc Students
CHEM1012	Chemistry IA	702
BIOL1011	Genetics & Evolution	667
BIOL1015	Human Biology	600
BIOL1012	Animal Biology	581
BIOL1014	Molecular & Microbial Biology	541
CHEM1013	Chemistry IB	516
BIOM2019	Human Anatomy	283
BIOM2007	Human Physiology	258
BIOM2008	Integrative Physiology	211
BIOL1013	Plant Biology & Biotechnology	197
BIOM2041	Principles of Pharmacol & Tox	192
BIOC2012	Biochemistry: Molecular Compon	191
BIOM3006	Human Phys & Pharm in Disease	175
BIOL2009	Genetics I: Molecular Genetics	170
BIOL2012	Immunology & Infectious Diseases	167
BIOM3005	Cardiovascular Science	166
BIOM2006	Principles of Biomedical Science	150
BIOM3004	Human Reproduction & Fertility	145
NEUR3002	The Integrated Brain	144
BIOM3001	Human Endocrinology	134

EPSA Faculty (top 20) 2005

Course Code	Course Title	No. BSc Students
STAT1201	Analysis of Biolog Data & Exper	510
PHYS1171	Physical Basis of Biol. System	394
MATH1051	Calculus & Linear Algebra I	122
MATH1050	Mathematical Foundations	84
MATH1052	Multivariate Calculus & ODEs	70
PHYS1001	Mechanics & Thermal Physics I	69
ERTH1000	Earth: Global Environments	57
MATH1061	Discrete Mathematics	54
PHYS1002	Electromagn, Optics, Relativ	51
MATH2000	Calculus & Linear Algebra II	48
GEOS1100	Environment & Society	42
PHYS1080	Stars, Galaxies & the Cosmos	36
CSSE1001	Software Engineering I	32
MATH2100	Applied Mathematical Analysis	32
PHYS2020	Thermodyn & Condensed Matter	21
INFS1200	Intro to Information Systems	18
MATH3101	Bifurcation and Chaos	18
MATH3302	Coding & Cryptography	18

Arts Faculty (top 20) 2005

Course Code	Course Title	No. BSc Students
PHIL1020	Introduction to Logic	31
PHIL1000	Introductory Philosophy	26
MUSC1700	From Elvis to Madonna	25
SPAN1010	Introductory Spanish A	21
WRIT1000	Intro to Acad Writing & Res	19
COGS1000	Minds & Machines: Introduction	18
FREN1010	Introductory French A	17
JAPN1010	Japanese I - Part 1	12
SPAN1020	Introductory Spanish B	12
MUSC1010	Intro to Music Technology	11
WRIT1001	Acad. English Writing for Asia	11
LTCS1004	Intro to Korean Popular Cult	10
JAPN2010	Japanese I - Part 2	8
FREN1020	Introductory French B	7
LING1005	Intro to Linguistics: Word	7
RELN1001	Belief & Unbelief	7
CHIN1900	Cantonese for Beginners	6
JAPN1020	Continuing Japanese I	6
MSTU1001	Introduction to Film & Televis	6

BEL Faculty (top 20) 2005

Course Code	Course Title	No. Students
ECON1010	Introductory Microeconomics	34
MGTS1301	Introduction Management	28
ACCT1101	Account for Decis Making	21
MKTG1501	Introduction Marketing	20
ECON1020	Introductory Macroeconomics	19
MGTS1201	Computer-based Information Sys	18
ECON1310	Quant Econ & Bus Analysis A	15
LAWS1100	Business Law	12
MGTS1601	Organisational Behaviour	9
FINM1401	Personal Wealth Management	8
FINM2401	Financial Management	6
MGTS2606	Managerial Skills & Comm.	5
ACCT2101	Financial Reporting	4
ECON1050	Introductory Mathematical Econ	4
MGTS2604	Intro. Human Resource Mgmt.	4
INFS3222	Systems Analysis & Design	3
ACCT2102	Fundamentals of Cost Accountin	2
ECON1100	Pol Econ & Comp Syst	2
ECON1120	The Economics of Social Issues	1
ECON1320	Quant Econ & Bus Analysis B	1

SBS Faculty (top 20) 2005

Course Code	Course Title	No. Students
PSYC1020	Intro to Psych: Phys & Cog Psy	287
PSYC1030	Intro to Psych:Dev, Soc & Clin	274
PSYC1040	Psychological Res Method I	89
PSYC2020	Neuroscience for Psychologists	48
PSYC2050	Learning & Cognition	46
PSYC3102	Psychopathology	46
PSYC2030	Developmental Psychology	41
PSYC2040	Social & Org Psychology	38
PSYC3082	Psychotherapies & Counselling	32
PSYC2010	Psychological Res Method II	28
PSYC3152	Applied Topics in Lifespan Dev	27
BIOM2003	Forensics	25
PSYC3010	Psych Research Method III	25
PSYC3020	Principles of Psych Assessment	23
PSYC3232	Behavioural Neuroscience	20
PSYC2341	Psych Problems of Adolescence	18
PSYC2351	Psychology & Human Sexuality	17
PSYC3132	Health Psychology	17
PSYC3192	Perception & Attention	17
PSYC3202	Industrial & Org Psychology	13
PSYC3252	Forensic Psychology	13

Health Sciences Faculty (top 20) 2005

Course Code	Course Title	No. Students
HMST1023	Health & Fitness - Diet & Exer	80
HMST1900	Biophysical Foundations of HM	33
HMST1910	Sociocul Foundation HM	24
HMST2730	Exercise Physiology	23
HPRM1000	Physical Activity & Health	20
PSYC2000	Psychology of Sport & Exercise	14
PSYC3000	Adv Sport & Exercise Psych	13
HMST3732	Advanced Exercise Physiology	11
HPRM3000	Health Promo: Perspect & Pract	11
NUTR3000	Nutrition & Exercise	8
HMST2630	Biomechanics & Biomaterials	7
HMST3052	Sports Med of Phys Activity	6
HLTH2000	eHealthcare	4
HMST2190	Sport & Physical Activity in S	3
HMST2530	Motor Control & Learning	3
HMST3103	Manag & Market Sport Phys Act	3
HMST3382	Exercise Science Tech Skills	3
HMST3533	Adv Motor Cont: Percept & Act	3

NRAVS Faculty (top 20)

Course Code	Course Title	No. Students
GNET3001	Quantitative Genetics	13
CHEM1000	Chemistry	5
LAND2003	The Soil Environment	5
STAT2701	Biometrics I	5
ANIM1008	Animal Health & Care	4
ANIM1014	An. Welfare, Bhave. & Handling	4
NUTR2001	Nutrition & Food Science	3
AGRC1004	Princ. of Agrc. & Food Tech.	2
ANIM1966	Equitation &Training	2
ANIM3016	Captive Wildlife Husbandry	2
BIOC2760	Agricultural Biochemistry	2
BIOL1660	Applied Biology I	2
ENVM2519	National Park Management	2
GNET2001	Agricultural Genetics & Biotec	2
MGTS1960	Business Management	2
VETS2001	Animal Health Technology	2
VETS3000	Animal Health & Epidemiology	2
AGRC1009	Rural Skills	1

Table 5.15 Enrolment in Part A Courses by BSc students 2005

Level 1

CHEM1012	703
BIOL1011	668
BIOL1015	600
BIOL1012	582
BIOL1014	541
CHEM1013	516
STAT1201	510
PHYS1171	395
PSYC1020	287
PSYC1030	270
BIOL1013	197
MATH1051	123
BIOL1016	113
PSYC1040	89
MATH1050	82
MATH1052	70
PHYS1001	69

ERTH1000	57
MATH1061	54
PHYS1002	51
GEOS1100	42
PHYS1080	36
CSSE1001	32
BIOL1017	31
COGS1000	18
ERTH1001	17
INFS1200	15
COMP1800	11
MATH1070	11
GEOM1000	8
CSSE1000	6
ENGG1010	6
MATE1000	4

Level 2

BIOM2007	259
BIOM2019	246
BIOM2008	211
BIOM2041	192
BIOC2012	191
BIOL2009	170
BIOL2012	167
BIOM2006	150
BIOL2008	121
BIOM2034	91
MICR2008	88
CHEM2041	82
BIOL2007	73
BIOC2014	70
ZOOL2029	66
ZOOL2028	62
CHEM2001	57
ZOOL2030	49
MATH2000	48
PSYC2020	48
BIOL2010	47
PSYC2050	46
CHEM2038	43
MARS2011	41
MARS2014	41
PSYC2030	41
PSYC2040	38
MATH2100	32
ENTM2011	31
PSYC2010	28
HMST2730	23
PHYS2020	21
BIOL2017	20
BOTN2002	20
BIOL2005	18
PSYC2341	18
STAT2003	18
PHYS2100	17
PHYS2810	17
PSYC2351	17
ENTM2010	16
MATH2200	16
PHYS2041	16

MATH2302	15
MATH2400	15
BOTN2001	14
PSYC2000	14
STAT2004	13
BIOT2002	12
PHYS2082	12
PHYS2170	11
PSYC2361	11
ERTH2002	10
ERTH2050	10
MATH2301	10
CSSE2002	9
ERTH2003	9
ERTH2005	9
GEOM2000	9
ERTH2004	8
PHYS2090	8
COMP2303	7
ERTH2006	7
HMST2630	7
PSYC2321	7
BOTN2003	6
GEOS2103	6
INFS2200	6
MATH2210	6
GEOM2001	5
LAND2003	5
PSYC2311	5
BOTN2004	4
COMP2502	4
GEOS2101	3
HMST2530	3
CHEE2001	2
COMP2304	2
COMP2702	2
CSSE2003	2
EDUC2000	2
ENVM2200	2
ERTH2280	2
CSSE2000	1
GEOS2100	1

Level 3

BIOM3006	175
BIOM3005	166
BIOM3004	145
NEUR3002	144
BIOM3001	135
BIOM3002	128
BIOL3012	117
BIOM3043	111
BIOC3003	106
BIOL3003	104
DEVB3001	92
MICR3001	84
DEVB3002	73
BIOM3008	72
MICR3002	72
NEUR3001	72
BIOL3002	70
BIOM3003	69
BIOL3006	67
BIOL3004	62
ZOOL3010	57
ZOOL3001	47
PSYC3102	46
BIOC3001	44
BIOC3002	42
MICR3003	41
ZOOL3005	38
BIOL3009	36
BIOL3044	34
ZOOL3002	34
BIOL3005	32
PSYC3082	31
BIOM3009	29
CHEM3004	29
BIOL3000	28
MICR3004	28
BIOL3015	26
MARS3001	26
ZOOL3006	26
PSYC3010	25
MARS3011	24
CHEM3007	23
PSYC3020	23
BIOC3004	22
BIOL3016	22
CHEM3008	21
PARA3002	20
PSYC3152	20
PSYC3232	20
CHEM3002	18
MATH3101	18
MATH3302	18
BIOT3004	17
PSYC3132	17
PSYC3192	17
BIOL3017	16
MATH3103	16
MATH3401	16
BIOT3001	15
CHEM3009	15
MATH3303	15
CHEM3001	14
ERTH3110	14
PHYS3040	14
BIOT3002	13
ERTH3212	13
GNET3001	13
MATH3404	13
PSYC3000	13
PSYC3202	13
PSYC3252	13
ZOOL3009	13
BIOL3008	12
BIOL3010	12
HMST3732	11
HPRM3000	11
MATH3102	11
PARA3001	11
PHYS3020	11
ERTH3001	10
ERTH3020	10
MARS3004	10
PHYS3050	10
PHYS3071	10
PSYC3142	10
STAT3004	10
ZOOL3007	10
BOTN3006	9
CHEM3003	9
ERTH3230	9
MARS3005	9
MATH3090	9
PSYC3262	9
BIOL3018	8
MATH3104	8
MATH3402	8
MATH3403	8
NUTR3000	8
PSYC3042	8
STAT3003	8
ENTM3003	7
ERTH3050	7
PHYS3810	7
PSYC3112	7
PSYC3172	7
PSYC3212	7
BOTN3011	6
COMP3201	6
ERTH3103	6
ERTH3130	6
HMST3052	6
MATH3202	6
PHYS3170	6
PSYC3071	6
BIOL3014	5
ENVM3200	5
ERTH3021	5
MARS3007	5
PSYC3052	5
PSYC3062	5
STAT3001	5
STAT3002	5
BIOL3011	4
CHEE3305	4
COGS3010	4
COMP3202	4
ENTM3002	4
INFS3202	4
INFS3204	4

PHYS3080	4
PSYC3162	4
BOTN3002	3
BOTN3004	3
BOTN3005	3
COMP3501	3
COMP3502	3
CSSE3005	3
ENTM3001	3
ENVM3201	3

GEOM3002	3
GEOS3101	3
HMST3533	3
INFS3101	3
INFS3200	3
INFS3222	3
MARS3010	3
MATH3203	3
BIOL3042	2
BIOL3043	2

CHEE3301	2
COMP3401	2
COMP3702	2
CSSE3004	2
ENVM3202	2
ENVM3203	2
GEOM3000	2
GEOM3001	2
MATH3201	2

5.3 Progression, Graduation, Transfer and Lapse Data

5.3.1 Analysis of students in 2003 cohort

In order to track a single, recent cohort of students from progression through to graduation, the 2003 cohort has been chosen for analysis in detail since it represents the most recent to have graduated (in 2005) within 3 years of commencement. Throughout the analysis, the timing refers to the commencement of the year specified. The results are presented diagrammatically (Figure 5.15) and the accompanying Tables 5.17 – 5.20 give the source data.

The combined data shows that:

- Approximately 15% of students were reported as lapsing after the first year of study in the BSc. (See below for more detailed analysis)
- Fewer than 10% of the commencing cohort graduate in three years and move to BSc (Honours) at the beginning of the following year.
- Approximately 20% of the domestic intake into the UQ MBBS come straight from a BSc at UQ and about half of these graduated from the BSc in the field of Biomedical Science.

In addition, approximately 25% of students transferred to another UQ program not involving the BSc after the first year of study. Foremost amongst these degrees were the Bachelor of Pharmacy, Bachelor of Veterinary Science, Bachelor of Physiotherapy, Bachelor of Occupational Therapy and Bachelor of Engineering (data not shown).

Figure 5.15 Progression, graduation, transfer and lapse data for the 2003 cohort

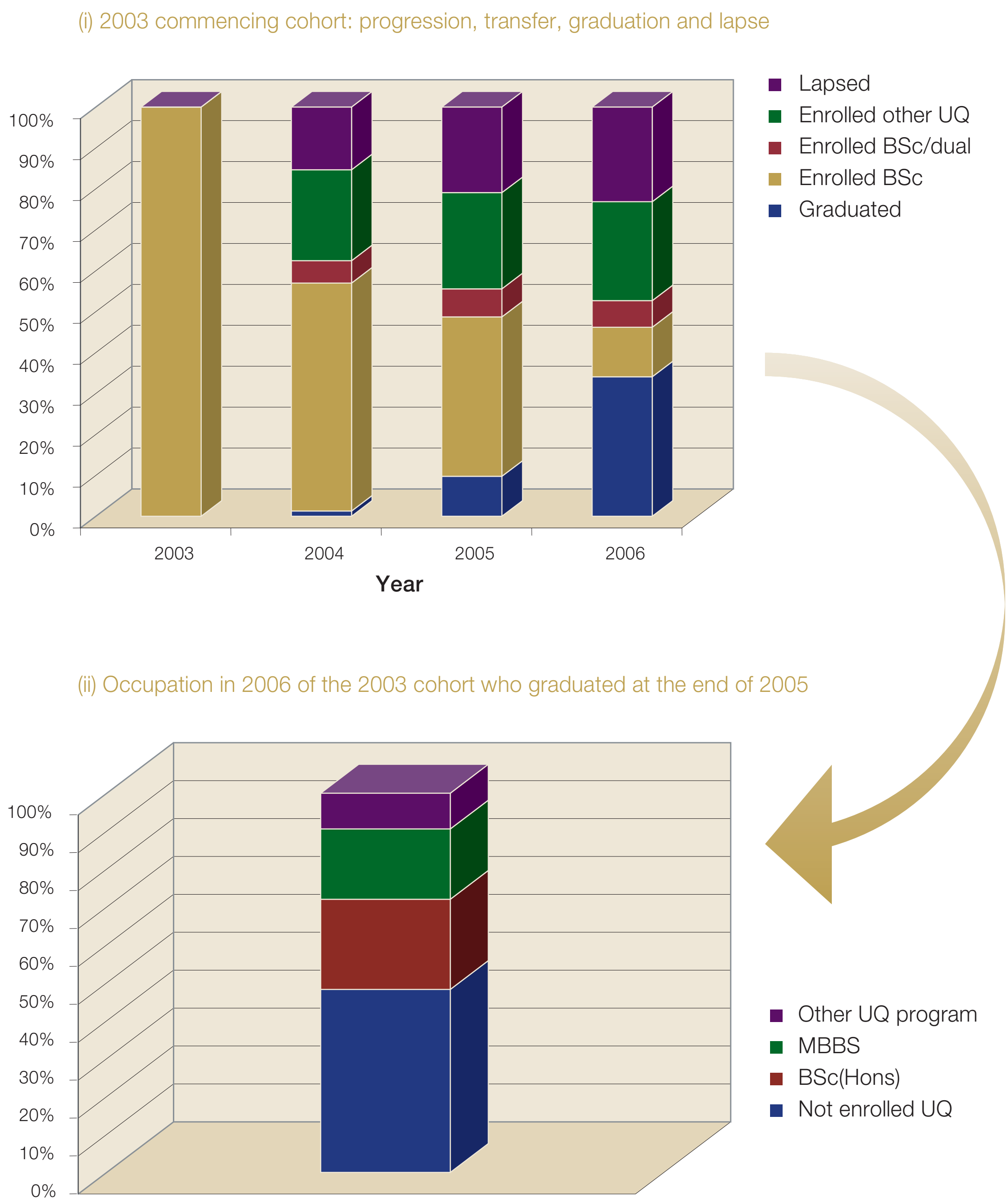


Table 5.16 shows the progression of students in the 2003 commencing cohort (860 total commencing) and their enrolment status up to and including 2006. For example, by the commencement of 2004, 11 students had graduated (presumably having been given 2 years of credit for study at another university). By the commencement of 2006, 293 had graduated, after three years of study.

Table 5.16 2003 BSc cohort (860 commencing students): Progression

		Year commencing			
Program	Status (at start of year shown)	2003	2004	2005	2006
All UQ Programs	Graduated	2	11	84	293
All UQ Programs	Enrolled	858	717	596	368
Not enrolled in any UQ Program	Lapsed	0	132	180	199
	Total	860	860	860	860

Table 5.17 shows breakdown of enrolled students into those enrolled in the BSc, BSc dual degrees and other programs at UQ. Table 5.18 tracks the graduated students to determine in particular how many continued from the BSc to further study in the following year. Table 5.19 analyses by program the students who continued to further study (transfer to Honours, MBBS, other), and Table 5.20 below breaks down the MBBS entrants by field of study in the BSc.

Table 5.17 2003 BSc cohort: Transfer to other degrees

Enrolled in	2003	2004	2005	2006
BSc	858	479	335	104
Dual Degrees	0	47	59	56
Other UQ Program	0	191	202	208
Total	858	717	596	368

Table 5.18 2003 BSc Cohort: Continuation with study after graduation

	2003	2004	2005	2006
Graduated with BSc and did not continue study at UQ in 2006	2	4	49	138
Graduated with BSc & continued study at UQ in 2006		4	14	148
Graduated other	0	3	11	7
Total	2	11	84	293

Table 5.19 2003 BSc Cohort: Postgraduate study by program in 2006

Program	Number
BSc(Hons)	68
MBBS	53
Other	27
Total	148

Table 5.20 2003 BSc cohort: entry to MBBS by field of study

Field of study	Number
Anatomical Sciences	1
Biomedical Science	21
Chemistry	1
Genetics	1
Human Movement Science	1
Mathematics	2
Microbiology	3
Molecular Cell Biology	1
Neuroscience	1
Pharmacology	5
Physiology	5
Undeclared - BACS	11
Total	53

5.3.2 Further analysis of lapsed students

The data for the 2004 cohort indicate that 12% of students lapsed after one year of study. This is slightly lower than the percentage that has remained relatively constant over the last 20 yrs (Table 5.20). The BSc lapse rates are lower than for the BA (Table 5.21).

Table 5.21 Lapse rates from the BSc and the BA after one year of study

	BSc		BA	
Start Year	# starting	Lapsed	#starting	Lapsed
1987	484	15%	1262	29%
1988	610	17%	1235	28%
1989	543	14%	1291	26%
1990	772	15%	1857	24%
1991	650	16%	1577	24%
1992	618	16%	1517	25%
1993	656	14%	1515	24%
1994	629	17%	1823	30%
1995	772	16%	1785	30%
1996	912	17%	1999	29%
1997	908	18%	2061	31%
1998	835	15%	1777	29%
1999	893	15%	1667	30%
2000	707	14%	1509	27%
2001	882	14%	1681	28%
2002	940	16%	1414	27%
2003	885	15%	1284	24%
2004	794	12%	1174	24%

Table 5.22 Cumulative percentages of lapsing students in the BSc, to Year 10 of enrolment for cohorts commencing 1987-2004

Start Year	# starting	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7	Yr8	Yr9	Yr10
1987	484	15%	19%	21%	24%	23%	22%	22%	21%	21%	21%
1988	610	17%	22%	23%	23%	24%	24%	23%	23%	23%	23%
1989	543	14%	18%	22%	23%	22%	22%	23%	22%	22%	22%
1990	772	15%	19%	22%	24%	23%	24%	23%	23%	23%	23%
1991	650	16%	20%	25%	26%	26%	24%	25%	24%	25%	24%
1992	618	16%	19%	21%	22%	21%	21%	21%	21%	20%	20%
1993	656	14%	19%	21%	22%	22%	21%	22%	21%	21%	21%
1994	629	17%	21%	24%	26%	24%	24%	25%	24%	24%	24%
1995	772	16%	18%	23%	23%	24%	22%	21%	21%	21%	
1996	912	17%	23%	26%	29%	28%	27%	27%	27%		
1997	908	18%	23%	27%	29%	29%	28%	27%			
2001	882	14%	18%	19%							
2002	940	16%	20%								
2003	885	15%									
2004	794	12%									

5.3.2.1 Analysis of lapsed students 2004 cohort

In order to obtain more information about the BSc students who lapsed after one year of study in 2004 some key data for lapsed students were compared with the total cohort for that year. This comparison was performed to look for any apparent indicators or reasons for lapsing.

The following demographics were compared between the lapsed group and the total cohort:

(i) QTAC preference for entry
(ii) Entry by rank or OP
(iii) Student age
(iv) First year GPA

It was not possible to identify any significant factor which differentiated the *majority* of the lapsed students from the *total cohort*. Surprisingly, the majority of lapsed students are in the Grade Point Average (GPA) range 1-3. Preliminary data obtained by interviewing lapsed students indicate that many are still studying and have used the first year of the BSc as a stepping stone to another program at another institution. This appears to be a quite acceptable function for a generalist degree such as the BSc.

5.4 Equivalent Full Time Student Load (EFTSL) and Revenue

Table 5.23 shows the EFTSL load by Faculty for all courses taken by BSc students at levels 1, and levels 2-4 (some level 4 courses are taken by undergraduates).

Table 5.23 EFTSL load by faculty for all courses taken by BSc students (2001 - 2005)

Level 1

	Year				
Faculty	**2001**	**2002**	**2003**	**2004**	**2005**
ARTS	46.29	36.41	44.4	37.48	47.04
BACS	511.28	543.23	519.09	467.44	514.5
BEL	13.82	17.74	23.84	22.44	23.6
EPSA	177.27	168.74	166.81	165.48	190.36
HLTH	14.26	21.69	25.22	14.71	18.97
NRAVS	2.62	4.59	2.88	3.91	4.42
SBS	76.76	91.28	102.33	86.49	89.42
TOTAL	842.31	883.69	884.56	797.94	888.31

Levels 2 – 4

	Year				
Faculty	**2001**	**2002**	**2003**	**2004**	**2005**
ARTS	15.79	22.8	23.64	20.9	18.06
BACS	729.43	718.05	710.54	726.98	713.26
BEL	6.38	4.19	6.58	6.19	5.1
EPSA	164.85	152.74	139.05	106.05	106.48
HLTH	24.42	21.44	20.42	29.24	22.5
NRAVS	5.61	5.94	5.9	7.55	6.93
SBS	77.84	73.97	75.25	79.9	76.06
TOTAL	1,024.32	999.13	981.37	976.81	948.38

Table 5.24 Total enrolments and EFTSL in BSc (Honours) program (2001 – 2006)

	2001		2002		2003		2004		2005		2006	
	#	**EFTSL**	**#**	**EFTSL**	**#**	**EFTSL**	**#**	**EFTSL**	**#**	**EFTSL**	**#**	**EFTSL**
ARTS			1	0.13			1	0.06	24	0.46	29	0.60
BACS	196	147.50	212	165.25	216	171.63	221	166.63	221	171.58	201	158.63
BEL			2	0.38			2	0.08	1	0.13		
EPSA	50	40.06	50	35.81	48	37.00	48	35.68	51	36.55	43	31.25
HLTH	6	3.75	4	2.38	3	3.00	8	4.63	4	1.38	6	1.63
NRAVS							2	0.25	1	0.13		
SBS	32	26.38	18	15.13	16	13.38	20	16.63	27	24.23	30	23.84
	279	217.69	279	219.06	283	225.00	288	223.94	298	234.44	275	215.94

Figure 5.16 compares the percent of total EFTSL per Faculty and percent of total courses offered in Part A of the BSc, by Faculty. This comparison does not include EFTSL earned from students in programs other than the BSc. In some cases, such as in maths and computing, courses also cater for large numbers of engineering students not included here. Table 5.25 shows the net income to Faculties from BSc enrolments.

Figure 5.16 Comparison of course numbers and EFTSL earned from science-based courses (Part A)

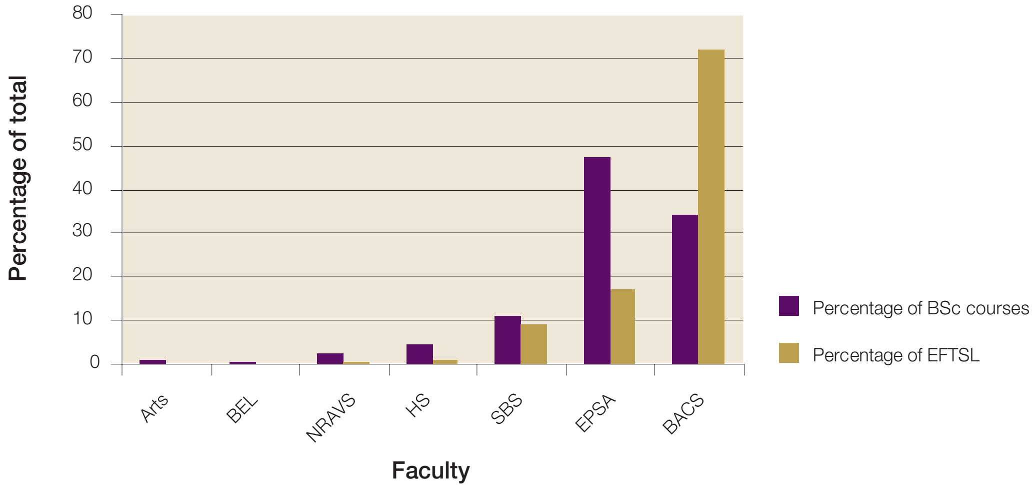


Table 5.25 Net income to faculties from BSc enrolments

	Year					
Income Type	**2001**	**2002**	**2003**	**2004**	**2005**	**2006 (Preliminary)**
Commonwealth Funding	9,727,342	9,309,171	8,758,620	8,636,282	10,451,935	12,336,999
Tuition Fees	1,070,697	1,310,614	1,634,142	1,663,466	1,968,899	2,088,052
	10,798,038	10,619,785	10,392,761	10,299,748	12,420,835	14,425,051

5.5 Equity, Diversity, Staffing Profile and Scholarships

5.5.1 Equity and Diversity

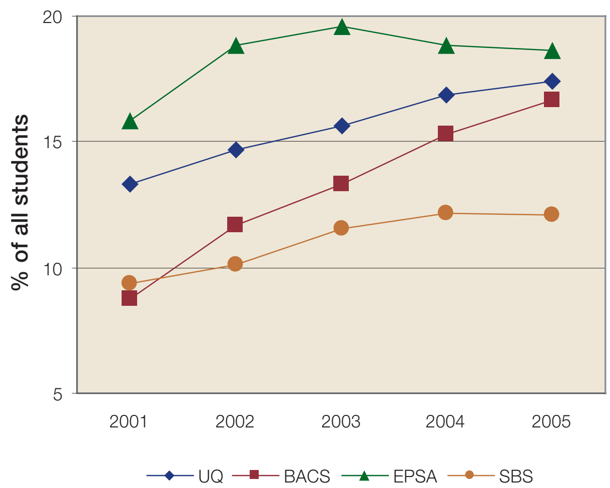
Analysis of student data over the period 2001 – 2005 reveals a number of trends associated with issues of equity and diversity. This data has been presented as a series of graphs covering a number of areas including:

- the mix of domestic and international students
- changing social and economic factors and gender balances

The data is sourced from the UQ Data Warehouse and has been separated into the student cohorts that generally align with the three faculties of Biological Sciences, Engineering, Physical Sciences and Architecture and the Behavioural Sciences. Data from the total UQ student body is also included for direct comparison. Student numbers are expressed as a percentage of the Effective Full Time Student Load (EFTSL) and where indicated, as a proportion of the total UQ student cohort or domestic cohort only.

International enrolments as a proportion of the student body demonstrate distinctly different trends between the faculties. The overall university trend is increasing while both the engineering and physical sciences and the social and behavioural science enrolments peaked around 2003 and have either plateaued or show a decreasing trend. Conversely, the biological sciences enrolments continue to grow (albeit from a low base) with an annual growth rate of around 2% per year. There are indications in the figure that this growth will slow in future years.

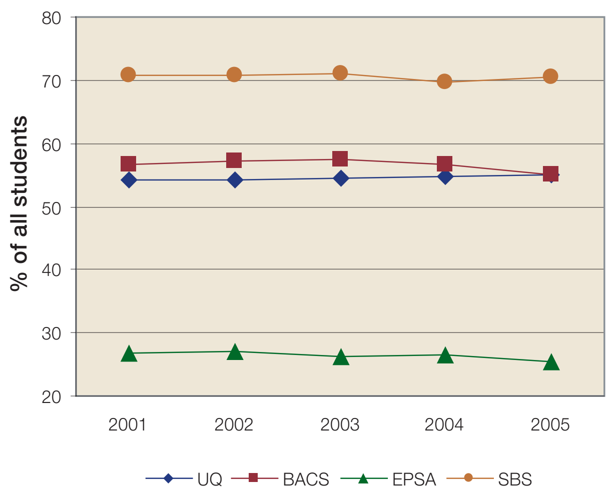
Figure 5.17 Equity and Diversity: International students



One of the factors that has the potential to impact on good communication with students is that relating to language. The adjacent figure demonstrates a clear trend of a growth of enrolled students where a language other than English is spoken at home. Although this does not indicate a language problem it does demonstrate a trend for a more internationally focussed student body. EPSA averages around 23% of their enrolled student cohort while the university and BACS demonstrate an annual growth which may reflect their increasing international enrolments. SBS is significantly lower at around 11% but still clearly shows a growth in this student cohort.

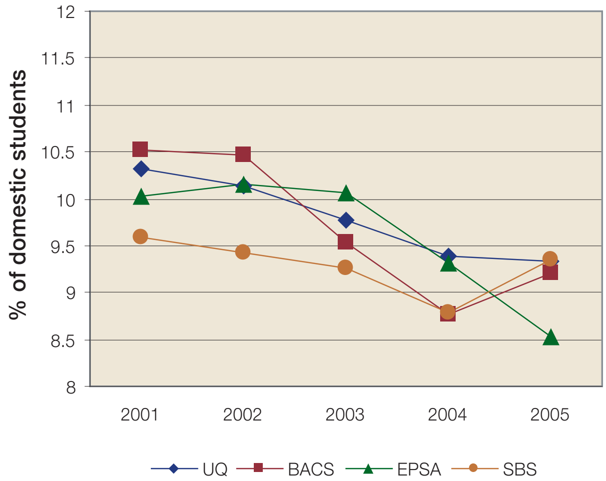
Female enrolments as a proportion of the student body have remained relatively steady over the period 2001 – 2005 with the suggestion of a small downward trend from 2003. Female enrolments in the engineering and physical sciences are significantly below the university average while in contrast, enrolments in the social and behavioural sciences average around 70%.

Figure 5.18 Equity and Diversity: Female enrolment



Students classed as coming from a low socio economic status as defined by the Federal Department of Education, Science and Training (DEST) have on average decreased over the period 2001 – 2005. However, this trend appears to have reversed in two faculties (SBS and BACS) in 2005 while at the same time a distinct decrease is seen for students enrolled in EPSA so that the total proportion of faculty enrolments that match the DEST criteria is approaching 8%.

Figure 5.19 Equity and Diversity: Low socio economic enrolments



Students classed as coming from a rural areas as defined by DEST show a decline in enrolments of approximately 2% over the period 2001 – 2005. The decline appears to have been halted over the period 2004 – 2005. SBS shows a clear trend of lower enrolments of approximately 5% when compared to either BACS or EPSA or the university as a whole.

One of the factors that has the potential to impact on good communication with students is that relating to language. The adjacent figure demonstrates a clear trend of a growth of enrolled students where a language other than English is spoken at home. Although this does not indicate a language problem it does demonstrate a trend for a more internationally focussed student body. EPSA averages around 23% of their enrolled student cohort while the university and BACS demonstrate an annual growth which may reflect their increasing international enrolments. SBS is significantly lower at around 11% but still clearly shows a growth in this student cohort.

Figure 5.20 Equity and Diversity: Language other than English

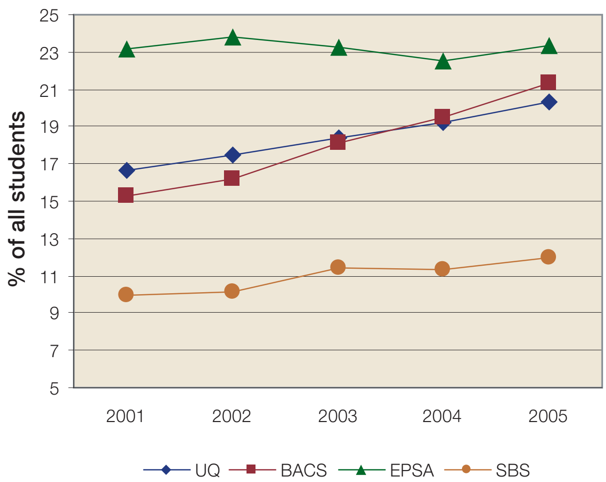
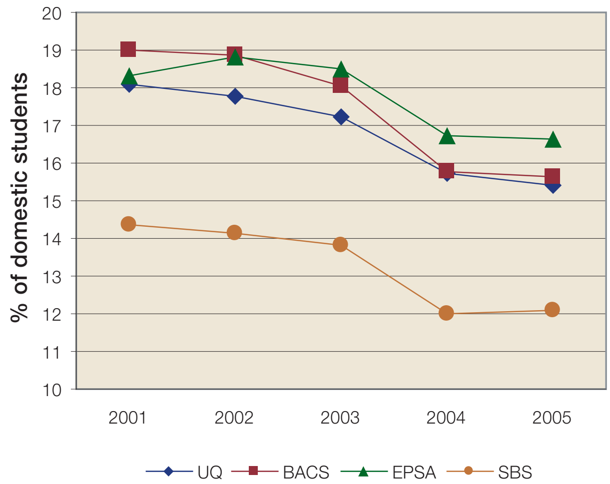
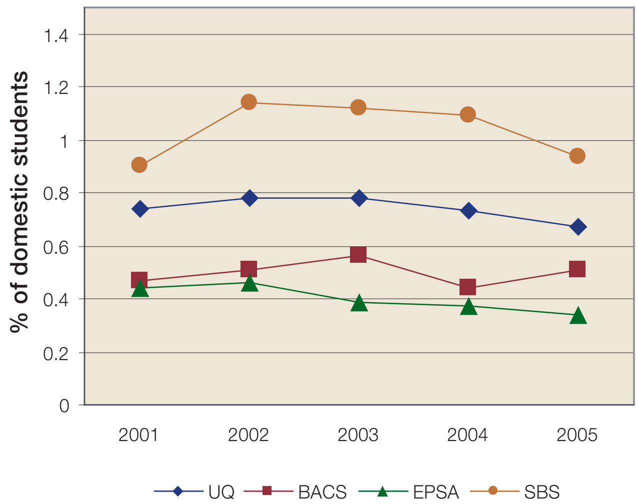


Figure 5.21 Equity and Diversity: Students from rural areas.



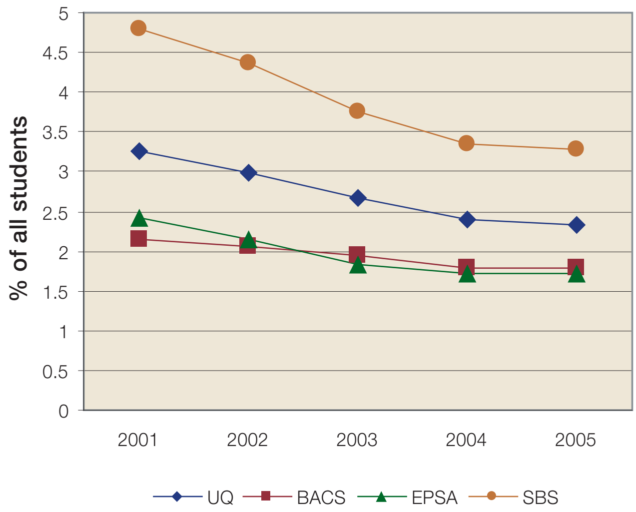
As a proportion of the Australian population Aboriginal and Torres Strait Islanders are approximately 2.5%. The university enrolment of this student cohort has averaged around 0.7% over the period 2001 – 2005 peaking in 2002 at 0.74% and showing a steady decline to average 0.63% in 2005. There is a clear difference in the proportion of this student cohort enrolled in the social and behavioural sciences compared with either the biological or the engineering and physical sciences.

Figure 5.22 Equity and Diversity: Aboriginal and Torres Strait Islanders



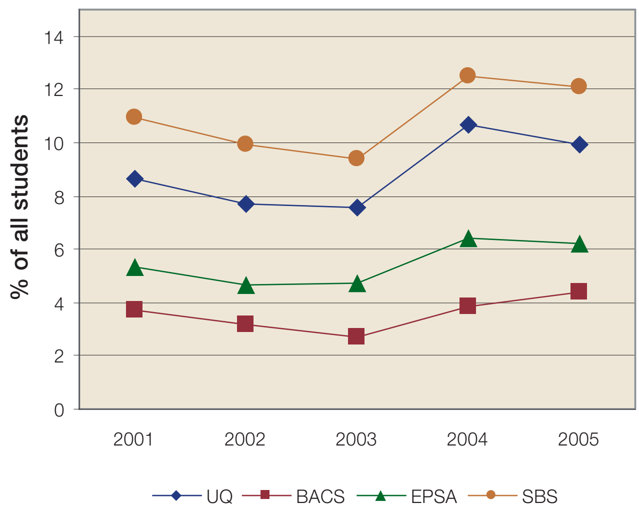
Students indicating a disability have shown a steady decline as a proportion of the enrolled university cohort. This is particularly seen in the social and behavioural sciences where the proportion of enrolled students has declined from around 4.8% in 2001 to approximately 3.3% in 2005 a decline of 31%. Although a decline is still apparent in the biological, engineering and physical sciences it is lower at around 23% over the same period (2.29 to 1.75%).

Figure 5.24 Equity and Diversity: Disability indicated



For students enrolled part time there has been a distinct change in the trend after 2003 where the decline was reversed. The average part time enrolments over the period 2001 – 2005 are different between the faculties with values of 10.9% for SBS, 5.47% for EPSA and 3.5% for BACS.

Figure 5.25 Equity and Diversity: Part time enrolments.



5.5.2 Staffing Profile

The figures shown in this section provide a snapshot of the academic and general staff for the three faculties in terms of classification level and gender and are current as of October 2006.

Figure 5.25 Academic Classification: Level Distribution

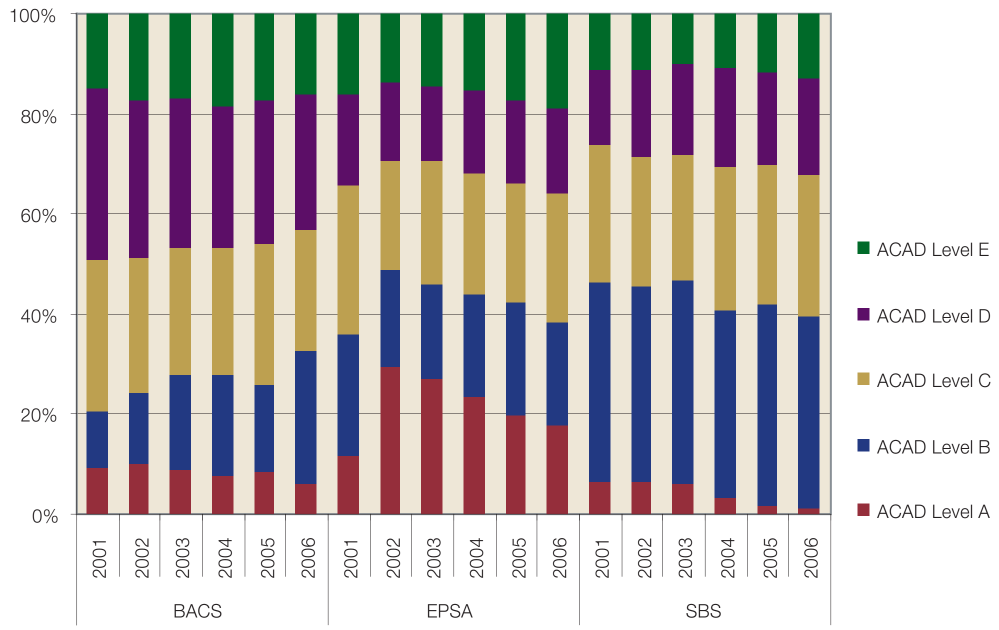


Figure 5.26 General Classification: Level Distribution

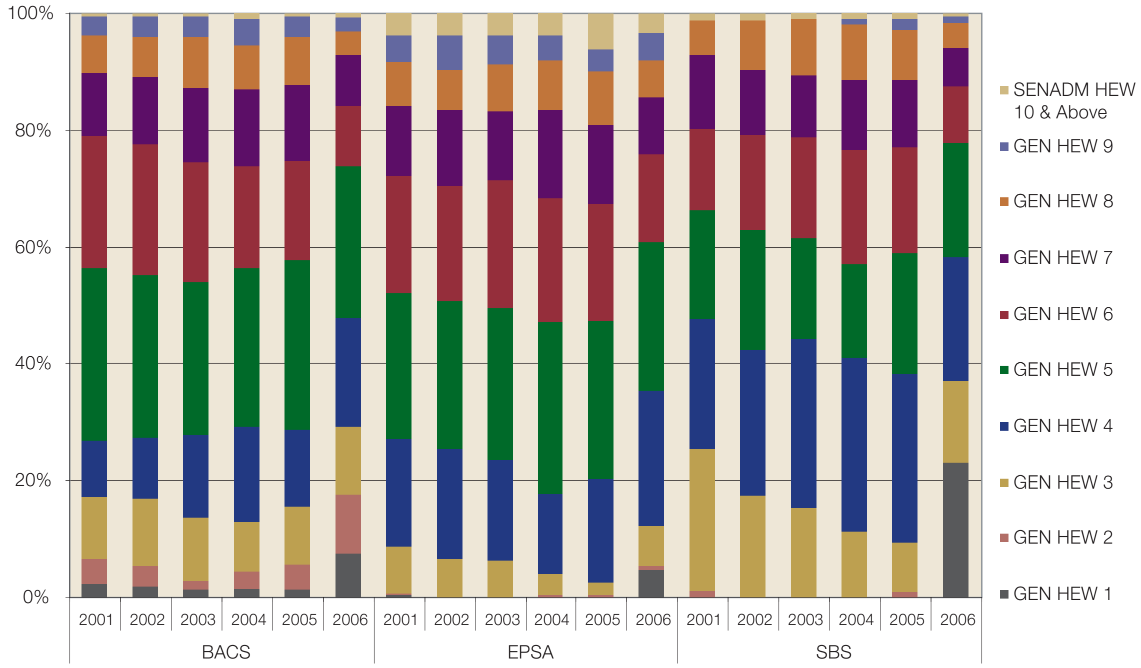


Figure 5.27 Teaching and Research Academic: Gender Distribution

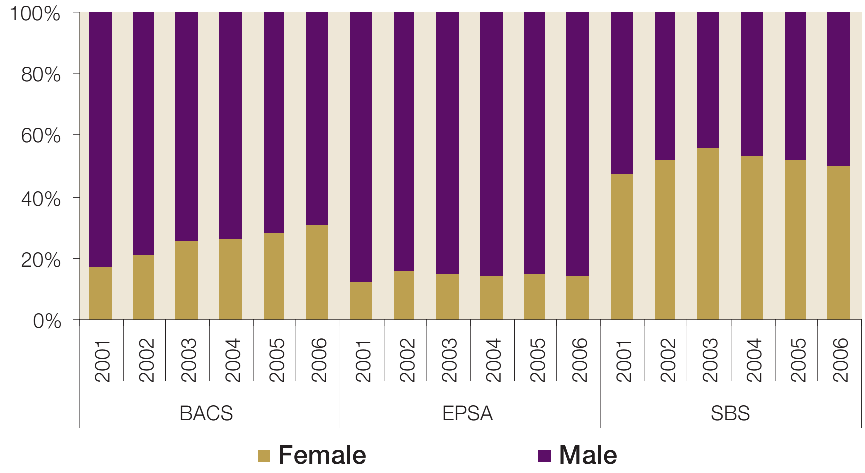
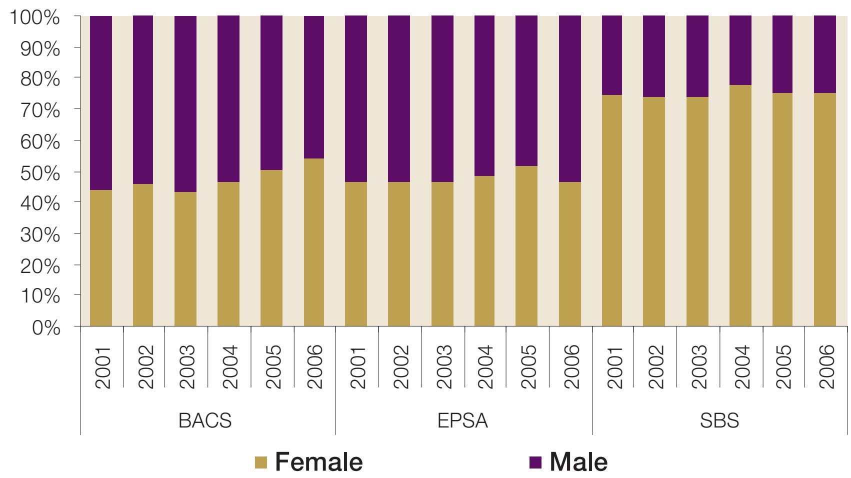


Figure 5.28 General Staff: Gender Distribution



5.5.3 Scholarships

Scholarships are a form of financial support designed to assist individual students complete a qualification, enhance their personal growth or directly advance their career. A range of these supportive packages are available across the faculties and these are listed below. In addition to the faculty supported scholarships or awards the university administers a large number of support programs from funding sources that vary from individual awards to federally funded programs.

5.5.3.1 Faculty of Biological and Chemical Sciences

Environmental Science & Marine Studies Undergraduate Scholarships

Two Bachelor of Environmental Science Scholarships and two Bachelor of Marine Studies Scholarships valued at $6,000 each. The scholarships will be awarded to outstanding students who are seeking admission in 2007 to the:

- Bachelor of Environmental Science or
- Bachelor of Marine Studies

HELP College University, Malaysia

An international undergraduate scholarship valued at AUD$23,000. The scholarship is available for students applying for one of the following degrees: The scholarship covers 50% of the tuition fee for up to 2 years (#32 units) valued at AUD$23,000.

- Bachelor of Science in Biological and Chemical Sciences (including Biomedical Sciences)
- Bachelor of Biotechnology
- Bachelor of Environmental Science
- Bachelor of Marine Studies

INTI College, Malysia

An international undergraduate scholarship valued at AUD$23,000. The scholarship is available for students applying for one of the following degrees: The scholarship covers 50% of the tuition fee for up to 2 years (#32 units) valued at AUD$23,000.

- Bachelor of Science in Biological and Chemical Sciences (including Biomedical Sciences)
- Bachelor of Biotechnology
- Bachelor of Environmental Science
- Bachelor of Marine Studies

KDU College, Malaysia

An international undergraduate scholarship valued at AUD$23,000. The scholarship is available for students applying for one of the following degrees: The scholarship covers 50% of the tuition fee for up to 2 years (#32 units) valued at AUD$23,000.

- Bachelor of Science in Biological and Chemical Sciences (including Biomedical Sciences)
- Bachelor of Biotechnology
- Bachelor of Environmental Science
- Bachelor of Marine Studies

Taylors College, Malaysia

An international undergraduate scholarship valued at AUD$23,000. The scholarship is available for students applying for one of the following degrees: The scholarship covers 50% of the tuition fee for up to 2 years (#32 units) valued at AUD$23,000.

- Bachelor of Science in Biological and Chemical Sciences (including Biomedical Sciences)
- Bachelor of Biotechnology
- Bachelor of Environmental Science
- Bachelor of Marine Studies

University College Sedaya International, Malaysia

An international undergraduate scholarship valued at AUD$23,000. The scholarship is available for students applying for one of the following degrees: The scholarship covers 50% of the tuition fee for up to 2 years (#32 units) valued at AUD$23,000.

- Bachelor of Science in Biological and Chemical Sciences (including Biomedical Sciences)
- Bachelor of Biotechnology
- Bachelor of Environmental Science
- Bachelor of Marine Studies

Summer Vacation Research Scholarships

These scholarships are designed to assist students to enrol in the Summer Vacation Research Project, BIOL3044. Students work directly with academic staff in a research laboratory. The total number of scholarships, which pay $180/week for six weeks, is approximately 100.

International Scholarships for Science Honours Programs

An international scholarship valued at AUD$11,600. The scholarship is available for students applying for the Honours year in one of the following degrees:

- Bachelor of Science (Honours) in Biological and Chemical Sciences
- Bachelor of Biotechnology
- Bachelor of Environmental Science
- Bachelor of Marine Studies

The scholarship covers 50% of the tuition fee for up to 1 year (#16 units) valued at AUD$11,600

Department of Primary Industries and Fisheries (QLD) – 2007 Marine Fish Habitat Scholarship (Honours)

Funding of up to $10 000 for an individual scholarship, to encourage research into the area of marine fish habitats.

Postgraduate Coursework Scholarship 2007 – India

An international postgraduate coursework scholarship valued at AUD$17,400. The scholarship is available for students applying for one of the following programs:

- Master of Biotechnology
- Master of Molecular Biology
- Master of Science (Conservation Biology)
- Master of Entomology

The scholarship covers 50% of the tuition fee for the duration of a standard coursework Masters programs (1.5 years or #24 units).

Postgraduate Coursework Scholarship 2007 – Thailand

An international postgraduate coursework scholarship valued at AUD$17,400. The scholarship is available for students applying for one of the following programs:

- Master of Biotechnology
- Master of Molecular Biology
- Master of Science (Conservation Biology)
- Master of Entomology

The scholarship covers 50% of the tuition fee for the duration of a standard coursework Masters programs (1.5 years or #24 units).

Postgraduate Coursework Scholarship 2007 – Vietnam

An international postgraduate coursework scholarship valued at AUD$17,400. The scholarship is available for students applying for one of the following programs:

- Master of Biotechnology
- Master of Molecular Biology
- Master of Science (Conservation Biology)
- Master of Entomology

The scholarship covers 50% of the tuition fee for the duration of a standard coursework Masters programs (1.5 years or #24 units).

5.5.3.2 Faculty of Engineering, Physical Sciences and Architecture

Dean's Excellence Scholarships

Sixteen undergraduate scholarships worth $5,000 per year for the duration of the program available to new students commencing study in 2007 in the following degrees:

Bachelor of Science and Bachelor of Arts with a primary focus on studies in:

- Computer science,
- Earth science,
- Geographical science,
- Mathematics,
- Physics,
- Statistics

Dean's Excellence & Equity Scholarships

Four undergraduate scholarships worth $5,000 per year for the duration of the program available to new students commencing study in 2007 in the following degrees:

Bachelor of Science and Bachelor of Arts with a primary focus on studies in:

- Computer science,
- Earth science,
- Geographical science,
- Mathematics,
- Physics,
- Statistics

Merit Based Postgraduate Equity Scholarships

The purpose of Merit-Based Postgraduate Equity Scholarships is to encourage participation in higher education by suitable candidates from groups in the community, which are currently under-represented at postgraduate level in the University and who are disadvantaged by the introduction of fees for postgraduate coursework programs.

Merit-based equity scholarships are open to people from the groups listed below, who are commencing a postgraduate coursework program in the Faculty of Engineering, Physical Sciences and Architecture and who would normally be liable to pay tuition fees:

- Aboriginal or Torres Strait Island people;
- people with a disability;
- people from rural and isolated areas;
- people from disadvantaged economic backgrounds;
- women enrolling in non-traditional areas of study, eg engineering or computer science;
- women returning to study, in particular after a break occasioned by family responsibilities;
- people from non-English speaking backgrounds;
- people who are unable to obtain financial support from their employers who may be, for example, voluntary organisations with limited funds;
- people who are unable to claim tuition fees as tax deductions, e.g. unemployed

Scholarships for Outgoing Australian Exchange Students

Ten scholarships offered annually to the value of $AUD2 500 for students studying under an approved University of Queensland international exchange program.

Commonwealth Supported Scholarship for UQ General Staff

The purpose of the Commonwealth Supported Postgraduate Equity Scholarships is to encourage participation by suitable candidates from the general staff of the University in postgraduate coursework programs offered by the Faculty.

Queensland Resources Council (QRC)

Four scholarships for Year 12 school leavers studying engineering, earth science or environmental science.

Vacation Scholarships

Offered from time to time by the faculty.

5.5.3.3 Faculty of Social and Behavioural Sciences

The most relevant scholarships for the faculty are shown below.

Scholarships for UQ's Student Exchange Program

UQ supported Student Exchange Program, has a number of grants of $4000 each for students interested in studying in Chile, Mexico, China, Japan, Korea, Singapore and Thailand.

Dean's Scholar Awards

SBS Dean's Scholars are recruited from all SBS programs and sequences of study, including students in dual degrees and students enrolled in the Bachelor of Arts and Bachelor of Science who have an SBS major. Students can be invited into the program after completing #16 of full-time study (one year) with a cumulative GPA of 6.25 or above or after completing #32 of full-time study (two years) with a GPA of 6.25 or above in their second year. There is a range of benefits provided both in-kind and financial.

UQ Scholarships for Undergraduate Domestic Students

- Commonwealth Accommodation Scholarships (CAS) - valued at $4161 per year for a maximum of 4 yrs
- Commonwealth Education Costs Scholarships (CECS) - valued at $2080 per year for a maximum of 4 yrs
- UQ Excellence Scholarships - valued at $6000 per year for the normal duration of a student's program

SBS Commonwealth Supported Postgraduate Scholarships

These scholarships are available to students who are eligible to participate in the Higher Education Contribution Scheme (HECS). Students awarded these scholarships will be able to undertake studies on a HECS-HELP basis in postgraduate programs for which tuition fees are normally charged. The scholarship will comprise the difference in the fees paid as a Commonwealth supported student and as a fee-paying student for courses within a nominated Social and Behavioural Sciences postgraduate program. Successful holders will be required to pay the Student Contribution portion only for their courses.

Carolyn D Baker Memorial Scholarship

The object of the scholarship is to provide an annual financial contribution to allow a postgraduate research student, studying in the discipline of Education at The University of Queensland, to attend and present a paper at an international conference. The value of the scholarship is $2500 per annum.

The scholarship is open to all full or part-time postgraduate research students undertaking research in the discipline of Education at The University of Queensland.

5.5.3.4 The University of Queensland Scholarships

There are a significant number of university managed scholarships available for students who are experiencing financial hardship. These scholarships include:

- Commonwealth Learning Scholarships;
- Commonwealth Accommodation Scholarships;
- Commonwealth Education Costs Scholarships;
- UQ Excellence Scholarships,
- Group of Eight Scholarhips
- UQ-Link Residential Support Scholarships

A complete list of the scholarships and awards offered by the university can be found on the UQ Programs and Courses web site at http://www.uq.edu.au/study/

5.5.4 Additional Data on Equity, Diversity and Staffing

Table 5.26 All University of Queensland - Student Load (EFTSL) in key equity groups 2001 - 2005

Student Equity Group	2001			2002			2003			2004			2005		
Total University of Queensland Equity Profile	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL
Female	54.92	54.27	14,927.58	54.89	54.24	15,705.30	55.19	54.58	16,041.23	55.24	54.68	16,035.95	55.46	54.97	15,916.77
Disability Indicated*	3.44	3.25	894.60	3.22	2.96	862.09	2.93	2.67	784.88	2.63	2.40	704.03	2.62	2.34	678.78
Non-English Speaking Background*	1.75	N/A	417.35	2.23	N/A	550.13	2.78	N/A	690.22	3.37	N/A	821.30	4.06	N/A	970.06
Aboriginal and Torres Strait Islander*	0.74	N/A	177.18	0.78	N/A	191.88	0.78	N/A	193.43	0.73	N/A	178.65	0.67	N/A	159.79
Low Socio Economic Status*	10.32	N/A	2,465.83	10.14	N/A	2,504.61	9.77	N/A	2,421.34	9.38	N/A	2,285.86	9.34	N/A	2,233.46
Students from Rural Areas*	18.10	N/A	4,324.10	17.79	N/A	4,393.61	17.25	N/A	4,278.09	15.74	N/A	3,836.61	15.43	N/A	3,688.30
Students from Isolated Areas*	1.87	N/A	446.08	1.92	N/A	475.48	1.71	N/A	423.60	1.56	N/A	380.18	1.38	N/A	330.91
International	N/A	13.13	3,611.87	N/A	14.68	4,250.50	N/A	15.63	4,594.98	N/A	16.87	4,948.62	N/A	17.43	5,046.69
External	N/A	3.93	1,082.20	N/A	4.45	1,288.65	N/A	4.44	1,304.09	N/A	4.61	1,352.62	N/A	4.52	1,308.92
Country of Birth Outside Australia	20.24	30.71	8,447.16	19.66	31.45	9,106.58	30.31	32.77	9,631.67	20.52	33.93	9,950.24	20.80	34.61	10,020.26
Language Other than English Spoken at Home	10.25	16.65	4,578.55	9.98	17.47	5,059.18	10.24	18.37	5,398.70	10.18	19.24	5,644.03	10.45	20.35	5,892.65
Part - Time	9.57	8.62	2,370.11	8.80	7.68	2,222.26	8.71	7.55	2,218.39	11.88	10.67	3,128.83	11.29	9.96	2,884.44

*Defined by DEST

Table 5.27 Biological & Chemical Sciences - Student Load (EFTSL) in key equity groups 2001 - 2005

Student Equity Group	2001			2002			2003			2004			2005		
Total University of Queensland Equity Profile	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL
Female	56.55	56.76	1,845.23	56.59	57.06	1,963.85	57.06	57.38	2,016.58	56.18	56.62	1,965.42	54.25	54.90	1,873.34
Disability Indicated*	2.09	2.15	69.84	2.15	2.07	71.33	2.04	1.94	68.20	1.89	1.78	61.70	1.99	1.79	61.02
Non-English Speaking Background*	1.70	N/A	50.53	2.63	N/A	79.85	3.74	N/A	113.83	3.84	N/A	112.76	4.89	N/A	139.02
Aboriginal and Torres Strait Islander*	0.47	N/A	13.86	0.51	N/A	15.63	0.56	N/A	17.00	0.44	N/A	12.97	0.51	N/A	14.62
Low Socio Economic Status*	10.52	N/A	312.07	10.46	N/A	318.02	9.53	N/A	290.27	8.76	N/A	257.67	9.21	N/A	261.85
Students from Rural Areas*	18.98	N/A	563.01	18.85	N/A	572.80	18.03	N/A	549.14	15.77	N/A	463.77	15.65	N/A	445.06
Students from Isolated Areas*	1.57	N/A	46.53	1.30	N/A	39.45	1.30	N/A	39.64	1.10	N/A	32.49	1.08	N/A	30.82
International	N/A	8.74	284.14	N/A	11.69	402.32	N/A	13.35	469.34	N/A	15.30	530.98	N/A	16.67	568.73
External	N/A	1.87	60.86	N/A	1.28	44.15	N/A	0.97	34.12	N/A	1.41	48.80	N/A	1.08	36.86
Country of Birth Outside Australia	20.44	27.40	890.69	20.43	29.73	1,023.20	21.73	32.18	1,130.96	22.24	34.14	1,184.97	23.01	35.84	1,223.08
Language Other than English Spoken at Home	10.90	15.29	497.06	11.22	16.23	558.44	12.42	18.09	635.70	12.82	19.51	677.09	13.30	21.35	728.57
Part - Time	3.98	3.70	120.34	3.50	3.17	109.07	3.06	2.68	94.03	4.39	3.87	134.22	4.91	4.36	148.62

*Defined by DEST

Table 5.28 Engineering Physical Sciences & Architecture - Student Load (EFTSL) in key equity groups 2001 - 2005

Student Equity Group	2001			2002			2003			2004			2005		
Total University of Queensland Equity Profile	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL
Female	26.88	26.79	1,275.93	26.90	27.13	1,322.18	25.93	26.35	1,263.03	26.51	26.40	1,230.84	25.73	25.46	1,179.77
Disability Indicated*	2.64	2.43	115.81	2.42	2.16	105.28	2.04	1.84	88.42	1.81	1.71	79.73	1.87	1.72	79.80
Non-English Speaking Background*	2.76	N/A	110.55	3.33	N/A	131.60	3.98	N/A	153.49	4.74	N/A	179.23	5.98	N/A	225.63
Aboriginal and Torres Strait Islander*	0.44	N/A	17.66	0.46	N/A	18.09	0.39	N/A	15.19	0.37	N/A	13.91	0.34	N/A	12.67
Low Socio Economic Status*	10.02	N/A	401.78	10.15	N/A	401.37	10.06	N/A	388.00	9.32	N/A	352.50	8.53	N/A	321.70
Students from Rural Areas*	18.34	N/A	735.21	18.80	N/A	743.57	18.49	N/A	712.95	16.72	N/A	632.33	16.65	N/A	628.09
Students from Isolated Areas*	1.81	N/A	72.60	2.02	N/A	79.98	1.89	N/A	72.70	1.52	N/A	57.50	1.37	N/A	51.51
International	N/A	15.84	754.28	N/A	18.82	917.16	N/A	19.57	938.11	N/A	18.86	879.26	N/A	18.61	962.16
External	N/A	1.36	64.75	N/A	1.74	84.97	N/A	1.74	83.23	N/A	2.81	131.10	N/A	2.52	116.82
Country of Birth Outside Australia	24.11	36.13	1,720.55	23.11	37.57	1,830.98	23.31	38.32	1,836.91	22.47	37.09	1,729.40	22.85	37.20	1,723.93
Language Other than English Spoken at Home	14.70	23.18	1,104.18	14.02	23.83	1,161.25	13.88	23.26	1,114.94	12.82	22.48	1,048.22	13.07	23.38	1,083.55
Part - Time	5.93	5.32	253.59	5.49	4.69	228.42	5.71	4.74	227.29	7.56	6.44	300.29	7.25	6.20	287.47

*Defined by DEST

Table 5.29 Social & Behavioural Sciences - Student Load (EFTSL) in key equity groups 2001 - 2005

Student Equity Group	2001			2002			2003			2004			2005		
Total University of Queensland Equity Profile	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL
Female	71.05	70.66	3,381.40	70.98	70.70	3,633.48	71.33	71.00	3,725.34	69.82	69.56	3,530.87	70.74	70.57	3,538.74
Disability Indicated*	5.03	4.79	229.33	4.56	4.36	224.10	4.04	3.76	197.28	3.54	3.34	169.64	3.52	3.28	164.29
Non-English Speaking Background*	0.78	N/A	33.81	1.08	N/A	50.10	1.45	N/A	67.21	1.66	N/A	73.88	1.66	N/A	73.28
Aboriginal and Torres Strait Islander*	0.90	N/A	39.15	1.14	N/A	52.65	1.12	N/A	52.15	1.09	N/A	48.40	0.94	N/A	41.56
Low Socio Economic Status*	9.58	N/A	415.44	9.42	N/A	435.23	9.26	N/A	429.92	8.79	N/A	391.79	9.35	N/A	412.26
Students from Rural Areas*	14.38	N/A	623.90	14.13	N/A	652.88	13.83	N/A	641.91	12.01	N/A	535.47	12.07	N/A	532.10
Students from Isolated Areas*	1.15	N/A	49.87	1.18	N/A	54.52	0.97	N/A	45.25	0.86	N/A	38.37	0.72	N/A	31.62
International	N/A	9.36	448.13	N/A	10.10	518.93	N/A	11.55	605.90	N/A	12.18	618.23	N/A	12.11	607.33
External	N/A	2.24	107.14	N/A	3.58	183.82	N/A	2.82	147.71	N/A	3.05	154.65	N/A	2.98	149.31
Country of Birth Outside Australia	17.64	25.35	1,213.06	16.30	24.74	1,271.72	17.52	27.04	1,418.93	17.11	27.21	1,381.01	16.84	26.91	1,349.72
Language Other than English Spoken at Home	6.18	9.98	477.56	5.71	10.11	519.76	6.22	11.43	599.85	5.75	11.30	573.59	5.76	11.96	599.63
Part - Time	11.71	10.96	524.50	10.75	9.91	509.39	10.33	9.40	493.25	13.67	12.49	633.94	13.26	12.08	605.69

*Defined by DEST

Table 5.30 Program Level - Student Load (EFTSL) in key equity groups 2001 - 2005

Student Equity Group	2001			2002			2003			2004			2005		
Total University of Queensland Equity Profile	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL	% of domestic students	% of all students	Equity group EFTSL
Female	55.88	55.42	12,055.59	55.91	55.32	12,410.05	56.27	55.69	12,567.11	56.27	55.88	12,452.45	56.00	55.63	12,387.27
Disability Indicated*	3.35	3.22	700.68	3.08	2.91	651.98	2.73	2.56	577.09	2.39	2.24	498.15	2.39	2.21	491.65
Non-English Speaking Background*	1.34	N/A	266.79	1.75	N/A	353.38	2.17	N/A	434.10	2.49	N/A	489.24	2.96	N/A	580.06
Aboriginal and Torres Strait Islander*	0.78	N/A	154.18	0.82	N/A	165.07	0.83	N/A	166.81	0.78	N/A	153.65	0.70	N/A	137.79
Low Socio Economic Status*	10.78	N/A	2,143.02	10.79	N/A	2,175.30	10.50	N/A	2,104.09	10.08	N/A	1,979.05	10.02	N/A	1,960.08
Students from Rural Areas*	18.69	N/A	3,717.60	18.81	N/A	3,791.04	18.49	N/A	3,704.47	16.82	N/A	3,303.24	16.38	N/A	3,204.68
Students from Isolated Areas*	1.94	N/A	385.52	2.00	N/A	402.79	1.84	N/A	368.28	1.73	N/A	339.37	1.50	N/A	292.97
International	N/A	8.57	1,864.93	N/A	10.17	2,281.44	N/A	11.23	2,535.17	N/A	11.87	2,644.50	N/A	12.12	2,699.13
External	N/A	2.93	637.76	N/A	2.96	663.22	N/A	2.80	631.78	N/A	3.18	709.56	N/A	3.24	722.24
Country of Birth Outside Australia	18.52	25.51	5,548.64	17.81	26.17	5,871.52	18.15	27.34	6,170.17	1,800.00	27.73	6,179.74	18.38	28.27	9,295.08
Language Other than English Spoken at Home	9.77	14.14	3,074.75	9.38	14.63	3,281.93	9.35	14.91	3,364.32	9.09	15.13	3,372.09	9.36	15.74	3,504.59
Part - Time	4.28	3.98	866.13	3.32	2.99	671.07	2.96	2.63	593.83	5.72	5.34	1,189.08	5.77	5.38	1,197.88

*Defined by DEST

SECTION 6

Administration and Management of the BSc

6.1 Overview of Contributions from the Faculties

A summary of all Faculties who earned Effective Full Time Student Load* (EFTSL) from BSc students over the past 5 years is given in Table 6.1. This includes load resulting from enrolments in both "Part A" courses (science) and "non-Part A" (non-science). The Faculties of BACS, EPSA, SBS (School of Psychology) and Health Sciences (School of Human Movement Studies) contribute all but a small number of the Part A courses.

* *EFTSL is a measure expressing student enrolments as a proportion of the standard annual program for a full-time student undertaking a normal full year of study in a particular year of a particular course. It is expressed in Equivalent Full-Time Student Load (EFTSL) values. A student undertaking a standard full-time annual program for a course generates one EFTSL. Each subject /unit offered by a department is weighted in terms of the proportion (of one) that the subject/unit represents of a year's work in a given course for a full-time student. These weights are then multiplied by the number of students enrolled in each subject/unit to determine the total subject load.*

Table 6.1 Summary of all Faculties who earned EFTSL from the BSc over the past 5 years

		2001		2002		2003		2004		2005	
		EFTSL	%	EFTSL	%	EFTSL	%	EFTSL	%	EFTSL	%
BSc	ARTS	62.08	3.3	59.21	3.1	68.03	3.6	58.38	3.3	65.09	3.5
	BACS	1,241.21	66.5	1,262.47	67.0	1,230.00	65.9	1,194.42	67.3	1,227.77	66.8
	BEL	20.32	1.1	21.93	1.2	30.54	1.6	28.62	1.6	28.82	1.6
	EPSA	342.24	18.3	321.97	17.1	306.11	16.4	271.78	15.3	296.84	16.2
	HLTH	38.68	2.1	43.13	2.3	45.64	2.4	43.95	2.5	41.47	2.3
	NRAVS	8.23	0.4	10.53	0.6	8.78	0.5	11.46	0.6	11.35	0.6
	SBS	154.61	8.3	165.25	8.8	177.58	9.5	166.39	9.4	165.48	9.0
BSc		1,867.38	100.0	1,884.50	100.0 %	1,866.69	100.0 %	1,775.00	100.0 %	1,836.81	100.0 %

The administration of the BSc differs from some other degrees which are entirely based in one School and which are thus administered largely at the School level.

Formal responsibility for the administration of the BSc is held by the Faculty of Biological and Chemical Sciences. Good communication between the contributing Faculties in administering the degree is essential, and is achieved in a variety of ways depending on the area.

For the purposes of this report, administration is described under the following headings:

- Program policy issues
- Student administration
- Marketing and International.

6.2 Program Policy Issues

The University requires that all undergraduate degree programs are overseen by a Board of Studies. The BSc Board of Studies, currently chaired by the BACS Faculty Director of Studies, considers all matters relating to program rules, program requirements, graduate attributes, curriculum, majors, new courses and duplication of content.

BSc Board of Studies – Terms of Reference

Role

The Science Board of Studies (i) has a leadership role in developing proposals for changes to the BSc program and implementing relevant innovations in the Faculties that contribute to the BSc; and (ii) reviews proposals for course and program changes submitted by the BACS School Teaching & Learning Committees (T&L Committee) or EPSA School Boards of Studies.

Membership

- Director of Studies, BACS (Chair)
- Director of Studies, EPSA
- Director of Studies, SBS
- Assistant Director of Studies, BACS
- Assistant Director of Studies, EPSA
- Chair, T & L Committee, School of Biomedical Sciences or nominee
- Chair, T & L Committee, School of Molecular & Microbial Sciences or nominee
- Chair, T & L Committee, School of Life Sciences or nominee
- Chair, T & L Committee, School of Geography, Planning & Architecture or nominee
- Chair, T & L Committee, School of Information Technology & Electrical Engineering or nominee
- Chair T & L Committee, School of Physical Sciences or nominee
- Chair, T & L Committee, School of Human Movement Studies or nominee
- Chair, T & L Committee, School of Psychology or nominee
- BSc Student Representative
- Marketing Manager, BACS
- Marketing Manager, EPSA
- Manager, Academic Administration, BACS
- Manager, Academic Administration, EPSA
- Secretary (nominee of the Director of Studies, BACS Faculty)

Terms of Reference

1. To advise the relevant Executive Deans on strategic directions for the review and development of the Bachelor of Science program, including its content, structure and rules.
2. To receive and consider submissions from School T&L Committees (BACS) and School Boards of Studies (EPSA, SBS, Health Sciences) regarding proposed changes to the Bachelor of Science program, including majors, courses and program rules, for submission where necessary to the University of Queensland Committees, including Academic Programs Review Committee (APRC) and Committee of Academic Programs Policy (CAPP).

3. To develop and implement within the relevant Faculties the best policies and procedures, consistent with the University's policies and procedures, for dealing with student related matters such as academic advising, program planning and enhancing the first year experience.
4. To work with the T&L Committees of the relevant Faculties to promote teaching scholarship of the highest standard in the Bachelor of Science program.
5. To develop and implement the marketing program for the Bachelor of Science program, in cooperation with the relevant School Heads and T&L Chairs and Faculty Marketing Managers.

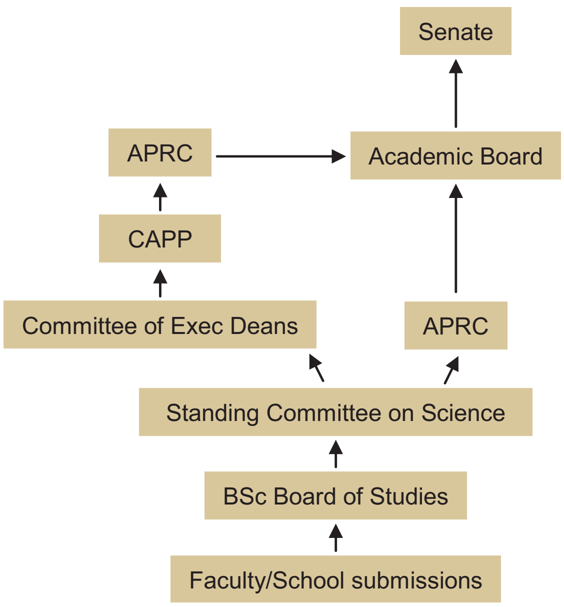
Frequency of Meetings

As often as necessary and at times when appropriate for the progression of changes to the BSc program through other committees including APRC and CAPP. The BSc Board of Studies will meet at least once per semester, and is expected to meet 4-6 times per year.

The Board of Studies reports to the Executive Deans through their representatives on the Board. The Standing Committee on Science was formed in 2002 to discuss issues requiring consideration at the Executive Dean level. It should be noted that this Committee has met on only three occasions to date, and its role may be superseded by the change to process in 2005 whereby major program issues are always discussed at the Committee for Executive Deans.

Rule and program changes which are approved through these committees are forwarded to the relevant University Committee. Major changes go to the Committee of Executive Deans, then CAPP then APRC. Minor changes go to APRC only. All changes are finally sent for approval to the Academic Board and then to the Senate. A diagram summarising the program approval process is given in Figure 6.1 (below).

Figure 6.1 Reporting structure for administration of the BSc



6.3 Student Administration

Responsibility for BSc student administration is divided between the BACS and EPSA Faculties according to field of study. Human Movement Science and Psychology fields in the BSc are managed by BACS. The BACS Faculty Academic Administration Office has oversight of admission, program change requests and certification of examination results whereas, Department of Education Science and Technology (DEST) reporting, withdrawal from courses, approval of special and supplementary examinations, re-enrolment following exclusion, award of credit for previous study and graduation of students are managed by the Faculty which owns the relevant field of study.

Dual degrees with the BSc are overseen by different faculties as follows:

BSc/BA	BACS
BSc/BEd	BACS
BSc/LLB	BACS
BSc/BEcon	BEL
BSc/BBusMan	BEL
BSc/BCom	BEL
BSc/BJ	BACS
BE/BSc	EPSA
BInfTech/BSc	EPSA
BSc/MBBS	Health Sciences

The BACS Faculty also manages orientation and the first round of academic advising for all new BSc students, with appropriate contributions from all Faculties in the interview process.

Academic advising after the orientation round is provided by the most appropriate Faculty, if necessary by a process of referral. Each Faculty manages academic advising in a slightly different manner. For example, BACS students are able to make an appointment for an advising session with one of a small group of academic staff members who have extensive experience in advising. Psychology advising is managed by administrative staff in the School office.

The BACS Faculty also has overall responsibility for updating central publications (program and course handbooks and related website databases) as well as the production of Year 1 and Year 2/3 planners to assist students in their program planning. There is again communication with all Faculties to ensure appropriate material is included.

A snapshot of the resourcing of student administration and major responsibilities may be obtained by looking at the BACS Academic Administration Unit, which as noted above is directly responsible for more than two thirds of the students (based on EFTSL) in the BSc as well as some overall responsibilities. Staffing is summarised in Table 6.2.

Table 6.2 Staffing of BACS academic administration unit 2006

HEW level	Responsibilities
8	Office Manager. Liaison with central administration and Faculties. Preparation of submissions to CAPP, APRC. Office supervision and performance appraisals
6	Assistant Manager; Teaching &Learning Committee and Timetable/Sign-on
5	Liaison with SMMS, plus support to BBiotech program
5	Liaison with SBMS, plus support to BBiomedSci program (Brunei) and BMarSt program
5	Liaison with SIB; plus support to BEnvSc program
5	Liaison with CMS; and 50% Personal Assistant to the Director of Studies
3	Reception, general enquiries (email, telephone, counter), appointments for academic advising

In an effort to quantify the workload in the Academic Administration Office, each staff member maintains a daily work distribution log. This is charted to help determine peak times throughout the year for planning purposes. The Office Manager reports quarterly to the Executive Dean on work undertaken.

There are some minor disadvantages resulting from the spread of the BSc across multiple Faculties. For example, there are occasions when it is not clear at the point of enquiry which plan a student is enrolled in and this can lead to confusion regarding the area of responsibility for administration. Additionally, students are formally assigned to BACS until they have declared a plan which another Faculty administers. This occasionally leads to delays in processing enquiries from students. This problem is greater for dual degree students who are sometimes referred on more than once before the correct officer to deal with the query is contacted.

6.4 Marketing and International Programs

6.4.1 Marketing

Major annual marketing initiatives are generally undertaken collaboratively between the Faculties with an increasing tendency to share resources. The major initiatives are outlined below.

Science Prospectus

Annual publication promoting the Bachelor of Science including career outcomes, study opportunities and professional associations.

Careers that Started in Science

Biannually, the BACS Faculty develops a ‘Careers that Started in Science’ booklet that focuses on the career paths of a selection of our graduates. This book has been particularly popular due to the information contained about career and study pathways, salary information and job overview. Career posters were also developed for science displays and distributed to all Queensland and northern New South Wales high schools.

Tertiary Studies Expo (TSXPO)

A major two day recruitment event held in Brisbane focusing on the school leaver market. Academic advisers provide detailed course and career information to prospective students and their parents in an individual capacity.

UQ Open Day

Hands-on science activities are organised for visitors to the campus to gain insight into science at UQ. Program presentations are performed throughout the day to highlight the degree program and the benefits of studying science at UQ. Academic advisers also provided detailed individualised advice.

Experience Science

Approximately 2,000 high school students from Queensland and northern New South Wales participate in two interactive workshops of their choice, combined with a short presentation by a scientist addressing the benefits of studying science at UQ.

Buddy Program

This program is designed to assist international and domestic students new to UQ, to become part of the university community as quickly as possible. A ‘Buddy’ is a primary contact person who provides information and guidance to incoming students. New students are matched with a student volunteer (these students may be international or domestic) during the initial arrival period or via email prior to arrival.

This program will become the Science Buddy Program in 2007 with an extension to the Faculty of Engineering, Physical Sciences and Architecture.

Student Ambassador Program

This program is coordinated by the Faculty of Engineering, Physical Sciences and Architecture, with contributions from the Faculties of Biological and Chemical Sciences, and Natural Resources, Agriculture and Veterinary Science. Ambassadors are nominated by each school to receive communication from the university which is disseminated throughout their school.

Frontiers in Science Lecture Series

The Bright Minds project provides a series of lectures from outstanding scientists to an audience of high school students and teachers. These lectures focus on cutting edge sciences and provide for interactive discussion about the topic.

BioFutures

The BACS Faculty sponsors the BioFutures program organised by the student chapter of the AusBiotech Association. As part of the sponsorship the Faculty presents a number of interactive workshops in the biotechnology area and also financial support. Attendance at the annual AusBiotech Careers night is an annual event and included in this sponsorship.

Campus visits

The BACS Faculty receives a range of requests for high schools to visit the campus and learn more about UQ's science programs. Students receive a short lecture, a tour of science facilities and view the UQ Student Recruitment Video. The School of Biomedical Sciences also caters for 3,000 high school students to visit the anatomy museum each year.

High School Careers Nights

A range of requests are received from high schools requesting an academic present at their local careers night. Where possible, academics attend and advise students and their parents about careers in science and UQ's programs.

Science Honours Day

This combined function was held for the first time in 2006 with the aim of combining the separate school functions into one major event. Staff, material and capital resources are pooled and students are exposed to a wide range of disciplines and potential research supervisors at the one location and at the one time. The event was considered to be successful and will be expanded in 2007.

Direct Mail

Several direct mail campaigns are undertaken each year to distribute Science publications such as the Science prospectus, planners and careers booklets as well as any additional information about Experience Science and Scholarships as examples.

Radio

Specific events that target a wider audience are also advertised on radio. For example, the Science Honours Day 2006 involved a series of spot promotions on the days immediately preceding the event.

Surveys

Surveys are used to collect feedback about student and staff experiences associated with specific events or to gather information about staff or student opinions. Surveys are conducted as paper-based or web-based and all feedback data is available online for analysis.

Guidance Officer Conference

The University coordinates a Conference each year for approximately 120 Guidance Officers and Careers Counsellors. The Faculty is an active participant and organises a presentation each year on topical issues. These information sessions are well received by this key group.

Careers in Science Evening

The BACS Faculty, in association with the Society for Undergraduate Science Students, organises a Careers evening to link employers with graduating students and future graduates. This event aims to provide a service to our students and to provide exposure to industry of the quality of our graduates and the science programs.

Careers Markets

Whilst the Faculties do not actively participate in the Careers Markets as this function is carried out by the Student Recruitment Team for the University, the Faculties provide promotional material for the science programs.

Physics Demo Troupe

The UQ Physics Demo Troup is a group of energetic and enthusiastic performers who run physics shows, workshops and talks to primary and secondary schools all around Brisbane and beyond.

Illuminating Science

A science website run by Physics that provides the latest news in science worldwide, local events, talks and activities as well as thoughts about academic life and studying physics at UQ.

Physics - Science in Action Program and QASAR Club

The Science in Action Program offers diverse and unique programs aimed at increasing the profile of the physical sciences and is targeted at school and special interest groups The program provides activities for schools visits and co-ordinates the QASAR club for secondary physics students.

Tools Of Science

This seminar series is hosted by The Physics Museum for students, scientists, engineers, historians of science and technology, teachers, collectors, and all those fascinated by old scientific instruments.

Mathematics - Club Infinity

Club Infinity is a free maths club for high school students and teachers with newsletters, quizzes and careers links for students with an interest in maths.

Junior Physics Olympiad

Provides challenging on-campus physics workshops for Year 10 students.

Siemens Science Experience

The Siemens Science Experience is three days of hands-on science activities in university laboratories, lectures and site visits for 500 Year 9 students in January each year.

Environmental Expo

Workshops and presentations for primary and secondary school teachers.

Mathematics - UQ/QAMT Maths Problem Solving Competition

The UQ/QAMT Problem Solving competition is an annual secondary school competition attracting nearly 2000 entries each year. Year 11 results in this competition are used in the selection of students for the National Mathematics Summer School in Canberra.

GTAQ/UQ Careers in Geography Day for Year 10 students

Industry speakers and hand on workshops at The University of Queensland's St Lucia Campus.

National Science Week

Activities conducted annually on or off campus

RoboCup Jnr

RoboCup Junior is a project-oriented educational initiative that sponsors local, regional and international robotic events for young students. It is designed to introduce RoboCup to primary and secondary school children, as well as undergraduates who do not have the resources to get involved in the senior leagues. The focus in the junior league is on education.

RoboCup is an international effort whose purpose is to foster Artificial Intelligence (AI) and robotics research by providing a standard problem where a wide range of technologies can be integrated and examined. As well, the initiative serves as a basis for project-oriented education.

STAQ Science Contest

The Queensland Science Contest is an annual event organised by the Science Teachers Association of Queensland (STAQ). The contest is open to all Queensland students from pre-school to year 12, and is judged across 5 age divisions. Students may enter their projects in one of 5 categories. They may also nominate to be considered for up to 2 bursary awards, provided their project topic is relevant to the particular bursary. Representatives from scientific and educational organisations will judge the projects.

Web

All Faculties maintain extensive websites and update all information in the UQ Programs and Courses database to ensure prospective students are able to easily obtain information about science programs and activities. A Science portal is currently being developed together with a Marine and an Environmental Portal which will bring together all the discipline-based science information across the university into three separate but unified sites.

6.4.2 International

Major international initiatives are undertaken collaboratively between the Faculties as outlined below.

Teaching Programs in Stanford University, University of California and Hobart William Smith and Union Colleges

The Centre for Marine Studies delivers three teaching programs under contract to Universities in the United States: Stanford University, University of California and Hobart William Smith and Union Colleges (HWSU). Each of the programs runs for approximately a full semester and is accredited to the home institution. The Stanford program accepts 50 students; University of California 35-40; and HWSU 35 students. The programs are taught mainly by CMS academic staff and tutors although HWSU does send two of their own academic staff to help with teaching into their program. The programs feature field trips to each of the University of Queensland's three marine research stations as well as terrestrial field trips to areas such as Lamington National Park. Quality control is provided by ensuring that the programs comply with University of Queensland policies and standards in course content, assessment and evaluation. Each of the partner institutions periodically audits its program to ensure that it complies with their own requirements.

Hobson's Service Centre

The faculties provide templates and information for Hobson's Service Centre which is used to answer enquiries received from prospective international students. Students who have enquired through Hobson's Student Centre are invited to meet UQ staff that may be travelling through the country for other reasons which helps to personalise their contact with UQ. An annual meeting with faculties and the Hobson Service Centre is held to brief and update the counsellors about the programs and to obtain an annual report of activities.

Study in Australia Exhibitions

These recruitment events are organised by Austrade, IDP Education Australia, and UQ's representatives overseas. Such events are held regularly in countries that are key regions for sourcing international students. For example, staff regularly attend recruitment events in Hong Kong, India, Malaysia, Singapore, Thailand and Vietnam.

Student Interview Sessions

These sessions are one-to-one meetings with prospective students and conducted with a view to increasing the application to enrolment conversion rate. Interview sessions give students who have selected UQ as a preferred study destination the opportunity to find out detailed information about the degree. Sessions are held in Singapore and Malaysia and conducted by trained faculty staff.

Admissions

The faculties work closely with the International Education Directorate (IED) to address issues concerning offer letters, turnaround of applications, increasing the conversion rate of applications, student visas, and other matters that impact on student enrolment.

UQ Pre-Departure Sessions

The UQ Pre-Departure Session is organised by IED twice a year in January and May, and held in Malaysia, Singapore, and Thailand. The purpose of these sessions is to introduce the Buddy Program, and prepare students for their studies at UQ.

Articulation Arrangements and Joint Programs

Articulation arrangements are in place with five polytechnics in Singapore, five colleges in Malaysia, and numerous other colleges in various countries. A twinning program with Taylor's College in Malaysia is been developed.

Institutional Visits

Academic staff regularly visit partner and potential partner institutions to discuss articulation pathways, deliver seminars or profile UQ's programs and research excellence.

International Education Services Foundation Program and Careers Day

The faculties attend the Careers Day to deliver a presentation on science degrees and to advise students on their study options. IES Foundation students participate in the Experience Science Program and visit UQ to use laboratory facilities for their practical work.

Agents Conference

A conference for key overseas recruitment agencies and their student counsellors is held annually at UQ. All faculties participate by delivering a presentation which is combined with updates on information relating to degrees, facilities and services. Counsellors also visit faculty laboratories as part of a tour of UQ.

Student Exchange Program

The faculties in conjunction with IED, organise a Student Exchange Seminar for science students each semester. The seminar provides key information relating to the program and visiting staff and current or returned exchange students, are invited to speak about their institution and experiences.

Scholarships

A range of scholarships designed to assist a student's progress in their undergraduate or graduate careers are offered by the faculties. A complete list is available elsewhere within this document (Section 7 – Scholarships).

SECTION 7

Educational Research & Teaching Scholarship

7.1 Reports from the BACS, EPSA and SBS Faculties

The Educational Research and Teaching Scholarship reports have been compiled by each of the three faculties that teach into the BSc. They cover the breadth of activities which are being undertaken to improve teaching and learning in the BSc. Just prior to this report being completed, Professor Peter Adams (School of Physical Sciences) and Professor Philip Poronnick (School of Biomedical Science) were awarded a highly prestigious Senior Fellowship from the Carrick Institute for Teaching and Learning in Higher Education entitled " Embedding Quantitative Principles in Life Sciences Education" and Associate Professor Ross Barnard (BACS – Biotechnology Program) and Dr Damian Hine (UQ Business School), were awarded a Carrick Institute Grant entitled "Extending Teaching and Learning Initiatives in the Cross-Disciplinary Field of Biotechnology".

The Educational Research and Teaching Scholarship Reports a presented in full in:

- Appendix 3 : BACS Faculty Report
- Appendix 4: EPSA Faculty Report
- Appendix 5: EPSA Faculty – School of Geography, Planning and Architecture Report
- Appendix 6: SBS Faculty – School of Psychology Report

7.2 Educational Enrichment Programs

The BACS, EPSA and SBS have developed educational enrichment programs for undergraduates which have become institutionalized in the BSc and which are highly supported by the student body (see Supplemantary Document: BSc Review Student Survey). The various programs are described in detail below.

The Advanced Study Program in Science team is comprised of: Robyn Evans (BACS), Joanne Blanchfield (SMMS), Michael Bulmer (SPS), and Elizabeth McGraw (SIB)

The Peer Assisted Study Session (PASS) program is organized and developed by Dr Valda Miller (SMMS).

The Peer Embedded Group Study (PEGS) program is organized and developed by Dr Roger Moni (SBMS) and Professor Phil Poronnik (SBMS).

7.2.1 Advanced Study Program in Science (ASPinS)

The Advanced Study Program in Science was instituted at UQ through the Bright Minds Program in 2001 (for further detail see Supplementary document: Bright Minds Final Report). It targets high achieving students and provides them with an enriched program of study from the commencement of their undergraduate science program through to graduation. Students enhance their university experience through:

- Small group interaction with other students of sciences and mathematics
- Individual mentoring by a scientist
- Access to research laboratories

- Access to scientists across many disciplines
- The formation of a social network with other ASPinS students

7.2.1.1 How does the Advanced Study Program in Science work?

The program takes in 40 commencing Bachelor's degree students each year. Successful applicants are chosen through a written application and personal interview process. Students in the OP1-3 range are invited to apply and those who satisfy the selection criteria and express a serious interest in pursuing a science-based career are chosen to participate. The cohort is given access to three courses that are unique to the program (one for each of the three years of the degree) and a range of associated opportunities which complement their plan of study.

7.2.1.2 First Year students

Features of the program available to first year ASPinS students include:

- A weekly lunchtime seminar series introducing students to some of UQ's brightest scientists who talk about their science and what motivates them
- A 2-day field trip to the UQ Moreton Bay Research Station at the beginning of semester 1, which provides the opportunity for students to get to know the group and do some field-based study.
- BIOL1017 "Perspectives in Science", a course designed to make students think about big problems from different perspectives. The course emphasises team work and communication. It is graded Pass/Fail to encourage students to achieve what they want from the session in terms of interest rather than focussing on assessment.

7.2.1.3 Second Year students

Features of the Program available to second year ASPinS students include:

- A fortnightly seminar series featuring early career researchers (junior academics)
- A 2 day field trip to Binna Burra at the beginning of semester 1, which provides the opportunity for social interaction with other Advanced Study Program students and participation in science related events.
- The opportunity, through enrolling in BIOL2107, to become actively immersed in a research laboratory doing an individual research project.
- Presentation of the student's research at the annual ASPinS Undergraduate Research Conference. This event is a forum for students to present their work in front of research mentors, peers, UQ researchers and family.

7.2.1.4 Third Year students

Features of the Program available to third year ASPinS students include:

- Attendance at research seminars across the university
- Access to scientists through 'Meet the Speaker' events, which give small groups of students (5-10) the opportunity to lunch with national and international scientists in an informal setting.
- Enrolment in BIOL3017, where students undertake a substantial research project, building on their laboratory experiences from BIOL2017.
- Presentation of the research at the annual ASPinS Undergraduate Research Conference. Participation in ASPinS culminates with the Graduation Dinner at the end of year 3.

7.2.1.5 Program outcomes

Since its inception in 2001 two cohorts of students have completed the Advanced Study Program in Science. The students have performed very well in their undergraduate studies and have showed a passion for research that is evident by the large numbers who have continued on into postgraduate research positions. The following statistics are available at this time on the progress of our first two cohorts. Twenty of the 21 traceable students from the first cohort carried out an honours degree or enrolled directly into an MBBS/PhD or an overseas PhD program. Of those completing honours, 13 have enrolled in a PhD (1 at Harvard University), 1 has entered an MBBS, and 2 are employed in the biotechnology industry. Of the 2005, graduating class 14 students are currently enrolled in honours, 1 is completing a BA, 2 have entered an MBBS, and 1 is currently on overseas exchange and will enter honours upon her return.

Comments from students completing Advanced Study are remarkably similar in highlighting the formative role ASPinS has played in their ongoing educational and career choices. The program provides challenging opportunities, a community of like-minded peers, and mentors to guide them. Although considered the most likely to succeed academically these students are often at highest risk for attrition from the sciences due to boredom.

Students are not the only beneficiaries of the program. Involvement of UQ academic staff in the program has risen steadily with each successive year. Seminar slots and discussion group opportunities with 1st and 2nd year students are a limited and sought after commodity. The number of academics willing to serve as mentors now exceeds the number of students in the program. Comments from participating academics are that they find these interactions with the students inspirational and uplifting.

7.2.1.6 Selected Advanced Study Program in Science testimonals

Rachel Norton (1st year 2005)

ASP has given me a support network at university, opened my mind to the many possibilities science research offers and introduced me to a great bunch of students and academics.

The field trip was an awesome experience. What better way to start your time at university than surrounded by positive, motivated people, talking with the leading scientific minds in Australia and getting to spend a fantastic weekend on Stradbroke Island wading through swamps and trawling for plankton!! The seminars are great too because they give you up-to-the minute insight into fascinating research and where your studies could take you. And sometimes they bring owls!

In short, I have two words to say about ASP. Do it!!

Bruce Chau (1st year 2005)

"The Advanced Studies Program at the University of Queensland is a highly motivating program where scientists and students early in their career are able to get into contact with each other in a relatively small group environment. It is an excellent program which complements the needs of students across diverse backgrounds with an appreciation for a broad spectra of the sciences and is a wonderful place where like-minded people can gather together, not only to learn but to have fun.

Having enjoyed chemistry since high school, the first semester of seminars offered by the ASP program have enlightened me on the broad spectra of research, especially in biological chemistry offered at the university - which is traditionally of very high calibre. The program itself has encouraged me to keep on pursuing this area in my further studies here

- something I feel extremely privileged and thankful for. It has positively contributed in my decision making in what to study next semester and perhaps for the rest of the science component of my degree.

I can only look forward to the other special courses and seminars this program has to offer next semester!"

Gaelen Burke (former ASP student 2002-2004)

My name is Gaelen Burke and I was one of the first cohort of ASPinSers. I am now finished the first year of my PhD at the University of Arizona, with Dr. Nancy Moran's group. It will take another 4 years at least to finish, but I'm really glad I came to the US to study.

I think the ASP was great and played a really important role in helping me meet people (especially mentors), get experience and inspire me to continue into a career in research and hopefully academia.

7.2.2 Supporting first year student learning through Peer Assisted Study Sessions (PASS)

7.2.2.1 Rationale

First year university students face an array of challenges, not the least of which is the rather daunting experience of navigating large class courses on a campus so unfamiliar that the experience for many is akin to the proverbial 'little fish' in an enormous pond. Students can be faced with a number of courses from which to select, many of which have densely structured, modular and multi-streamed curricula in which the content can appear confusing and irrelevant. It is not uncommon for students, who are drawn from a diverse social, academic, ethnic and cultural background, to feel acutely isolated and confused in this unfamiliar environment which for many can lead to the decision to withdraw from higher education before the end of their first semester.

7.2.2.2 Distinctiveness, coherence and clarity of purpose

In response, the Peer Assisted Study Sessions (PASS) Program, a small group, peer based learning model, was implemented in 1994 by the Departments of Botany and Biochemistry in the Faculty of BACS, specifically to provide students in first level courses with structured study in a supportive and peer mentored environment. Sessions provide small group, collaborative learning opportunities for students, and are facilitated by two course competent leaders who are currently 2nd or 3rd year undergraduate students. The current scope of the program is listed below:

Biology and Chemistry based courses, with current student enrolment

BIOL1008	Biochemistry & Microbiology for Human Movement Students: 224 students
BIOL1011	Genetics & Evolution: 1093 students
BIOL1012	Animal Biology: 857 students
BIOL1013	Plant Biology & Biotechnology: 251 students
BIOL1014	Molecular & Microbial Biology: 1044 students
BIOL1016	Ecology & the Environment: 321 students
CHEM1020	General Chemistry: 1467/87 students
CHEM1030	Chemical Bonding & Organic Chemistry: 107/1008
CHEM1090	Introductory Chemistry: 134 students

Physical Sciences, with current student enrolment

MATH1040 Introductory Mathematics: 293/161 students

STAT1201 Analysis of Biological Data & Experiments: 192/571 students

Geographical Sciences and Planning courses, with current student enrolment

GEOS1100 Environment and Society: 147 students

PLAN1001 Introduction to Planning: 175 students

PLAN1000 Integrating Planning Projects 1: 69 students

REDE1300 Building Construction Management and Economics: 161 students

The philosophy of the PASS program design draws from contemporary learning theory and research. PASS leaders are provided with training to develop strategies that encourage active engagement in learning in a wide range of instructional modes. Leaders also learn to design learning activities structured as formative self- and peer-assessment tasks which are course and program relevant. Leaders therefore scaffold students' often tentative forays into complex coursework and most importantly, embed within first year students positive attitudes and a 'you can do it' approach to new work. As well, leader-generated activities are regularly made available to academic staff to monitor students' learning progress and rectify problem areas. This practice supports a two-tiered mentoring approach to student learning: academic to PASS leader to student. Our program's distinctiveness lies in the collection and availability of previous leader-generated activities as a sustainable resource. Thus, each succession of leaders has ready access to this collection which they may amend, delete or add to, in order to promote optimal learning for their students, in an authentic communal constructivist approach to fostering learning enhancement.

Now in its 13th year of implementation, this program has extended across two faculties, four schools, and integrated within fifteen different first year courses. Currently PASS sessions are regularly offered across the majority of first level Biology, Chemistry, Mathematics, Statistics, Geography and Planning courses, comprising 163 PASS groups per week, each with 15 to 30 students. Collectively, this initiative supports approximately 3500 first year students every week. Regular program evaluations indicate significantly reduced attrition and improved student outcome (Miller, V., Oldfield, E. & Bulmer, 2004; Figures 7.1 to 7.5 and Table 7.1).

7.2.2.3 Breadth of impact

Besides the benefits noted for students, leaders and academic staff within the Faculties of BACS and EPSA, the PASS model has been articulated more widely across this university and indeed within other national and international institutions. In a report to the president of the academic board by the review committee of the School of Molecular & Microbial Sciences, May 2005, Commendation 3 from Teaching and Learning Commendations and Recommendations stated: *"The School is to be congratulated on the innovative pedagogy in teaching, including the outstanding PASS program."* A summary of the impact of the PASS program locally, nationally and internationally:

Locally:

- PASS leaders are invited by faculty to join the "Scientist in Residence" program, to propagate an appreciation of Science based activities within primary middle school classes.
- PASS leaders are invited by faculty to become involved in the "buddy" program.
- PASS leaders participate in Orientation Week activities, as guides for first year students.
- PASS leaders have provided original formative learning activities and co-edited "Learning Guides" for the courses BIOL1011, BIOL1012, BIOL1013, BIOL1014 and BIOL1015.

- PASS leaders have facilitated student interaction in collaboratively based group projects for STAT1201 students within the Collaborative Learning Centre (see Bulmer, M., Miller, V., Byers, H., Milne, D. & O'Brien, M., 2005)

Available at: http://science.uniserve.edu.au/pubs/procs/wshop10/index.html

- PASS coordinators have been actively involved in introducing the PASS program to the Faculty of English, Media Studies & Art History, and contributing to the leader development workshop.
- PASS coordinators have written a new PASS Leader Development Handbook, with the help of PASS leaders (2006). The handbook is currently used at UQ based Schools of Molecular & Microbial Sciences, Integrative Biology, Physical Sciences and Geography, Planning & Architecture, and nationally at the Biology Department, Flinders University, South Australia.
- PASS coordinators and students of MATH1040 will be involved in a recently approved Carrick Institute funded project re. development of software that will facilitate the flexible delivery of process oriented formative assessment tasks in mathematics courses.

Nationally:

- PASS coordinators have been invited speakers to the "First Year Experience Forum", 2005 National UniServe Conference, The University of Sydney. Available at: http://science.uniserve.edu.au/workshop/fye2005/
- PASS coordinators have helped to introduce the PASS program into the curricula of all Biology based courses at Flinders University, South Australia.
- PASS coordinators have collaborated with faculty to introduce the PASS program into the curricula of Chemistry based courses at Australian National University, Canberra. Funding for the program has been approved.
- PASS coordinators have helped to improve the PASS program within the curricula of Economics based courses at The University of Sydney, New South Wales, and are currently collaborating with the PASS coordinator re. a cross-discipline based project to investigate how the structure and delivery of formative assessment can influence student learning constructs.

Internationally:

- PASS coordinators have collaborated with the existing PASS program coordinator of Arts and Law based courses at Victoria, University of Wellington, New Zealand.
- PASS coordinators have contributed a case history entitled "The incorporation of Peer Assisted Study Sessions (PASS) into the core curriculum of Chemistry 1A (CHEM1012): learning activities as formative assessment practices" for inclusion into a book "Formative Assessment", Ed. A/Prof Alastair Irons, School of Informatics, Northumbria University, U.K.
- PASS coordinators have collaborated with Dr Hugh Fleming, PAL and Student Development, Academic Services, Bournemouth University, U.K. re. upgrading the current leader development manual.
- The PASS model at the University of Queensland, Australia was one of three retention strategy case studies for discussion at the "Student Retention Research 2004" workshop at the University of Sussex. Available at: http:www.ics.heacademy.ac.uk/student_retention/student_experience/pass.htm

7.2.2.4 Benefits for students

Because the PASS sessions are facilitated by student peers, first year students feel more able to admit ignorance and misconceptions, and seek information, advice and remediation, without fear of jeopardizing their academic outcome. By sharing similar career interests with their students, leaders are also able to communicate their own appreciation for the discipline and therefore act as role models, or mentors. As a result, students gain confidence in their ability to instigate their own learning processes and, as they develop higher learning skills and engage more deeply with the discipline, progress from dependent, to interdependent, to independent learners. Enhanced benefits for students are documented in extensive student survey results, an example of which is displayed in Section 7.2.2.8.

7.2.2.5 Benefits for leaders

There are multiple benefits to being a PASS leader. Initially, leaders attend "leader development" workshops where they are instructed in group dynamics and behaviour, metacognitive and cognitive principles of learning and to identify differences between surface and deep learning approaches. Notable outcomes for leaders follow progressively from the benefits, and may be defined in terms of enhanced development of both cognitive and affective (transferable) skills:

- Improved understanding/consolidation of basic material
- Leadership and communication skills development
- Improved learning and study skills
- Time and team management skills

7.2.2.6 Benefits for academic staff and the university

The ability to engender increased comprehension of course material is the principle reason for including PASS in course curricula. Lecturers comment that they find a higher degree of deep understanding as shown through assessment after PASS was implemented. The fact that leaders often complete further studies in the field in which they were leaders is an added bonus to the university.

Other benefits to academic staff include timely feedback from students via leaders, permitting rapid alteration of lecture format or re-presentation of content or concept. This realistic course-related approach is more strongly supported by academic staff than independent study skills programs. PASS tends to relieve academics from counselling anxious students, allowing more time for research and personal development (Playford, J., Miller, V. & Kelly, 1999).

7.2.2.7 Concern for equity and diversity

A major concern of the program designers was the variability of educational experience students brought to these courses (ranging from OP 1 to 12), the difficulties entailed in the transition period between high school and university study, the diversity of students' cultural, social and ethnic background, and the variation of study and career pathways that characterise first year science cohorts. In this respect, PASS has proved to be a successful support mechanism for all students. Not only does the PASS program address the needs of 'high-risk, high-attrition' students but regular, continued contact with PASS leaders provides a flexible and friendly environment where students may find it easier to unravel the more difficult aspects of course content.

The special needs of international students are particularly catered for in PASS by the flexibility of the PASS 'sign-on' procedure that allows identification of cohorts and leaders for each session and the freedom to choose one particular PASS session that will best address these needs. Students welcome the opportunity to meet and study with students from other cultures, while learning with their friends.

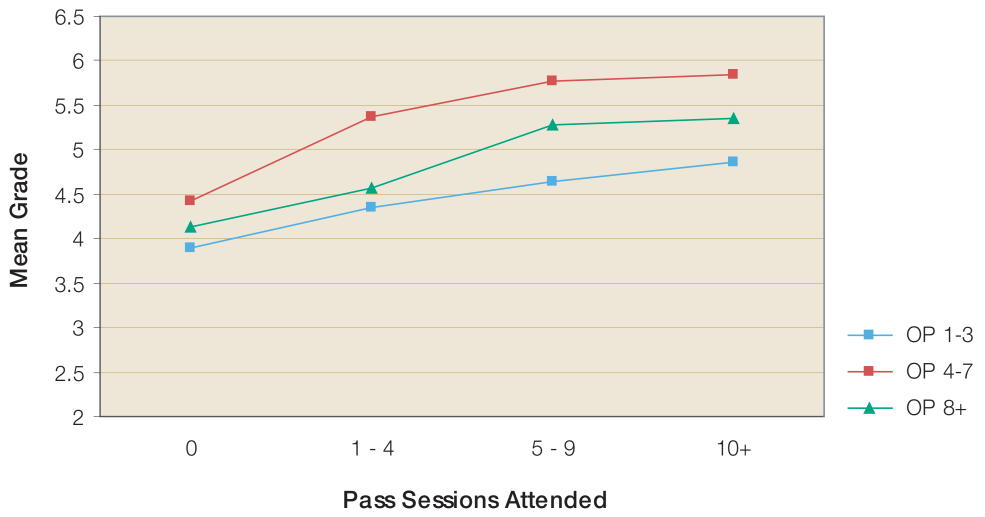
7.2.2.8 Conclusions

The benefits of the PASS program extend to first year students, participating student mentors (PASS leaders) and academic staff. PASS is an initiative that continues to be expanded across the UQ, in addition to attracting interest nationally and internationally. The PASS initiative clearly demonstrates a capacity to support and improve the learning environment for first year students, through the continual development of quality teaching practice and learning support.

Figure 7.1 Student attrition: Pre and Post** PASS

Biochemistry & Microbiology BL103			Chemistry 1A CH112/CHEM1012		
Year	Enrol. Nos.	% Failure (Gr.1+2+3)	Year	Enrol. Nos.	% Failure (Gr.1+2+3)
1993	710	13.0	1999	1279	15.2
1994	789	16.1	2000	1066	16.0
1995	991	17.8	2001	1040	6.7**
1996	1108	9.8**	2002	1118	11.4**
1997	1148	9.6**	2003	1131	5.1**
1998	1100	8.5**	2004	987	4.9**

Figure 7.2 Mean STAT1201 grades by PASS attendance for OP 1-3 (+), OP 4-7 (*), & OP 8+ (o)



The lines in Figure7.2 are roughly parallel, and a multiple regression for grade using OP score and PASS attendance shows no interaction between these two factors. Thus for the statistics course it appears that mean grade is related to PASS attendance in a similar way regardless of student background.

Figure 7.3 Mean BIOL1014 grades by PASS attendance for different OP subsets

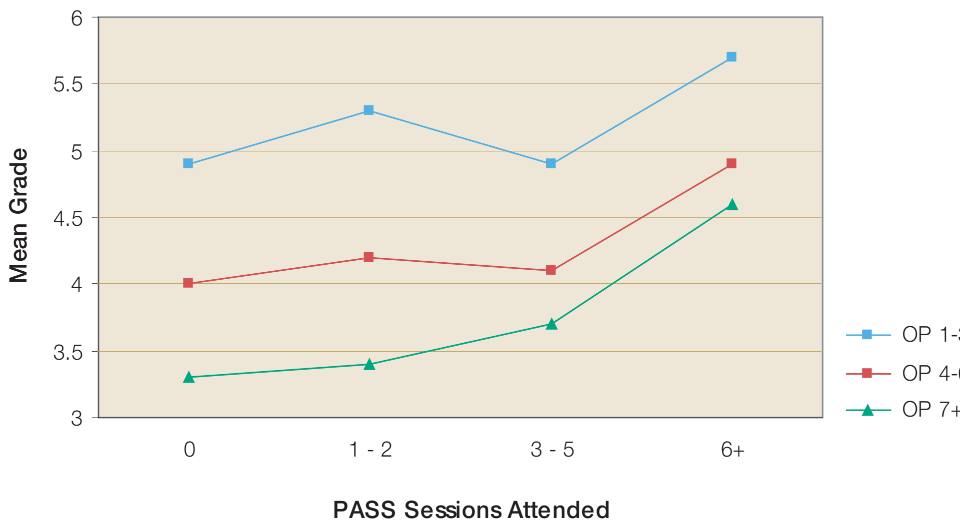


Figure 7.4 Student outcome and recruitment in Chemistry: Grade distribution

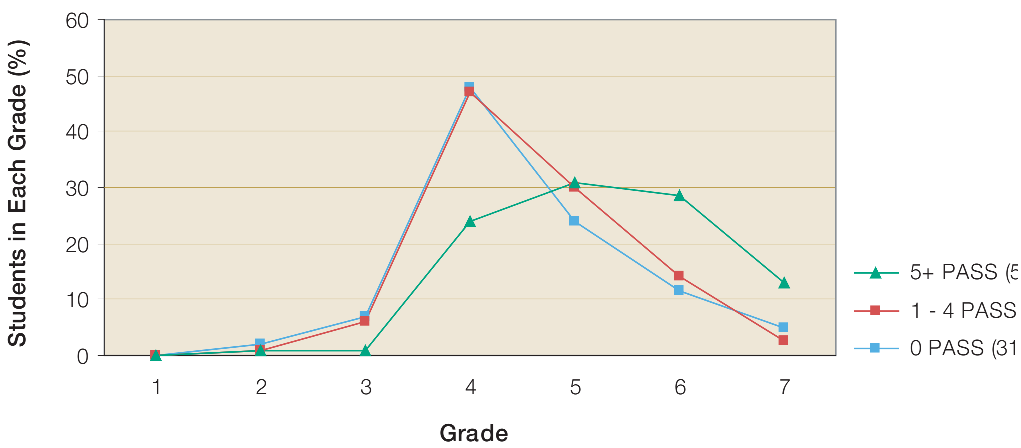


Figure 7.5 Student outcome and recruitment in Chemistry: Mean grades

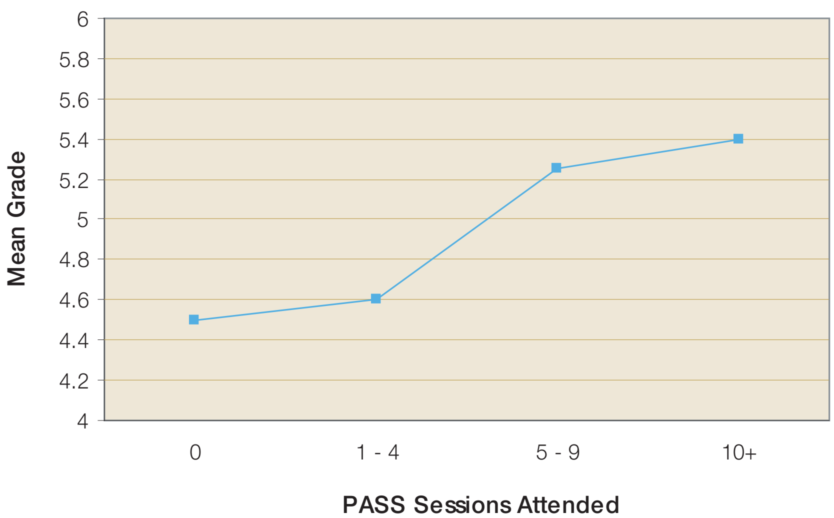


Table 7.1 Student outcome and recruitment in Chemistry: Recruitment of science students

	1st Year		2nd Year		3rd Year		Total Courses	
BACS Faculty	Old	New	Old	New	Old	New	Old	New
Faculty	3	8	1	1	6	3	10	12
Biomedical Sciences	1		7	6	14	12	22	18
Molecular & Microbial Sciences	4		10	6	24	18	38	24
Integrative Biology	4		14	7	30	20	48	27
Existing Courses	12		32		74		Total Existing	118
Proposed Courses		8		20		53	Total Proposed	81
							31.4	% reduction

Note: The above numbers count each course once and therefore do not count courses that are offered in both semesters.

7.2.2.9 Student feedback for program evaluation

(i) Student feedback for evaluation of PASS: BIOL1015

Q1. Have you found PASS to a useful aid to your studies?

100% Yes responses:

– *It has helped me understand the concepts in an enjoyable atmosphere.*

– *It has been most helpful. Thank you for running these sessions because they give me the opportunity to interact with other and have my questions answered. It has really helped with my understanding.*

– *You actually find out how much you don't know which inspires you to do study! PASS also helps to consolidate work.*

– *It helped refresh the content that was being taught in lectures*

– *Yes! It's great. I go to two PASS sessions every week!*

Q2. Would you recommend PASS to another students and why/why not?

100% Yes responses:

– *It increases your understanding, is fun and saves time because there is less to learn by yourself.*

– *I would because it provides a relaxing, friendly, easy-going learning environment.*

– *Because it helped me understand the course much better.*

– *Definitely – it really helps you learn and it helps you get to know the experienced students.*

– *It helps you keep up to date with the work.*

– *Provides insight into depth of knowledge required.*

– *Relaxed, informal environment of small groups allows you to ask questions without being embarrassed as lectures are so big.*

– *Helps you study and understand more.*

(ii) PASS leader feedback for evaluation of PASS: BIOL1014

Q1. Why did you apply to be a PASS leader, and what were your expectations of being in the PASS program?

"I didn't expect that PASS would be as fulfilling as it has been: friendships with other leaders and your students, watching them develop their skills and knowledge throughout the duration of the semester. The support we receive as leaders is invaluable!"

Inspiration:

Overwhelmingly, leaders report finding PASS an extremely useful and enjoyable experience as first year students themselves, feeling empowered and inspired by their own PASS leaders.

"I was a PASS addict; I just couldn't get enough of it!"

Reinforcement:

To re-visit the first level foundational material that they had enjoyed as first year students.

"PASS is a good opportunity to return to and reinforce my knowledge base."

Mentoring:

To be a positive influence on students' perceptions of the course;

To establish a group where comfortable relationships form so students are more at ease in seeking further depth and interest in the subject;

"To bring the same enjoyment and enthusiasm to PASS as my leaders did to me while they helped me to understand the lecture material".

Involvement:

To achieve close working relationships with fellow PASS leaders and students; To gain teamwork, problem solving, communication and leadership skills; To enjoy the relaxed, convenient and jovial atmosphere; to earn money;

"To get more involved in a great University experience that I could share and value."

Q2. Would you recommend being a PASS leader to other students, and if so, please give reasons for your answer.

100% Yes responses:

"Student-student interactions on a personal small group level remove alienation barriers, allow explorative learning as opposed to rote study learning from a textbook and encourage creative presentation of study sessions to suit students' learning styles."

Consolidation & adaptation:

To help to consolidate second and third year course material; To encourage self-learning skills; To become aware of different learning styles and methods; To adapt planned sessions to the needs of the group at the time; To learn to explain complex concepts simply and concisely.

"I find that explaining material to someone else is the best way of reinforcing it in my mind".

Personal & interpersonal:

To help develop personal responsibility; To improve communication, leadership, teamwork, time management & public speaking skills; To encourage new friendships in an informal low pressure environment; To motivate students so that they can become more self-motivated.

"PASS is a genuinely beneficial experience rewarded by having the personal satisfaction of helping people to learn how to learn".

Rewards:

Students are inspiring and fun to work with; Personal control with designing, structuring and directing group activities; Personal reward of positive feedback is gratifying;

Coordinators are very supportive; To be paid for doing something that has so many intrinsic rewards; To meet many different people, and to have the opportunity to forge new friendships.

"It is great when students realise that the course work actually is not all that scary!"

7.2.2.10 Selected References

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7.2.3 Peer Embedded Group Study (PEGS)

7.2.3.1 Introduction of Peer Embedded Group Study in First-Year Human Biology: Contextual background of BIOL1015

Human Biology (BIOL1015) is a one-semester, interdisciplinary course run in first semester primarily for students enrolled in Pharmacy and Human Movement Studies (n~400) and in second semester, primarily for Science students (n~900). The course aims to provide first-year students with a foundation of disciplinary knowledge, conceptual frameworks and practical skills in Human Biology. As a keystone course, it also attempts to provide students with a socio-affective orientation to university learning by engaging students in the professional learning community of scientists at UQ.

The School of Biomedical Sciences (SBMS) has used the enhanced student charge to progressively improve the learning opportunities for students enrolled in BIOL1015. Many of the substantial changes to course objectives, course content, teaching strategies and assessment have been evaluated and documented. In 2004, the course was delivered through traditional lectures and practicals, and 80% of assessment was based on multiple-choice questions. In 2005, two assessment tasks with an early-career focus on argumentative writing and high-order reasoning skills within the context of Human Biology, were introduced. These now represent 40% weighting of the course. These 2005 initiatives (including interactive lectorials using individual audience response units, “clickers”) are being documented: one article is under review (in *Biochemistry and Molecular Biology Education*); one is ready for submission (to *Assessment and Evaluation in Higher Education*) and one is being drafted (for *Studies in Higher Education*). All manuscripts target peer-reviewed, science-related journals with impact factors (details available from Roger Moni). Student achievement was supported through the existing Peer Assisted Study Sessions (PASS) program, a form of cross-level, small-group peer tutoring. In a course debriefing, experienced teaching staff in BIOL1015 decided that most second-year PASS leaders lacked the academic maturity to support the new and more demanding written assessment tasks which had been introduced. On that basis, another form of cross-level, small-group tutoring (Peer Embedded Group Study) is being trialled as a pilot case study in 2006.

7.2.3.2 Peer Embedded Group Study (PEGS)

PEGS aims to assist peers (i.e. students of similar social groupings) to embed and drive learning within small-group study sessions. The main organisational aspects of PEGS include: an explicit focus on understanding and fulfilling assessment requirements versus clarification of course content; one of twelve Honours students facilitates each session; these Honours students are trained to model professional communication and high-order thinking, advise students on organisational matters and facilitate student-led discussions; four, 90-minute sessions are timetabled to support the assessment requirements. Student attendance is voluntary. In brief, the aim of PEGS is for first-year Human Biology students to:

- focus on understanding and preparing better for assessment
- meet other students
- help develop teamwork for later course assessment
- receive feedback on understanding to monitor how well they are performing
- identify questions to ask lecturers
- help each other learn effectively by forming their own study groups.

PEGS faciltators are trained by the course co-ordinator and the authori. One of these Honours students acts as the logistics co-cordinator. Training sessions are timetabled as closely as possible to the targeted assessment tasks. This includes:

- understanding the aims of the course
- how each assessment task aims to progressively develop the professional knowledge, skills and dispositions of students across the undergraduate Science program
- how to use *Praise-Question-Polish* to facilitate student enquiries
- use of a *PEGS Package*.

Details of the “PEGS Package for Facilitators” is available in full in Appendix 7.

7.2.3.3 Effectiveness of PEGS

PEGS is being trialled as pilot project using a descriptive, case study research design. To date, this has entailed collecting data from facilitators and students using diaries, opinion surveys and testimonials. More complete questionnaires and focus group interviews are planned for later in semester two, 2006. The author advises caution regarding premature and unsubstantiated estimates of efficacy.

In semester one 2006, the main focus has been on assisting the PEGS facilitators. This includes a *PEGS Package* (Appendix 7) and asking facilitators to document in session logs, their perceptions of students’ engagement, learning needs of students, students’ levels of understanding and of their own confidence and competence as a facilitator. No conclusions can be made at this early stage. Full sets of data about the perceptions of facilitators are not complete and therefore what follows must be considered as speculative and lacking critical appraisal.

PEGS facilitators have generally reported that the sessions are of: moderate interest to students, strongly meet the academic needs of students around assessment, that students exhibit a range of understandings around course content, and that as facilitators, they have grown in confidence and competence. One facilitator volunteered their second session plan as a record of how to lead a successful session. One facilitator wrote,

> *It is my observation that this format of tutoring empowers students to feel confident about having scientific discussions with their peers and encourages the formation of learning groups independent of PEGS…. although I have not seen statistics to support this, it makes student more confident and savvy in approaching the assessment task*
>
> (PEGS Facilitator)

To date, sixteen first-year students have volunteered opinions about their early experiences (sessions one and two) with PEGS in semester two. These data have not been systematically coded to define consensus themes. Therefore, what follows must be considered as sketchy, being based on an unstandardised methodology to collect qualitative data. A range of views is expressed around the following themes:

Understanding assessment requirements.

Only positive comments have been provided. Four opinions follow:

- It was useful to get more of an overview of the assessment and the format it had to be written in
- I've found pegs to be fairly helpful, particularly when going over the
- personal response exemplars, and when I've required some clarification on points.

- Overall I think PEGS is helpful because it makes the assessment items clearer and and easier to complete.
- PEGS has been useful for learning about the genres for the written assessments through discussing the examplars.

Fostering high-order thinking.

Two positive comments follow:

- Thought-provoking questions helped test understanding rather than memorised-knowledge
- PEGS encourages independent learning, but with the support of a tutor who helps cultivate learning techniques and direction. As the tutors are not actually answering specific questions on the topic, it is much harder for any of the tutor's misconceptions to be passed on to the students.

PEGS facilitators

Most comments were positive. Two follow:

- They encourage self learning, but are happy to help you along when you need it.
- Being able to talk to the tutor about their research and future pathways in biomedical science/ research.

Course content

Most of these students expressed that PEGS sessions should address course content, not only deal with assessment needs. Three samples follow:

- I think that the tutors need to address actual lecture topics, rather then focusing entirely on assessments
- I do however think that it should be made a bit more like the pass sessions in giving us some extra quetion sheets to look at for revision and clarification on any topics

  As the Human Biology course covers a lot of content and knowledge, I think it may be helpful to incorporate some sort of 'revision' system into the PEGS sessions.

7.2.3.4 Outcomes

No clear outcome statements can be made. The pilot study is too immature. Further, the author views PEGS as being an educational initiative, *not* an innovation. The latter includes changes to learning, teaching and assessment which are associated with (but not necessarily causal to) demonstrated outcome improvement(s) e.g. increased student engagement or academic results. However, the author surmises the following as issues which need to be more richly investigated:

- Induction and training of facilitators is a complex process which can best be addressed using observational data obtained from standardised protocols. There is a long history of using these to assess teacher and student behaviours in classrooms. This type of fidelity testing using intercoder-reliability measurements would provide a more systematic description of actual in-class practices of PEGS facilitators.
- Student and staff expectations need to better understood and implicit assumptions, challenged. Some BIOL1015 teaching staff have expressed grave concern about the ability of tutors (including Honours students) to explain course concepts. These staff members make a clear role distinction between "lecturers" and "facilitators". Many students however, apparently expect facilitators to provide more didactic teaching around course content.
- What distinct groups of students can be defined within the BIOL1015 cohort? What are their distinct needs? How can teaching more effectively cater for these presumably, diverse needs?

7.2.4 UnIChe Activities at the University of Queensland

UnIChe is a collaboration between the chemistry & chemical engineering departments at the Universities of Queensland, Newcastle, Melbourne, the Australian National University and Australia's largest chemical manufacturer, Orica Ltd. It is a facilitated network of relationships between industry and academia, fostering the attraction to, and retention of, the most academically able students into the study of chemistry, chemical engineering, and at UQ, biotechnology.

The UnIChe scheme is a new model for industry-university interaction in Australia. It has a decentralised, informal and flexible structure, overseen by a paid coordinator and a management committee. UnIChe's resources include in-kind and cash contributions from the Federal Government and its university and industry participants. Funds are used to support undergraduate short courses, school liaison and recruiting, summer school and a research scholarship for undergraduates, field trips, PhD and Honours project scholarships and vacation work for students.

At UQ, the UnIChe program sponsors activities designed to introduce students to opportunities for research and employment in the chemical industry across Australia. Major activities include:

- Careers in Chemistry Lunchtime series. Guest speakers include past UQ students, current UQ research academics and Australian chemical industry representatives to relate their experiences in the chemical industry;
- UnIChe Winter Fieldtrip. Second year students travel to Newcastle for a two-day fieldtrip to visit industrial sites and network with career chemists and engineers. They meet scientists on-site and tour research laboratories, pilot plants, coal mines and industrial manufacturing plants;
- UnIChe Summer School. A two-week residential program that introduces third year students to the management of industrial chemical research and entrepreneurial activity. Based at the Australian National University and the University of Melbourne the visit includes industrial site visits, lectures and fieldwork; and
- UnIChe Summer Scholarships. A unique program that places first year students with mentors in University of Queensland laboratories for six weeks to experience research that is, for most students, the first research exposure of their careers. Some feedback from students is attached as an appendix.
- Monthly eNewsletter. Keeps students informed about UnIChe activities, chemistry information, chemical industry news, work experience opportunities and other chemistry relevant events at UQ.

7.3 Outreach Programs

The BACS, EPSA and SBS Faculties are involved in a large umber of outreach programs which aim to assist the learning experiences of primary and secondary schools and the broader community. A selection of programs are described in detail below. A short summary of all the outreach programs across the faculties can be found in Section 6 - Marketing and International.

7.3.1 UQ Science Ambassador Scheme

7.3.1.1 Background

The Faculties of Engineering, Physical Sciences and Architecture (EPSA), Biological and Chemical Sciences (BACS), and Natural Resources, Agriculture and Veterinary Science (NRAVS) host a range of different activities targeted at secondary school students. These programs include vacation schools and camps, days of excellence, campus and school visits and lecture series.

Traditionally, we have relied on teachers to promote interest in these events within their schools. Prior to 2001, throughout the school year, we embarked on numerous bulk mail-outs addressed to relevant teachers within the schools (e.g. Heads of Science) and hoped that the information was passed on to interested students. However, we believe that much of the information never filtered through to the school students because of the large volume of this type of mail that teachers receive. This has been supported by anecdotal evidence which has emerged during discussions with numerous teachers.

7.3.1.2 The Scheme

To enhance the effectiveness of the mail-outs, and to ensure a high level of awareness of our science-based activities amongst the school student population, we introduced *The University of Queensland Science Ambassador Scheme* in 2001, a pilot venture funded by EPSA, BACS and NRAVS.

The intended role of the Ambassadors and the anticipated benefits to the selected students and the participating schools are outlined below:

Role of the Ambassador:

- To act as a contact for our science programs within their school (in addition to the Head of Science and Subject Coordinators)
- To liaise with the Head of Science and Subject Coordinators to bring science and technology activities to the attention of fellow students and teaching staff
- To arrange for notices of activities to appear in the school newsletter
- To make announcements and report on activities at school assemblies
- To raise the profile of science and technology issues within their school

Benefits to the Student:

- Formal recognition of their interest and aptitude in science and technology
- Improve communication skills
- Develop networking skills
- Raise their awareness of science and technology issues

Benefits to the School:

- Strengthen links between the school and The University of Queensland
- Ensures school students have access to the programs offered by The University of Queensland
- Encourage student participation in university activities to help with the secondary – tertiary transition
- Raise the profile of science and technology within the school
- Participants in the Scheme

All secondary schools in northern New South Wales and Queensland were invited to participate – approximately 410 schools in total. The Science Ambassadors were year 11 students in 2001, each with an aptitude and a genuine interest in science and technology, selected by a teacher nomination process. In recognition of their selection, each UQ Science Ambassador received a blazer badge/pin, a certificate and a UQ T-shirt.

Table 7.2 Number of Ambassadors & Schools participating in the scheme to date

(Note that schools can nominate more than one ambassador – the school is charged $22 per additional ambassador. The first ambassador is free.)

Year	Number of Ambassadors participating	Number of Schools participating
2001	163	146
2002	255	219
2003	198	172
2004	192	157
2005	171	122
2006	229	152

Communication with the Ambassadors

Between six and seven different packages of information are sent to the ambassadors each year. In addition to this, students and teachers are emailed updates on a regular basis. Each mail-out contains an informative, personally addressed letter which outlines upcoming events, as well as a selection of inserts including UQ News, program prospectuses, the Infinity magazine and brochures supplied by the Office for Marketing & Communication (OMC).

Events promoted include:

- Experience Science
- UQ Open Days
- TSExpo
- Robocup
- Junior Physics Olympiad
- Biofutures
- Engineering Links
- National Science Week
- Engineering Week
- Siemens Science Experience
- National Youth Science Forum
- QUITS
- Mineral Venture
- STAQ Science Competition
- Frontiers in Science Lectures Series
- BrisScience Lecture Series

The UQ Student Science Ambassador Prize

Throughout the year, ambassadors are encouraged to keep us informed about what they were doing to promote science and UQ activities within their school. As a motivator, the most active ambassador receives recognition for their efforts by winning the UQ Science Ambassador Prize at the end of the year. Winners typically have written articles for their school paper, featured in local newspapers, started science clubs, designed and run extra activities during Science Week, regularly promoted upcoming science-related events via parade speeches and notice board announcements and even developed web sites featuring science content. Prize winners receive an engraved UQ pen and plaque.

Each year, eight UQ Science Ambassador Travel Scholarships worth $250.00 each are offered to assist ambassadors from rural areas attend UQ-related science camps in Brisbane.

Costs

Maintenance costs for the program are around $16,000 per annum. These costs cover printing and stationary, postage, T-shirts, badges, certificates, Ambassador prizes and scholarships, and casual salaries for students to pack the mail-out contents. Usually maintenance costs are shared between EPSA, BACS and NRAVS. Indirect costs of approximately $19,000 per annum cover the salary for the Coordinator of the scheme (50% of ½ time Academic A, including on-costs).

7.3.1.3 Outcomes

Typically between one-quarter and one-third of the student Science Ambassadors go on to enroll at UQ. Since the scheme began, there has been an increase in UQ science enrolments from: Brisbane, Darling Downs, Moreton, Mackay, Fitzroy, Far North, Wide Bay, and Northern Zones. It has not been determined whether these increased enrolments relate directly to the UQ Science Ambassador scheme. However, feedback[1] on the scheme is consistently extremely positive, with many comments along the lines of:

> *"A privilege and a pleasure"*
>
> *"Thankyou so much for this wonderful opportunity! It's great to see what's going on at UQ."*

Teachers have also informed us that the role has developed an aura of prestige, with their keenest and brightest students vying to be nominated as a science ambassador. Once teachers have experienced the benefits of the scheme, they tend to become strong supporters of it. We have had instances where teachers, upon being transferred to a new school that has not previously participated in the scheme, will introduce the scheme to that school. Thus the scheme has certainly fulfilled its primary objective: to ensure that UQ marketing materials reach their target. It is harder to ascertain whether the scheme has boosted UQ enrolments, but at the very least, feedback on the scheme is very positive and support for it amongst the schools remains high. Details of the scheme have not been published, mainly in an effort to keep the scheme exclusive to UQ.

7.3.2 Enrichment Studies in Chemistry and Biology

The Enrichment Studies program allows academically able students to study first-year university courses, in biology and chemistry, at school without the need to attend lectures on campus. The courses, Genetics & Evolution and General Chemistry are studied over Years 11 and 12 alongside the normal Senior Subjects.

The aims of the program are:

- To attract the brightest minds to UQ; to strengthen links between UQ and secondary schools by forming a network of schools and teachers closely allied with this University;
- To enrich the learning experience for very able students at senior high school;
- To provide professional development opportunities for upper secondary teachers of chemistry and biology so that there are advantages for all students over the long term; and
- To enhance students' learning experience during 1st year at UQ by providing students with the opportunity to broaden their degree or to take higher-level courses at an earlier stage.

Schools are strongly supported in the teaching of these University courses with the provision of course materials, professional development programs, and continuing assistance as requested. The way in which the program can be taught within schools is flexible to cater for the diversity of students as well as for schools outside SE Qld.

Practical work is conducted at UQ where the experience is identical to that of university students. This is a very important aspect of the program which allows students to experience life as a student at UQ first hand. Schools in regional Qld are able to come to UQ for a period of time to complete experiments. If this is not possible, alternative experiments sanctioned by the course coordinator are able to be completed at their school. Every effort is made to assist these schools in Cairns, Rockhampton, Townsville and Moranbah as well the schools closer to the University.

Examinations are conducted on the same day throughout Qld in November of Year 12. Assessment of all tasks is moderated by academic staff and Grades (1 - 7) are allocated by the course coordinator according to the same Assessment Criteria and Standards used for University students.

Students who choose not to sit for the examination still have the benefit of being involved in this program. This has been shown to be an important aspect of the program and provides excellent preparation for university study. To be eligible to gain credit, students are required to enrol at UQ in July of the year in which they will complete Year 12.

7.3.2.1 Benefits derived from the program

Benefits to UQ

- High achieving students are attracted to UQ. These are students most likely to continue postgraduate studies at UQ, which aligns with the University's strategic directions
- It is envisaged that students' enjoyment of the subject, as a result of this program, will influence their selection of subjects within their science degree
- Apart from the direct impact on students, a cohesive group of teachers closely allied with this Faculty is formed, which is in line with strategic objectives in the University's Strategic Plan
- The Faculty is seen in a positive and professional manner by teachers, students and parents. This also aligns with strategic objectives in the University's Strategic Plan
- Data from the first cohort of students in 2001 to the most recent in 2005 demonstrates the high achievement of students in the Enrichment Studies Program

Benefits to students

- Enjoy the challenge
- Enjoy the experience of being Uni students when they complete practical work on campus
- Good preparation for university study (regardless of whether or not students sit for the exam)
- Granted credit for CHEM1012/CHEM1020 and BIOL1011
- Can immediately study any subject for which this is a prerequisite
- Have the opportunity to broaden their degree or to take higher-level subjects at an earlier stage
- Successful completion of program is highly regarded for acceptance into the Advanced Study Program

Benefits to teachers

- Enjoy teaching motivated intelligent students, as well as the challenge involved
- Provides excellent professional development for teachers
- Seminars and workshops help to update teachers' knowledge

Benefits to Secondary Schools

- Provides a real program to cater for gifted students
- Expands educational opportunities
- Enhances the school's reputation

7.3.2.2 Outcomes

Results for courses completed at school

Since the introduction of the payment of a levy, the numbers of students sitting the exam has decreased but the results of those who do so have improved significantly.

The 2005 cohort in both Chemistry and Biology were especially able groups with a high percentage of students obtaining a grade of 5 or higher (Figures 7.6 and 7.7).

Figure 7.6 Outcomes for students taking the Chemistry exam in 2005

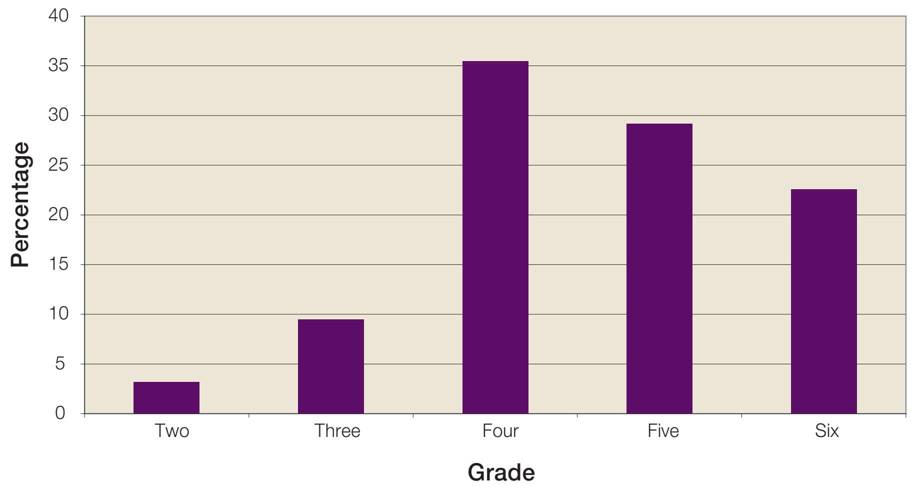
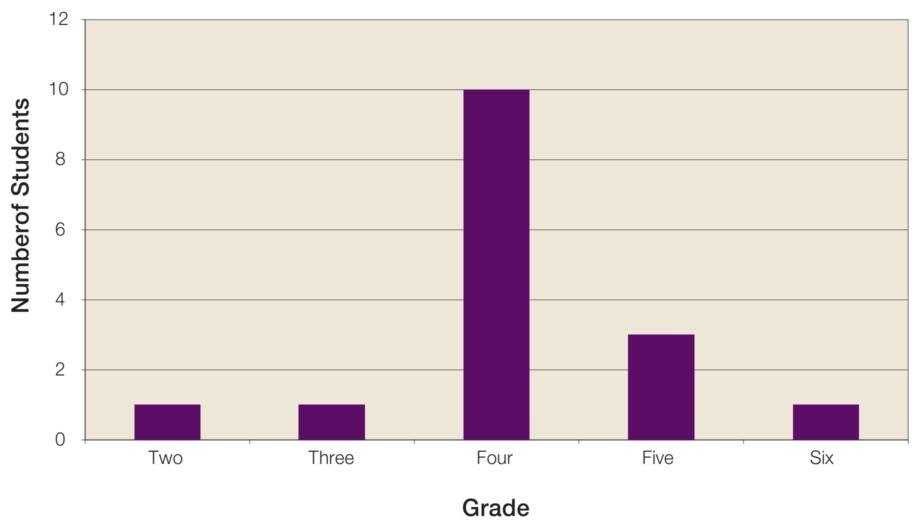


Figure 7.7 Outcomes for students taking the Biology exam in 2005



Student enrolments

Chemistry cohort

- Of the 58 students who sat for the chemistry exams in 2005, 34 students enrolled at UQ
- Of these students, 29 are in the BSc program or in science related programs
- Of the remaining students, 1 is in Law and 1 in Business Management

Biology Cohort

- Of the 16 students who sat for the biology exam in 2005, 6 enrolled at UQ
- Of these students, 5 are in the BSc program
- The remaining student is in the Arts program

Data is being collected for students who are involved in the Enrichment Program but do not complete the courses. These students are in the course purely as enrichment and not to claim credit. Instead they effectively 'repeat' the course at University (Table 7.3).

Table 7.3 Enrolments in enrichment in science program 2001 – 2005

Year	2001	2002	2003	2004	2005
Number of students who sat the exam	63	128	72	58	55
Percentage of students enrolled at UQ	73%	59%	52%	41%	62%
Percentage (Grades 5 – 7) enrolled at UQ	78%	86%	78%	62%	74%

7.3.2.3 Achievement at UQ

First year results for the 2004 cohort from last year showed that:

- 39% of students were awarded the Dean's commendation for high achievement
- 25% of students attained a GPA greater than 6.5 with 5% achieving a GPA of 7

7.3.2.4 Teachers

It is a requirement that teachers update their knowledge in order to teach the university courses and teachers have the opportunity to be involved in excellent professional development activities. This is an important aspect of the Enrichment Studies program with a long-term outcome. All students benefit, not only those directly involved in the program. Schools in the Enrichment Program are treated as a special group of schools and strong links have been made between them and the University.

7.3.3 Frontiers in Science Lecture Series

The Frontiers in Science program provides science teachers, as well as keen students with up to date information about the latest research in science. Professional development such as this is very important with the rapid advances in science across a broad range of fields. The long-term goal of the program is to increase scientific literacy in the community.

7.3.3.1 Outcomes

- This lecture series brings cutting-edge science to the classroom
- Approximately 150 teachers and students attend each session

- The program has the potential to reach an even larger number of students as teachers use the information in class
- Talks are topical and relevant to the curriculum
- Presenters are top UQ research scientists who are effective at communicating their excitement of science
- The supper break between lectures provides the opportunity to talk with scientists
- The usual format of two lectures with a supper break works well
- Some sessions may have a different format, for example, a debate style forum
- A network of teachers, who look forward to meeting at this event each month, has resulted
- Students attending for the first time continue to come regardless of the area

The lecture series is highly valued by teachers and students as a program which enables them to keep with up to date with the latest research in science. Many of the schools buy season tickets for the series each year. Feedback is always very positive:

> *Thanks for yet another great seminar! My students have come away full of enthusiasm as usual. Keep up the great effort!*
>
> *(A teacher from Brigidine College)*

> *Thank you once again for providing an informative and interesting series in 2004. We are lucky to be able to hear about current research at UQ - and I always use it with my classes.*
>
> *(A teacher from Wavell Heights SHS)*

> *Thanks again for another very successful lecture series this year. I have a group of students who love Frontiers and are already keen to go next year.*
>
> *(A teacher from St Josephs College, Gregory Terrace)*

UQ is fortunate to have such a large pool of research scientists to make this program so successful. Sessions are planned so that the two lectures within each program complement each other and are relevant to the curricula. The series is always held in the QBP Auditorium with supper in the foyer.

The highlight for 2006 will be the October session when Australian of the Year, Professor Ian Frazer will be a guest speaker. Professor David Hume, also an immunologist, will give the second talk.

A list of talks and speakers from 2002 to 2006 is shown below.

Table 7.4 Frontiers in Science Lectures 2002 - 2006

Date	Title	Presenter
Mar-02	Genomics and Bioinformatics	Professor John Mattick
	What gene does what? Linking Genomics with Reality	Professor Peter Gresshoff
Apr-02	Stem Cells & Tissue Engineering	Associate Professor Vic Nurcombe
	Tissue Engineering of Artificial Blood Vessels	Professor Julie Campbell
May-02	Biotechnology, Ethics and Public Policy	Professor Wayne Hall
	geneISSUES: Medical Miracle, Ethical Dilemmas	Ms Angela Wallace
Aug-02	Developing new drugs: what is the best approach?	Professor Peter Andrews; and
	Custom designing drugs	Associate Professor Jenny Martin; and
	Drugs from Nature	Dr Richard Lewis; and
	Combinatorial approach	Dr Mark Smythe

Date	Title	Presenter
Sep-02	Emerging Diseases	Professor John Mackenzie
	Bright Minds Launch	Dr Rita Colwell (NSF)
Oct-02	Going for Gold - a Hypothetical	Norman Swan
		Panel of experts
Feb-03	Dilemmas in Wildlife Management	Professor Gordon Grigg
	Decision Making and Biodiversity Conservation	Professor Hugh Possingham
Mar-03	The two edged sword of the immune system	Professor David Hume
	What genes gave me kidneys and why should I care?	Associate Professor Melissa Little
Apr-03	Genetic engineering of plants- what's here and what's coming	Associate Jimmy Botella
	Molecular Biology and Evolution	Associate Professor Steve Barker
May-03	New disease emergence- how, why and when?	Professor John Mackenzie
	People, parasites, pests and plagues	Associate Professor Peter O'Donoghue
Jun-03	Water to Hydrogen Fuel: A clean sustainable energy cycle coupled to pure water production	Dr Ben Hankamer
	Delivering the Hydrogen Economy: the fuel cell	Professor John Drennan
Aug-03	The Future of our Reefs (live video conference discussion)	
	Coral bleaching and coral disease: major threats to the future of our reefs	Associate Professor Bette Willis
	Little bugs, big impact	Associate Professor Ron Johnstone
	Can science save the dugong?	Professor Helene Marsh
	What has mathematics got to do with saving the Great Barrier Reef?	Professor Hugh Possingham
Sep-03	Biomedical engineering and fire hazards in reduced gravity environments	Dr Ted Steinberg
	Meanwhile, down at the blood farm	Associate Professor Lars Nielsen
Feb-04	NASA R&T programs for Space Transportation	Dr Charles E. Cockrell Jr
	HyShot soars into next phase	Professor Allan Paull
Mar-04	Nano-biotechnology: what's nano got to do with bio?	Professor Matt Trau
	A soft future?	Dr Paul Meredith
Apr-04	Is Brain Function Dependent on the Production of New Neurons?	Professor Perry Bartlett
	Studying Human Consciousness using Perceptual Rivalry	Professor Jack Pettigrew
May-04	Drigs from Venom	Professor Paul Alewood
	Designer Drugs	Associate Professor Jenny Martin
Jul-04	Cancer Genetics: where are we and where are we going?	Dr Georgia Chenevix-Trench
	Hot topics in medical ethics	Associate Professor Kim Summers
Aug-04	The impact of biotechnology on sustainability	Professor Peter Gresshoff
	Will land degradation be the sharp end of the Malthusian Principle?	Associate Professor Neal Menzies
Oct-04	Dissection insulin secretion in 3D	Dr Brad Marsh
	Computation and the transformation of science	Dr Lindsay Hood
Feb-05	Plants, petrol, genes and the Future of Humanity	Professor Robert Birch
	Response: What does Mathematics have to do with the Future of Humanity?	Professor Hugh Possingham

Date	Title	Presenter
Mar-05	Colloids in Nanobiotechnology: How Colloids are used in Biotechnology Devices and Tissue Engineering	Dr Gwen Lawrie and Dr Kevin Jack
	Materials for Life: Bone Biomaterials	Dr Lisbeth Grondahl
Apr-05	Bacterial Biofilms: a cause of persistent infections	Dr Mark Schembri
	Parasites – Perspectives on unpopular passengers	Associate Professor Tom Cribb
May-05	Why Australia needs Megascale facilities to study Nanoscale objects	Associate Professor Ian Gentle
	Living Polymers	Dr Michael Monteiro
Jul-05	The Nature, Timing, and Causes of Global Coral Reef Decline	Dr John Pandolfi
	The making of a sea shell: identification of genes encoding strong and beautiful calcareous architectures	Associate Professor Bernie Degnan
Aug-05	Tracking the origin of volcanic eruptions from Greek mythology to modern chemistry	Dr Kurt Knesel
	When did Homo become sapient?	Dr Tom Loy
Oct-05	Underwater Chemistry	Professor Mary Marson
	Photobiology of Reef Building Corals	Dr Sophie Dove
Feb-06	Using stem cell biology to bioengineer new blood vessels	Professor Julie Campbell
	New approaches to tackling the wound care challenge	Associate Professor Zee Upton
Mar-06	Searching for Genes that Fit: the genetics of human epilepsy	Dr Robyn Wallace
	The importance of making new nerve cells for a healthy brain	Professor Perry Bartlett
Apr-06	From the SunShark to the UltraCommuter: A Solar Powered Sports Coupe Vehicle	Dr Geoff Walker
	Ocean Waves: A Source of Energy and a Source of Trouble	Associate Profressor Peter Nielsen
May-06	Human Cloning our Way to National Happiness	Associate Professor Ian Godwin
	Sustainable Health Management in Aquaculture	Dr Andrew Barnes
Jul-06	Dark energy and sound waves from the early Universe	Associate Professor Michael Drinkwater
	Cosmic Random Numbers	Dr Michael Bulmer

7.3.4 The Scientist in Residence Program 2006

7.3.4.1 Introduction

The Scientist in Residence Program supports and encourages science learning in schools through the formation of partnerships between teachers and University of Queensland science students. Together the teacher/UQ young scientist team develops a plan tailored to the individual teacher's needs and the special interests and skills of the young scientist. The young scientist visits the class weekly, guiding the students in hands-on activities, experiments, and research projects.

7.3.4.2 Aims of the Scientist-in-Residence Program

The aims of the Scientist-in-Residence Program are to:

- Support and Encourage Primary teachers in the teaching of science
- Provide primary students with positive experiences in science
- Provide positive role models of scientists to schools

- Enhance links between The University of Queensland and local communities
- Provide university students with an opportunity to broaden their perspectives on science, share their knowledge, and develop their communication and interpersonal skills.

Table 7.5 Schools currently Involved in the Scientist-in-Residence Program and their scientists

Funding	School	Scientist	Area of Study
ASISTM 1	Fig Tree Pocket SS	Stacey Cole	PhD (Neuroscience)
		Anna Denman	BSc/BE
	Upper Brookfield SS	Gen Mortimer	BSc/BE
		Amy Smith	BSc/BE
	Chapel Hill SS	Miriam Sullivan	BSc
		Andrew Wight	BSc/BJ
	Pullenvale SS	John Woodford	BSc
		Vivian Shek	PhD (Info Tech)
	Sherwood SS	Anna Denman	BSc/BE
		Dan Craig	BSc/Bed
ASISTM 2	Nudgee Jnr College	Lorine Wilkinson	Post Doc IMB
		Gwen David	BSc
	Holland Park SS	Leonie Butler	BSc/BEd
		Richard Brackin	BSc
	Holy Family School	Matthew Josiah	BSc
		Aimee Wilson	BSc/BJ
	Inala SS	Emily Rickman	BSc
		Mattthew Deady	BSc/BE
	Oxley SS	Louise Hudson	BSc
		Emily McConochie	BSc/BA
HEESP	Richlands East SS	Jacinta Peebles	BSc/Bed
		Richard Brackin	BSc
	Inala West SS	Tu Pham	MBBS
		Brian Green	PhD
	Glenala SHS	Emily Rickman	BSc
		Jay Nicholson	PhD (Medical Entomology)
	Carole Park SS	Brian Green	PhD
		Mirjana Tokovic	BSc
	Serviceton South SS	Nicky Tan	BPharm
		Jessica Stonier	BSc/Bed
Independent	Marshall Road SS	Meggie Voogt	BSc
	Junction Park SS	Ashley Skilleter	BSc
	Wellers Hill SS	Rebecca Harth	BSc
		Alfred Phillips	BSc
	Holland Park SHS	Dan Craig	BSc/Bed
	Indooroopilly ASC	Dana Bradford	PhD (Neuroscience)

7.3.4.3 Outcomes

Since the program's recommencement in late 2005, all of the aims of the program have been demonstrated.

Support and Encourage Primary teachers in the teaching of science

- Surveys of 17 teachers involved in the program find that 100% of teachers found the Scientist in Residence Program to be worthwhile.
- Approx 76% of teachers surveyed said that the program increased their confidence in teaching science.
- Approx 82% of teachers surveyed indicated that the program increased their enjoyment of teaching science.

Provide primary students with positive experiences in science

- Regular e-mail feedback from the Scientist in Residence and teacher to the coordinator illustrates the positive experiences that have been brought to the classrooms.

Provide positive role models of scientists to schools

- From the teacher surveys "The girls saw her (our real scientist) as a role model".

Enhance links between The University of Queensland and local communities

- I regularly receive phone calls and e-mails from the schools involved. In addition, schools have been talking and I have provided activities and ideas to other local schools.

Provide university students with an opportunity to broaden their perspectives on science, share their knowledge, and develop their communication and interpersonal skills.

- On a recent Scientist in Residence Survey, students indicated that they had gained/learned the following: "think creatively", "how to explain science in very basic terms", "thinking on my feet", "patience", "a better understanding of how to communicate science", "enhanced communication skills".

7.3.5 Engineering and Physical Sciences' Outreach

7.3.5.1 Centre for Microscopy and Microanalysis (CMM)

The CMM has a wide range of instrumentation used for research and the support of research in the physical, biological and engineering sciences. These include transmission electron microscopes with near atomic scale resolution of the crystal structure of materials through to scanning electron microscopes used to examine the surface structure and morphology of samples at the scale of micrometres to millimeters. Staff will discuss the applications and research uses of this instrumentation with visiting groups.

- **Cyberstem:** A CMM program where schools can connect directly with the centre and see microscope images live on their computers. Students can converse directly with the operator.

7.3.5.2 Earth Sciences Museum

Run jointly by the University and the Queensland Museum and holds the largest University-based collection of fossils, rocks, minerals and microfossils in Australia. The fossil collection comprises material documenting the fossil heritage of Queensland and contains significant comparative collections from around the globe. Particular strengths lie in Palaeozoic corals, brachiopods and trilobites. The rock collections form the core of the geological research record for the University and comprise lithological, sedimentological and mineralogical specimens of economic and geological importance to the State. The mineral and rock collections contain ore body material from world class mining provinces such as Mount Isa. The Museum houses displays on the geology of Brisbane, fossils and minerals from around the world. The Museum also houses guest displays by the Cosmological Association of Queensland and the Queensland Chapter of the Mineralogical Society of Australia.

7.3.5.3 Other Laboratories

- **Fluids Laboratory:** Provides hands on exposure to the principles of fluid mechanics and their practical application in Civil Engineering (waterwaves, river flows, culverts, weirs, pipe flow). Water rockets are shown as an example of "recreational fluid mechanics", i.e. how you can have fun with fluid mechanics.
- **Environmental Wind Tunnel:** Go for a ride in a large wind tunnel and learn about the wind and its effects on buildings and people.
- **Structures Laboratory:** Students see a demonstration of the strength of structural materials (steel/concrete). Staff members will discuss the implications of structural strength and material selection for the design of structures.
- **Shock Tunnel Laboratory:** Contains high speed wind tunnels used to investigate scram jet and re-entry aerodynamics for space vehicles designed for interplanetary travel. Tours for schools.
- **Phenomena in Microgravity Laboratory:** Contains a drop tower capable of producing two seconds of high quality reduced gravity. Experiments conducted using the drop tower benefit spaceflight research and industries ranging from materials manufacture and chemical processing to propulsion sciences. Demonstrations of the drop tower facility can be given off campus.
- **GIS and Remote Sensing Laboratory:** The session offers hands-on experience in the basics and expanding applications of geographical information systems and remote sensing.

7.3.5.4 MAD Fun and Games (Manufacturing and Design)

Using a well known modular manufacturing system (LEGO), students are involved in the design and manufacture of machines that are required to perform different tasks. It develops their understanding of design, manufacturing and engineering in general, as well as such skills as teamwork and communication. It gives them hands on experience with kinematics and dynamic in a fun environment.

7.3.5.5 Mining

- **Mining 1 – Tour of the Underground Mine:** This program includes a demonstration of the main components of an underground mine system. It includes discussion on the role of a mining engineering the successful operation of an underground mine, and examples of the duties of an engineer (for example, monitoring airflows)
- **University Mine Open Day:** (Division of Mining and Minerals Process Engineering). Come to the Annual Mine Open Day (held on the Labour Day weekend each year) and visit the underground workings, watch the students battle it out in the Annual Student Mining Competition, pan for gold and more.
- **Mining 2 – Research in the field of Mining Engineering:** Students can see a demonstration of research areas in mining engineering. Examples include strength testing of rock and simulation of large excavation equipment (dragline).

- **Minerals Process Engineering:** a demonstration of size reduction and mineral separation processes: particle crushing using jaw crusher, ball mill demonstration, mineral separation using hydrocyclone, jig and flotation cell.

7.3.5.6 Robotics

- **RoboCup Junior Competition:** The RoboCup Junior National Competition, held in September at The University of Queensland, is the culmination of student involvement in the RoboCup Junior project throughout Australia. The competition has three robot building challenges – Soccer, Rescue and Dance – which are structured to account for age differences and abilities.
- **Robotics Laboratory:** The Robotics Laboratory is involved in cutting edge research in mobile robot technology and school visitors can interact directly with the robots of the future.

7.3.5.7 Information Technology and Electrical Engineering

- **Biomedical Engineering Laboratory:** A visit to the Biomedical Engineering laboratory in The School of ITEE at UQ will allow students to gain hands-on experience. Students can measure the signals from their heart (electrocardiogram) the oxygen content of their blood (pulse oximetry) and make images of some of their internal organs using an ultrasound imaging machine.
- **Sustainable Energy Research Group (SERG) Laboratory:** The Sustainable Energy Research Group laboratory in The School of ITEE at UQ is exploring more sustainable ways to generate and utilise energy. We research in Photovoltaics (solar cells) and wind generation, the use of fuel cells, and improving passenger transport from bicycles to buses.

7.3.5.8 Computers that can see you

Come and see our real-time face recognition system. See if the computer can recognise you and say your name. Similar SMARTGATE face recognition systems are now being installed at Australian airports to deter criminals. Check out the cricket analysis system that can measure the spin on a ball and determine LBW decisions. Fly over the UQ campus with interactive virtual tours.

7.3.5.9 Light and Laser

- **Science in Action Laboratory:** A hands-on demonstration laboratory where students are introduced to the properties and applications of laser light. Demonstrations and experiments from other areas of the physical sciences to suit curriculum needs can be arranged by consulting with the program coordinators. For large school groups where visits to the University are not feasible, a Science in Action theatre-style presentation within the school can be arranged.
- **Optical Tweezers Laboratory:** A hands-on laboratory where students are able to manipulate microscopic particles using light. This elegant and new technique has diverse applications including studies in biological and medical fields, and it demonstrates many physical phenomena, including momentum transfer and principles involving optics and light.

7.3.5.10 Physics Museum

The Physics Museum houses optical, electrical, acoustical and many other scientific instruments and devices dating back to the origin of the University of Queensland in 1911and beyond. Most of the items on display are of interest because they illustrate principles of physics and because of the craftsmanship involved in their making. Activity sheets for school groups are available.

7.3.5.11 Mathematics

Mathematics invites school groups to participate in workshops on a variety of topics including: Mathematics in science: population biology and epidemics; modelling in cell biology; simulation of complex natural systems (flocking, hive behaviour); the dynamics of particles, from atoms to planets. Mathematical concepts: exponentiation and doubling; symmetry; density, mass and centre of mass; shapes and surfaces; optimisation. Mathematics in the arts and entertainment: probability and game shows; the statistics of Shakespeare; complex systems and movie magic. Teachers are invited to discuss other possible topics, and workshops can also be arranged to suit curriculum requirements. Workshops are available both on- and off-campus

7.3.7.12 Public Lectures

- **Tools of Science:** Public lectures on scientific instruments and technology, called Tools of Science, is open to the public. They take place monthly, March to November, a
- **Teachers In-service Education:** A number of in-service training talks or short courses are available. Geographical information systems and town planning have been popular offerings.

[1] *Feedback is obtained by two methods:*
- *Informal feedback through discussions with students and teachers throughout the year*
- *Ambassadors and participating teachers are surveyed at the end of each year.*

Section 8

Graduate Destinations

8.1 Overview

As previously mentioned in Section 5, the National Graduate Destination Survey (GDS) is conducted on April 30 each year and results are compiled by each Institute and sent to the Graduate Careers Council of Australia (GCCA) for analysis. The survey is conducted in the year following students' graduation. For example, 2003 graduates are assessed in April 2004 and the results published late in 2004, after a reasonable response time. Thus, each survey examines the graduate destinations approximately 6 months after graduation. The analysis presented here has been restricted to Pass and Honours graduates of the BSc program and as such does not include data on graduates from dual undergraduate degrees. Additional GDS data has been presented in Section 5.

Approximately 60% of respondents in either the BSc or BSc (Hons) program continue on into full time study after graduation (Table 8.1). About one-fifth of respondents with a BSc qualification are seeking full time employment at the time of the survey. This is slightly higher for respondents with a BSc (Hons) degree (30%). About 14% of respondents with a BSc degree are in full time work while this is significantly higher for BSc (Hons) graduates (23%). Part of this difference may be due to the higher proportion of BSc remaining in full-time study.

Table 8.1 Graduate destinations 2001 – 2004 (National Data)

Program	Graduation year	Number of Graduates	Total number of respondents	% Respondants in full time study	% Respondants available for full time work	% Respondants in full time work
BSc	2001	609	609	53%	19%	13%
	2002	586	586	55%	20%	11%
	2003	473	354	73%	24%	16%
	2004	526	362	74%	24%	16%
	Mean			64%	22%	14%
BSc (Hons)	2001	201	201	43%	22%	18%
	2002	219	219	47%	26%	20%
	2003	206	120	77%	31%	25%
	2004	200	113	61%	39%	27%
	Mean			57%	30%	23%

8.2 Occupational Trends

The data from the NGDS survey for the 2001 to 2004 graduates in BSc and BSc (Hons) was compiled into 11 broad categories (Table 8.2). In most cases the percentage distribution of occupations within each degree program was very similar across the four years. The five principal areas of employment for BSc graduates are Professions; Hospitality; Education/Childcare; Science; and Retail/Sales/Customer Service, which together account for 74% of all graduate destinations. Of note is that only 18% of BSc graduates were employed in jobs directly related to Science (Science and IT).

There is an interesting shift in employment dynamics for BSc (Hons) graduates. While 80% of Honours graduates find employment within the same 5 principal areas as for the Pass graduates, 66% of the Honours graduates are employed solely in Science and Education/Childcare. The largest shift is for jobs in Science, which increased from 18% for Pass graduates to 46% for Honours graduates.

The Australian Council of Deans of Science 2000 report on employment outcomes from 6 Australian Universities indicated that 50% of BSc (Hons) graduates end up in Science-related jobs. This data indicates that the employment outcomes for University of Queensland graduates, at least within 6 months of graduation, are consistent with national trends.

In summary, about 60% of either BSc or BSc (Hons) graduates continue on to further full-time study in the year following their graduation. Of those BSc graduates who are employed in the year after graduation, 18% are in Science-related jobs. Of those BSc (Hons) graduates who are employed in the year after graduation, 46% are in Science-related jobs.

Table 8.2 Graduate occupations

	BSc				
Occupation	**2001**	**2002**	**2003**	**2004**	**Mean**
Administration	7%	8%	5%	7%	7%
Hospitality	8%	12%	14%	17%	13%
Education, childcare	17%	13%	12%	15%	14%
Healthcare	7%	3%	6%	9%	6%
IT	3%	4%	1%	3%	3%
Managerial	4%	3%	3%	4%	4%
Professions*	9%	16%	9%	6%	10%
Retail, Sales, customer services	21%	20%	25%	23%	22%
Science	17%	12%	21%	11%	15%
Trade, Services	3%	3%	5%	1%	3%
Other	4%	5%	1%	5%	4%

	BSc (Hons)				
Occupation	**2001**	**2002**	**2003**	**2004**	**Mean**
Administration	9%	7%	9%	4%	7%
Hospitality	0%	1%	2%	4%	2%
Education, childcare	24%	23%	14%	20%	20%
Healthcare	5%	3%	2%	6%	4%
IT	0%	0%	0%	0%	0%
Managerial	2%	0%	7%	4%	3%
Professions*	3%	3%	2%	8%	4%
Retail, Sales, customer services	5%	12%	7%	8%	8%
Science	50%	49%	49%	37%	46%
Trade, Services	0%	0%	5%	2%	2%
Other	5%	3%	2%	6%	4%

** includes consultants, accountancy/finance-related jobs, engineers, insurance, librarians*

8.3 What do Employers Want from Graduates?

In 2000 the Australian Council of Deans (ACDS) published a report on the study of employment outcomes for Science graduates in the period 1990-2000 (McInnis et al., 2000). Of the employers consulted in this large study there was general agreement that they looking for the following generic skills:

- Decision makers
- Communication skills
- Team work skills
- Interpersonal skills
- Project management minded
- Problem solving skills
- Technical skills
- Creativity

Similar desirable attributes of graduates have emerged from numerous subsequent studies and reports from various organisations. In 2000, the Commonwealth Department of Education, Training and Youth Affairs released a report on "Employer satisfaction with graduate skills"(Nielson, 2000). Again, academic achievement, computer skills, management skills, oral communication, interpersonal skills, team-working, problem solving skills, creativity and enthusiasm, among others were considered important. Similar conclusions were reached in 2004 by the Commonwealth funded report on the "Learning outcomes and curriculum development in Biotechnology" (Gray et al., 2004) and the reports from the Business Council of Australia entitled "New concepts in innovation" and "Changing paradigms" (Howard, 2006), which was published in 2006. The current UQ BSc. (Hons) examination process clearly assesses each of these attributes within specific contexts (see Section 10 of this document).

8.4 Development of a BSc Alumni or Network

University of Queensland has come to the stage of maturity that requires a commitment to developing a comprehensive alumni. While the three Faculties responsible for the BSc. have made an attempt at doing this, more could be done. Currently the Marketing Manager in BACS is able to capture some data from science students upon finishing their degree. Students are asked to fill in a questionnaire about their current employment status. They are also asked to be part of the BACS Faculty Alumni. However, this information is not always conclusive. Not every science student completes the forms and more often than not contact is lost with the student altogether. It is acknowledged that there is a need to commit significant resources to ensure that a more effective structure is put in place for maintaining contact with the B.Sc. and B.Sc. (Hons) graduates and following their career paths. The University of Queensland is acknowledging this need and has put in place a committee to address university wide alumni initiatives. As part of this initiative, the BACS Faculty has just finished preparing its first Alumni Engagement Plan which will be implemented and developed over the next 5 years (see Appendix 8 for details).

In addition to this, the following recommendations from the Honours and Careers Working Party should also be considered:

- allocating a free e-mail address for up to ten years after graduation;
- establishing a pass-word protected website for alumni, where they could exchange news and information about their careers;
- on-going library access (for a set period of time e.g. up to 5 years after graduation)

- sending regular e-mails asking graduates to update their career progress and encouraging them to visit the UQ website and make use of UQ resources
- establishing a reunion program where graduates from particular eras are invited to a reunion weekend which might feature lectures from well known peers as well as a number of sponsored social events.

The advantage of a follow-up program is that it provides a database of career outcomes, which will be essential when advising students about career paths and possibilities. It also encourages students to regard the university as a partner in their career which can lead to high achieving students accepting jobs at the university and promoting the benefits of a UQ BSc. elsewhere. If the feeling of a "sense of community" is successfully established among BSc students, they will value the chance to continue to contact their peers and mentors, and it is important that procedures are put in place to facilitate this. To date, the BACS Faculty and Brightminds have attempted to pursue this line of contact and collected career/employment profiles on a number of graduates, in widely different fields, and complied two publications which are distributed to secondary and tertiary students (Supplementary documents: (i) Brightminds – Careers that Started in Science and (ii) BACS – Careers that Started in Science). The disadvantage is the cost of establishing and maintaining the structures necessary to keep in contact with ex-students. Any web-based system will need significant start-up resources and maintenance investment to ensure the privacy of graduates is not compromised.

8.5 References

McInnis, C., Hartley, R. and Anderson, M. (2000) What did you do with your Science Degree? A national study of employment outcomes for Science degree holders 1990-2000. A report prepared for the Australian Council of Deans of Science. http://www.acds.edu.au/

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Gray, P., Barnard, R., Franco, C., Youngm F., Hine, D. and Rifkin, W. (2004) Learning outcomes and curriculum development in biotechnology. Stage 2: Dissemination of best practice. Commissioned by the Australian Universities Teaching Committee, Department of Education, Science and Training. http://www.autc.gov.au/projects/completed/comp_learning_outcomes_dev_biotech.htm

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Section 9

Stakeholder Consultation

9.1 Position Papers from Schools that Teach into The BSc

9.1.1 School of Biomedical Sciences (SBMS)

UQ is a leader in research and teaching in the biomedical sciences and there is a clear increase in the numbers of students wanting to study biomedical science as a professional outcome. However, we face new challenges due to commercialisation of tertiary education, the rapid rate of progress in the sciences, globalisation, pluralism in our society and the diversity and expectations of students. In order to maintain our leadership position we must therefore renew the processes by which we select, sequence, organise and structure the knowledge, resources and activities that constitute the learning experience in biomedical science.

We as a faculty represent one of the few truly research-intensive teaching institutions where our ongoing excellence in creating new knowledge is translated to our students through our teaching. Our excellence in research is reflected in our innovative teaching programs and commitment to excellence in teaching.

The new curriculum must align with and be informed by the graduate attributes for the BSc and those developed for specific majors in the review process, to provide in-depth disciplinary knowledge and skills, intellectual challenge, critical judgement, independence and creativity, and social and ethical understanding. The curriculum must also have defined scope and sequence by which knowledge and skills are progressively developed.

The approximately 700 first year science students who enter the SBMS teaching and learning program each year via human biology (BIOL1015) can be divided into 3 main cohorts:

1. Those with no specific career focus but with an interest in a broad-based science education;
2. Those wishing to enter professional courses, eg Medicine, Therapies and Pharmacy;
3. Those who passionately aim to pursue a career in the biomedical sciences.

At the end of their undergraduate studies, those who find employment do so in either the professions or as researchers or in more commercial aspects of industry. An innovative curriculum that engages students in science in a sustained manner will prepare the students better for these career destinations and also resolve key issues of attrition.

9.1.1.1 Challenges

Despite our past success and the general levels of student satisfaction, we recognise that to maintain our leadership position we must address key challenges as listed below:

1. To formulate the new BSc curriculum in terms of the entry and exit levels by:
   - facilitating an effective transition from Year 12 to first year
   - identifying the necessary skills that students must possess upon exit from the BSc and progression into their chosen career paths.

2. To ensure that the development and refinement ideologies that drive the review and its implementation are equitable and involve the practitioners at all levels.
3. To align the curriculum of the core enabling sciences with the essential elements of biology for all first year students to provide a sound foundation for study in years 2 and 3.
4. To continue to address and better meet the needs of the three identified cohorts of students and to cater for high achiever students who specifically seek careers in biomedical science.
5. To address biocomplexity by developing a curriculum that reflects the increasingly interdisciplinary nature of biomedical science.
6. To address the specific communication needs of students relevant to their disciplines.
7. To immerse science students in the UQ research culture from Year One as active participants.
8. To develop educational practices, using new content delivery and assessment modes, that foster deeper learning in the setting of the large numbers in our student cohorts.
9. To enhance the skill base and employability of graduates by increasing practical competencies relevant to career outcomes and including other aspects relevant to the more commercial avenues of science.
10. To develop inclusive strategies to capitalise on the increasing diversity provided by the large size of the student cohorts in terms of their backgrounds, skills and levels of expectation.

9.1.1.2 Implementation strategies

It is proposed that the following strategies will form the nucleus of our curriculum review based on the challenges that we have identified:

1. Develop ongoing interactions with schools, employer bodies and other stakeholders in Australia and internationally to assist in formulating key outcomes of the curriculum review and its ongoing implementation.
2. Establish school and faculty-based teaching interest groups to facilitate the sharing of new knowledge relevant to educational practice in the science teaching and learning program. Obtain quality feedback from present and recent past students using diverse survey modes.
3. Introduce relevant compulsory courses in first year in the enabling physical sciences (in areas such as physics, statistics, calculus), chemistry and biology (plant, animal and microbial cell biology; genetics; biological chemistry). Include higher level study of some areas of the enabling sciences in the development of the curriculum for particular majors.
4. Introduce a BBiomSci degree program to cater for the cohort of high achieving students who are passionate about a career in the biomedical sciences. Consider the diversity of possible career paths of the other cohorts in the focus of courses in the BSc.
5. Define key majors within our programs with an emphasis on majors that promote interdisciplinary study across schools in BACS and other UQ faculties.
6. Include explicit teaching of communication skills as part of an integrated approach to teaching professional genres in a clearly developed sequence throughout the program.
7. Provide a visible presence for UQ research staff from the schools and institutes at all levels of the undergraduate experience to forge more direct links between research and coursework.
8. Establish and foster extended learning communities through collaborative learning to improve students' depth of learning. Promote enquiry based learning using a framework that recognises quality resources and delivery modes for higher education.

9. Provide resources and infrastructure to support deeper engagement in practical/ competency skills with appropriate assessment. Introduce key elements of information technology, intellectual property management and business principles into the curriculum where relevant.
10. Implement an appropriate variety of inclusive and equitable teaching strategies that utilise multiple modes of delivery, resources and assessment. Promote a variety of opportunities for student engagement in international learning communities.

9.1.1.3 Key components of the curriculum review process

The curriculum review process must be carefully structured and informed by principled scholarship. This means that we must:

- Recognise that curriculum, pedagogy and assessment are three integral elements of curriculum renewal.
- Address the diverse needs of students by inclusive educational processes.
- Define the ideas and ideologies that form the foundations of our teaching outcomes, such that theories of learning inform changes in our teaching practice. This should be done in the context of learning communities at both the academic and student level.
- Capitalise on the synergy between online and other learning modes and embed these strategies in the curriculum from year one.
- Recognise that for the revised curriculum to remain relevant for the next 10-15 years, it must have an inherently dynamic structure to allow it to adapt to changing requirements.

9.1.2 School of Integrative Biology (SIB)

9.1.2.1 Attributes and skills of BSc graduates

1. All BSc students must be exposed to hands-on practical content throughout their BSc. Depending on the discipline, this would involve laboratory work, field work, computational work and problem solving. It is critical that practical skills are not solely taught by some form of computer simulation.
2. Written language skills need to be developed for all science students throughout the BSc. This development will include writing scientific reports and critical essays.
3. Science students need a thorough understanding of what constitutes science and what is not science, through exposure to scientific methods and the philosophy of science.
4. All BSc students need appropriate mathematical and computational skills. For biologists, these necessary skills are not restricted to “statistics”.
5. Students need to develop skills in oral presentation of information throughout the BSc.

9.1.2.2 Structure and content of the BSc

1. Evolution by natural selection is the central theory of biological science. All biological science graduates must have a good understanding of it.
2. The BSc should be based around the strong research culture at UQ, from first year onwards.
3. Appropriate assessment methods are keys to a successful BSc program. Current assessment practices overemphasize recall of disconnected facts. Assessment needs to move more towards assessment of the ability to write coherently, critical analysis, problem solving and integration and synthesis of ideas from disparate sources.

4. Students should be able to retain a substantial amount of flexibility about future options in first year. In particular, they should be able to have access to most third year options in at least three broad major study areas at the end of their first year (ie three of biology, chemistry, mathematics, physics, geographical sciences, computer science etc.). Specialisation into potential career sub-streams (pre-medical, marine, plant biotechnology, forensics) in first year is highly undesirable and career limiting for essentially all students. It should not be encouraged through suggested course combinations that exclude major areas of biology in first year.
5. All students taking biology in first year should have a comprehensive education in the full range of biological science, from genetics and molecular biology through to ecology, and across animals (including, but not restricted to humans), plants and microbes.
6. Biological science students need better access to relevant physics and mathematics in first level. Similarly, physical science students would benefit from improved access to biological science courses
7. Linkages between different courses need to be improved through reinstatement of appropriate prerequisites and inclusion of key 1st and 2nd level courses in lists defining majors.
8. Second level courses need to build the basis for specialisation in third level, but need to be designed so that they do not unnecessarily limit options for further study. More collaboration between schools in second level courses is essential.
9. There should be sufficient 3rd year course choices to enable students to undertake intensive and comprehensive study within their chosen major and third year courses should be particularly strongly based on the university's research culture.
10. BSc honours should continue to be focussed on research training. Whether additional coursework should be incorporated and the extent to which the amount of coursework should be standardised across disciplines or majors needs to be considered carefully.
11. The current structure of the timetable, with weekly contact hours throughout the semester constrains innovative intensive teaching and field work. The possibility of restructuring the timetable to provide more opportunities for courses to be taught intensively over one or two weeks needs to be considered.

9.1.2.3 Background of students

1. Currently, the BSc has year 12 prerequisites of maths B and either chemistry or physics. It is anomalous that biology is not an alternative to chemistry or physics, particularly as most BSc students are biologists. First year biology should presume Year 12 school biology, with a catch up remedial course (as is the case for maths, physics and chemistry) for students without that background.
2. The BSc curriculum should be better able to handle and extend exceptionally able students.

9.1.2.4 Process for the BSc review

1. Development of a new curriculum should be driven by the schools and centres.
2. The development of majors should form the framework for the new curriculum.
3. Student opinion should be collected via properly structured focus groups, in addition to Ceval.
4. Input from major BSc employers is important.
5. Input is also needed from secondary school teachers, particularly on better handling of the school/first year transition.
6. It will be necessary to also review the named 4 year degrees (BEnvSci, BBiotech, BMarSt)

7. External input to the review is essential. It is also important we include a review of the way in which the leading institutions against which we benchmark structure their BSc curricula. One good source of information is the Boyer Commission Report http://naples.cc.sunysb.edu/Pres/boyer.nsf/

9.1.3 School of Molecular and Microbial Sciences (SMMS)

The review of the BSc to be conducted by the university in 2006 provides the faculty with a unique opportunity to address a number of perceived shortcomings in the current curriculum. We in the faculty should be justifiably proud of the quality of both our teaching program and our graduates, however there is general consensus that:

- Our course offerings may be too extensive, providing too much choice for students often resulting in poor development and integration of fundamental skills
- The majority of our students do not gain a sufficiently solid grounding in the enabling sciences, particularly chemistry, mathematics and physics
- As a consequence of limited coordination between the schools there is some overlap in, and therefore repetition of, course content
- Ever increasing student numbers has meant that exposure to quality hands-on practical experience has suffered. We need to formulate new approaches that will allow us to provide this essential training more effectively
- Specialization too early in some areas results in many students graduating with degrees that may be too narrowly focused. We need to provide a more considered path to fields of study/majors that delivers a curriculum that equips our graduates with the comprehensive skills necessary to succeed in their chosen career path.

This position paper highlights some of the strategies our School considers should form part of the review process.

9.1.3.1 First level recommendations

1. 1st level biology should comprise a comprehensive presentation of the science at all of its levels of organization; from molecules through cells to organisms and populations. Comparative biology approaches provide the ideal foundation on which to build subsequent specializations in our faculty.
2. Consideration should therefore be given to reducing the number of current 1st level biology courses to establish a “core” biology that would introduce students to the ‘enabling biological sciences’ such as biochemistry & molecular biology, genetics, physiology, evolutionary biology and ecology. Our view is consistent with the findings of the recent external review of SMMS which suggested no more than three 1st level biology courses under the current UQ system.
3. In view of the strong demand for biomedical sciences, the possibility of an additional non-core human biology course could be considered but this course should be an option in addition to a core 1st level biology curriculum.
4. 1st level chemistry should be recognized as a key enabling science for biology students and should be assigned 2 courses within a new core curriculum.
5. Although provision of biologically-relevant examples in chemistry should be encouraged, the 1st level chemistry curriculum should not be altered to incorporate biochemistry.
6. The highly successful PASS program should be further resourced with additional tutors and increased formal training. Seamless integration with online resources and delivery support should also be developed. Given the success of the program consideration could be given to extending the program into selected courses in 2nd level.

7. The increasing prominence of biology as an information science should be recognized in a new curriculum. This will require a new 1st level course in mathematics and statistics that equips students with the skills to deal with large data sets, combinatorial and computer-based modelling approaches.
8. The pivotal importance of sciences outside of biology should be recognized and a curriculum should be developed which allows students to excel in the chemical, mathematical and physical sciences.
9. Students should be aware of the history and philosophy of science, the difference between science and technology and science as method to understand the physical and biological world, rather than a social construct. Exposure to these concepts needs to be embedded within any new curriculum.
10. Physical sciences for biologists should also be considered as a possible 1st level course.
11. In order to ensure sound pedagogical development, prerequisites should be reinstated. The free choice currently on offer to students, coupled with the diversity of biology courses available results in a lack of overall program coherence and inadequate and inconsistent preparation of students for the interdisciplinary teaching of subsequent years.

9.1.3.2 Second and third level recommendations

1. 2nd level teaching should build on the broad 1st level curriculum and should continue to teach ‘core enabling biological sciences’ as well as introduce more integrative discipline areas (eg microbiology, parasitology, pharmacology, entomology) for the first time. This will require real cooperation between Schools in the delivery of core areas.
2. 2nd level courses should be designed to provide a sound base for a variety of courses at 3rd level. Specialist stand-alone courses in 2nd level that only lead to a single course in 3rd level should be avoided. Consequently, a serious review of the wide diversity of courses currently offered at 2nd level across the faculty needs to be undertaken with a view to significant reduction in overall course offerings. The latter would be essential if pre-requisites were reintroduced.
3. Chemistry should be recognized as a discipline that is distinct from the biological sciences and a curriculum should be maintained that allows students to be educated to a level that meets RACI accreditation.
4. Conversely, graduating biologists often have too little background in chemistry. We need to develop more effective biological chemistry offerings that can form part of the core component at 2nd level.
5. Adequate practical training needs to be embedded within 2nd and 3rd level courses.

9.1.3.3 Honours

1. The level of coursework provided within the honours year should be increased across the disciplines to enable students to develop in depth specialist knowledge and skills.
2. Despite the faculty-wide standardization of the honours program in 2005, students engaged in different streams still have some concerns over differences in assessment workload. A review of the 2005 honours year should be undertaken as part of the current curriculum review with a view to establishing a consistent pattern of honours level teaching, obviously taking into consideration the special demands of individual disciplines.

9.1.3.4 Delivery

1. While formal lectures will continue to be a core approach for delivery to large classes, consideration should be given to a supporting framework that encourages the development and implementation of additional learning approaches that can be embedded within each course.
2. The content and delivery of courses should be mapped and configured so that students acquire distinctive scientific and generic skills within different courses.
3. We need to enhance current student exposure to quality practical training that more effectively feeds on the high quality research being undertaken within the faculty. Given the difficulties inherent in delivery to large numbers of students in disparate courses, that often have overlapping content, consideration could be given to some centralization of the practical experience into dedicated practical courses. Innovative group and module delivery should also be considered.

9.1.3.5 Ownership

1. The development of the new curriculum should be led by staff from Schools and Centres through the collegial interactions of disciplinary working groups.
2. Greater academic staff ownership of course content would in turn provide greater coherence in content delivery throughout the curriculum. The definition of majors in 2006 offers one possible approach to achieving this. Consideration should be given to the establishment of cross-school/faculty working groups with a vested interest in individual majors who will be given a coordinating/advisory role in the content of courses at all levels that impacts on their discipline. These groups would work with individual course coordinators to provide a formalized overview of course content as it feeds up through the curriculum from 1st level to honours.
3. External advice should be sought from outstanding university science teachers and appropriate benchmarking carried out to ensure that the UQ science degree is of a high standard internationally.

9.1.4 School of Engineering

The School of Engineering contributes to two majors within the BSc - materials science and minerals science, and the metallurgy plan within PGBSc(Hons). In addition, students have the option of enrolling in a dual degree, Bachelor of Engineering (BE)/Bachelor of Science (BSc).

At the course level, BE students undertake introductory science courses (in chemistry, physics, biology) which are either compulsory or available as introductory electives.

9.1.4.1 Engineering plans within science degrees

Recent enrolment in the undergraduate plans within the BSc or BSc dual degrees has been minimal. Undergraduate enrolments totalled 6 in 2001 (materials science 5; mineral science 1) and 3 in 2005 (materials science). Only one student has undertaken BSc honours within metallurgy (2002). It is interesting to note a small interest by international students in the MSc (materials) during 2004-05. (Please refer to the attached table.)

It should be noted that the BE/BSc is the only engineering dual degree which permits students to complete double majors and minors within the BE, hence certain changes to engineering specialisations should not impact on incoming BE/BSc students. (For example, chemical & metallurgical double major will replace the minerals process specialisation from 2006.)

The low enrolments in the minerals science and materials science plans within the BSc suggest that students keenly interested in these areas prefer to enrol in the BE and complete more in-depth study. Alternatively, the low enrolments in these plans, particularly BSc (single degree) may suggest a lack of promotion.

9.1.4.2 Science Courses within the BE, BE/BSc

Changes to the BSc at the course level, such as changing the semester of offer or day/times of offer to introductory level courses would have significant impact on engineering students and staff. Most Year 1 BE students choose to complete one of two general programs of study which lead to specific specialisations. The year 1 BE timetable is now tightly constructed with the cooperation of BACS and School of ITEE. It is essential that with an additional 100 students commencing in engineering from 2006 that this integrated timetable remains as stable as possible.

Similarly, any structural changes to the BSc with regard to completion of a general plan, or the completion of a major (or double majors) may impact on the flexibility of the timetable.

9.1.4.3 Multi-disciplinary Education

Academic staff within the School appreciate the educational benefits of students from varying disciplines participating within their courses. Students learn from the differing backgrounds and problem-solving styles of their peers, and develop an awareness of working in multi-professional teams.

9.1.4.4 Further Directions

It would be timely to seek student and industry feedback, including –

- what is attractive about a generalist science degree versus a specialist science degree
- reviewing enrolments in all existing specialisations for the pass and honours programs, and identifying reasons for low enrolments where relevant (including materials science, mineral science, metallurgy)
- reviewing domestic and international markets, particularly for specialisations that are offered in the BSc (pass, honours) and could be further developed or promoted within the MSc.

9.1.5 School of Geography, Planning & Architecture (GPA)

9.1.5.1 GPA involvement in the BSc

GPA is responsible for two fields of study within the BSc, Geographical Science and Geographical Information Science. The former is focussed around courses in physical geography (climatology, geomorphology, biogeography) and spatial technologies (remote sensing and GIS) and the latter is focussed on the spatial technologies with links into Information Technology. The number of students completing the geographical science field of study is small (<10/annum) and the number completing the geographical information science field of study is negligible (failing a marked increase in enrolments, it is likely that this FoS will be deleted from 2007). Despite these low numbers in GPA FoS, significant numbers of BSc students enrol in a wide variety of GPA courses.

9.1.5.2 GPA curriculum and pedagogy in the BSc

GPAs particular contribution to curriculum and pedagogy in the BSc includes: (1) the scope of the subdisciplines in geography including the substantive fields of climatology, geomorphology, hydrology, biogeography and landscape ecology, the analytical fields of remote sensing and geographical information systems, and the connections between these fields and subdisciplines which can shed light on the forcing factors which influence the human impact on, exploitation of, and management of, environmental systems. In contemporary North American practice, this suite of disciplines is referred to as earth systems science; (2) by contrast with most other areas, an emphasis on large space and time scales; (3) an emphasis on, and ongoing commitment to, field teaching (in association with small and large group classroom teaching, and physical and computer laboratories).

9.1.5.3 Issues

1. Common content

The BSc is characterised by its generalist approach, the wide range of constituent disciplines, and diverse student backgrounds; given this, it seems inappropriate to make compulsory common content that ALL BSc students must take. Whilst some science graduates may benefit from introductory chemistry; others (perhaps many!) would benefit from a comprehensive introduction to environmental systems and their analysis. Perhaps mandated common content would be most appropriate within the fields of study, including all year levels of the program (perhaps similar to the approach to majors in the BA).

Articulation with other programs: Increased rigidity / loss of flexibility is likely to reduce possibilities for students coming into the UQ BSc from other, including international, institutions.

2. Dual degrees

Dual degrees offer students a wide range of interesting and challenging learning and career opportunities. A more rigid BSc is likely to inhibit student participation in these programs.

3. Fields of study

We would support the adoption of the term ‘major’ to describe ‘fields of study’, both for simplicity and for consistency with long standing practice in the BA. We would support the adoption of a compulsory major within the BSc, although this is not a high priority. However, we would strongly support a mechanism for early declaration of majors to help provide direction for students’ individual study programs at an early stage and to provide a basis for effective ‘pastoral care’ by coordinators of majors. A ‘general science’ major would be an option for those unable/unwilling to nominate a specific major.

4. Links to BSc organisational structure

Since the adoption of the current faculty structure, there is a degree to which GPA, and perhaps other schools in EPSA and elsewhere, may have been somewhat alienated from the BSc organisational structure. This is unhealthy for science at UQ. Recent changes have reduced this problem. We commend this more inclusive approach.

9.1.6 School of Information Technology and Electrical Engineering (ITEE)

9.1.6.1 Background - ITEE involvement in the BSc

The School of Information Technology and Electrical Engineering (ITEE) is responsible for the Computer Science field of study within the BSc and has some involvement in the Computational Science field of study.

9.1.6.2 Common content

Given the generalist nature of the BSc, the wide variety of fields of study, and the wide variety of student backgrounds, we believe it is difficult to mandate any common content that ALL BSc students must take. Whilst some scientists may benefit from introductory chemistry; others (perhaps many!) would benefit from introductory computer science. We believe the introduction of common content should not be program-wide but should be specific to particular fields of study. If the BSc degree moves towards the concept of majors and double majors, it would be possible to mandate particular required content for particular majors, eg the zoology major (or double major) could mandate some chemistry content (to use an example raised by others). Double majors would permit the specification of greater number of required units, eg double majors in the Bachelor of Engineering specify #60 of the total #64. The computer science field of study in the BSc is already structured along these lines and specifies course requirements for 32 units of study, rather than just the #8 of advanced courses specified in other fields of study.

9.1.6.3 International articulation

A number of students entering the BSc do so with credit from other institutions, including overseas institutions – sometimes from institutions with a limited base of disciplines. If the BSc degree is changed to require courses from a wide range of disciplines it may be difficult to create suitable articulation plans and the amount of credit given may have to be reduced, which could make the UQ BSc less attractive to international students.

9.1.6.4 Double degrees

The BSc degree is sometimes taken as a dual degree with some other program of study. Any changes which decrease the flexibility of the BSc degree will again decrease the attractiveness of the BSc.

9.1.6.5 Mandating a field of study (major)?

One option which should be considered is to mandate that students choose a particular field of study or (double) major, as per the BA degree. In conjunction with more detailed course requirements for each field of study (major), this would ensure that students studied the material considered essential for that particular type of science. In this way, it would be possible to determine and map suitable graduate attributes also and ensure that graduates in each field of study had gained suitable attributes. We would recommend that both single and double majors be supported, with the possibility that some fields of study will only be available as single majors, some only as double majors, with (hopefully) the majority available as either single or double majors.

If it is considered appropriate that students can earn a general BSc degree (with no field of study specified), then perhaps some "required" courses should be specified. This will be the only way that particular graduate attributes can be enforced in a generalist BSc graduate. The course lists should be designed to permit students taking a major to fall back to the "general" BSc degree if required. The existing BInfTech degree works in this manner.

9.1.7 School of Psychology

9.1.7.1 Background - Psychology involvement in the BSc

The School of Psychology is responsible for the psychology field of study within the BSc and has some involvement in the neuroscience field of study. Students studying psychology in the BSc can either take the 28 unit sequence of study accredited by the Australian Psychological Society (this is the pre-registration requirement for students wishing to pursue a career as a psychologist) or they can complete a field of study in psychology by taking 8 units of 3rd year courses offered by the school. The APS-approved sequence is highly structured and requires students to take 6 units of 1st psychology courses, 10 units of 2nd year courses, and 12 units of 3rd year courses. On completion of this sequence, students are eligible to apply for an honours program in psychology – this 4th year gives students the necessary qualification to apply for provisional registration as a psychologist. A 2-year postgraduate course or 2 years of supervised practice is required before students meet the requirements for full registration. For students with the appropriate background in science and broader interests in this area, the BSc has been a very useful program in which to embed the accredited sequence of study in undergraduate psychology.

9.1.7.2 Issues for the consideration in the forthcoming BSc Curriculum Review

From the School of Psychology's perspective, there are a number of issues that we would like to see taken up in the BSc review. The main challenge that we see is the need to balance the extent to which students are able to obtain the skills, knowledge and attributes that distinguish BSc students from other students with the capacity for students to specialise in their areas of interest/s. To this end, we would like to see the review give consideration to the following issues:

- The possibility of building stronger sequences of study or majors, involving articulated programs of courses at all levels, within the BSc. The generic graduate attributes of the BSc should be embedded in such sequences of study, as should the specific attributes of the particular program of study. Even at advanced levels, more structure may be required to ensure that the appropriate breadth is obtained in a particular program of study, particularly those that span discipline boundaries – for instance, in neuroscience, a major should require students to study courses ranging from the molecular study of neurophysiology to the 'whole person' aspects of the field that include such topics as behavioural and cognitive neuroscience.
- The need to have clear breadth requirements – these could operate in terms of both foundation level courses and sequences of study.
  - In terms of the foundation courses, a range of different areas should be considered – e.g., coverage of the "enabling" sciences and relevant social sciences, behavioural sciences and humanities (eg philosophy of science, public policy and science etc). The possibility that the foundation requirements will differ for different students entering the BSc should also be considered – this could be achieved by building relevant foundation courses into each of the majors.
  - In terms of sequences of study, the BSc should be flexible enough for students to specialise in more than one area – in the case of psychology, relevant joint specialisations that should be possible include psychology & neuroscience, psychology & physiology, psychology & genetics etc.
- The need to embed clearly into all sequences of study the opportunity for hands-on practical training, involvement in research-related experiences, the capacity for students to spend a semester abroad, and the flexibility for appropriately qualified students to fast-track their degree programs.

9.1.7.3 Where do School of Psychology students go?

A large number of our 3-year graduates go onto further study, predominantly honours in psychology but also into professional training programs such as medicine and graduate entry allied health programs. Those who enter the workforce go into a wide range of areas including positions in health care settings both public and private, government positions, and positions in industry and management. Many 3-year psychology graduates are employed to undertake applied research.

9.1.7.4 What are our BSc Psychology program objectives?

Objective 1

To provide a broad understanding of psychology as the scientific study of human behaviour that will permit graduates with the APS-approved psychology sequence either to go on to further study or to gain employment in a diverse range of settings.

Objective 2

To provide a critical understanding of the key theoretical approaches and empirical findings in the core areas of basic psychology (cognitive, developmental, social and biological psychology), and provide basic skills in applying this understanding in real-world contexts.

Objective 3

To provide a deep understanding of the basic research methodologies used across the range of the discipline of psychology. This includes the study of statistics within the context of psychological research, research design, and the understanding of psychological test construction and interpretation.

Objective 4

To provide a deeper level of understanding in areas of the student's choosing (cognitive, developmental, social and biological psychology, and the applied and professional areas of psychology).

What attributes should BSc Psychology graduates possess?

Attribute 1: In-depth knowledge of the field

Attribute 2: Effective communication

Attribute 3: Independence and creativity

Attribute 4: Critical judgement

Attribute 5: Ethical and social understanding

9.1.8 School of Physical Sciences

9.1.8.1 Context for a review

There is an increasing awareness that science and technology are pivotal to the future economic competiveness of countries, and that they hold the key to advances that will affect "the way people will live, work and interact in the future[1]".

UQ is a leading research-intensive university offering a comprehensive range of high-quality teaching programs informed by research. If it is to retain this position it must review its science curriculum to ensure that it continues to produce graduates who can take their place at the cutting edge of scientific innovation.

The importance of curriculum review is supported by the July 2005 report of the SPS Review. The Review Committee recommended that ("as a matter of priority") the reviewed BSc degree "should entail pedagogical balance between the different sciences including quantitative courses, such as mathematics, statistics and physics, particularly in the first year[3]".

9.1.8.2 The current climate

The environment in scientific research, employment and the education sector is changing. The internationalisation and commercialisation of tertiary education imply that our graduates must be competitive with graduates from other universities around the world. Areas of scientific research change frequently and often involve topics at the boundaries between traditional fields. The biological sciences have reached a stage where many advances will critically depend on an understanding of physical principles of biological systems. In addition, the capacity to acquire large amounts of data and the ability to successfully model increasingly complex systems has fundamentally changed the way we approach science. The complex nature of the scientific enterprise now demands new statistical, computational and visualisation skills. Moreover, graduates will have a succession of "careers" over their working lives.

It is difficult to see how science graduates can have the flexibility to successfully adapt to and take advantage of changing research and commercial environments unless they possess a broad knowledge of their discipline, built on a solid foundation of the enabling sciences including chemistry, mathematics, statistics, and physics[2]. These could be part of a core first year or alternatively could be streamed from first year.

9.1.8.3 Where do School of Physical Sciences students go?

Our graduates go to a very wide variety of professions including in education, finance, computing, government, hospitals, industry and management. Many are involved in applied research in these areas.

9.1.8.4 What attributes should Science graduates possess?

Science graduates should possess:

1. A broad-based knowledge of science, an in-depth knowledge of their chosen discipline, and familiarity with the relationship of their chosen discipline to other disciplines.
2. The ability to design effective experiments, record and manage data, and to analyse and make inferences from data.
3. The ability to apply the scientific process to solve problems.
4. The ability to apply their theoretical knowledge to the study and solution of cross-disciplinary problems.
5. An exposure to hands-on practical content using the latest technology as well as to Industry practice, and experience in a work environment where relevant to their discipline.
6. The ability to access, evaluate and use information.
7. The quantitative skills and knowledge of the underlying principles of their chosen and related disciplines to model and predict the behaviour of relevant natural systems.

8. The ability to communicate with other scientists and with the general public.
9. An understanding of their professional and ethical responsibilities.

9.1.8.5 What can SPS bring to the Science degree?

Besides fundamental knowledge, we believe that to attain key graduate attributes it is particularly important that all science students learn basic quantitative analysis and related problem-solving skills. Currently EPSA students develop these skills in mathematics, statistics, and physics courses. While there are mathematics, statistics, and physics courses coordinated by SPS that are available to BACS students, recent discussions with Schools from BACS indicate that existing courses should be reviewed and re-designed to meet the specific quantitative and problem-solving skill needs of their students. We propose to design new course material in close collaboration with Schools in BACS to address these needs. To facilitate this process the new course material may not be presented as a traditional single discipline course, but may be taught in a more problem-based approach as a joint activity between SPS and other schools. However this must be executed with a view to maintaining pedagogical balance across the BSc program.

9.1.8.6 Further Challenges:

As a School SPS needs to:

1. Develop inclusive strategies to cater for the increasing diversity in the backgrounds, skills and expectations of our students.
2. Develop educational practices that optimally use new technology and assessment modes to improve learning and hands-on skills.
3. Enhance the skill base of our students to equip them for careers in both the private and government sectors.
4. Engage UQ research staff to facilitate the embedding of research into our teaching program to enhance the undergraduate experience and to equip students for careers in research.
5. Develop communication skills for all our students throughout the BSc.
6. Constantly review our syllabi to ensure a smooth transition from high school to university and to ensure our syllabi prepare students for new research/career opportunities as they present.
7. Maintain a strong teaching program across the BSc, ITEE and engineering degrees, and to package courses to suit the needs of this broad client group. Many early-year SPS courses play a service role for all BSc students including our own students.
8. Ensure we offer a range of later-year courses in earth sciences, physics, mathematics and statistics which develop advanced quantitative and analytical reasoning skills, equipping students for an extensive range of research-oriented career options.

9.1.8.6 References

1. Fulfilling the Promise. A Report to Congress on the budgetary and programmatic expansion of the National Science Foundation. Accessed at: www.nsf.gov/nsb/documents/2003/nsb03151/coverlink.pdf
2. Draft report of the major international conference “Science Teaching and Research: Which way forward for Australian Universities?” held at The University of Queensland on 18-19 November 2004. Accessed at: www.brightminds.uq.edu.au/ TRC/downloads/session_summaries.pdf
3. Report of the School of Physical Sciences Review, July, 2005.

9.2 Summary of School Review Recommendations Relevant to the Bachelor of Science Review

Over the last 5 years many Schools in BACS, EPSA and SBS have undergone a review. Each of these Schools was asked to summarize the recommendations in relation to teaching and learning, which resulted from those reviews, and which are pertinent to this review of the BSc as a whole.

9.2.1 School of Biomedical Sciences (SBMS)

9.2.1.1 Relevant recommendations

The School of Biomedical Sciences was reviewed in August 2003. The recommendations of the Review Committee that are relevant to the Bachelor of Science Review are:

1. There should be a joint planning process for the development of a high quality accelerated program for the group of talented students guaranteed a place in the MBBS program on entry from school.
2. Plans to expand the Bachelor of Biomedical Science degree in the domestic market should be developed following resolution of the discussions regarding the accelerated 2 year degree for OP1 students entering the MBBS program.
3. Participant Schools should develop a cost benefit analysis to support proposals for future course and degree programs, such as the B Pharmaceutical Sciences before committing financial and human resources to the introduction of such programs.
4. The School should provide a leadership role in the coordination of the development and implementation of new programs in neuroscience teaching and the enhancement of the current field of study in the BSc. This should include input from the health, molecular, biomedical, psychological and behavioural disciplines.
5. The purpose, scope and amount of practical class teaching should be reviewed by the school Teaching and Learning Committee in the context of the 2004 faculty-wide review of practical teaching in order to improve the outcomes of this expensive, but important, form of teaching.
6. Opportunities for high quality BSc students to obtain research experience/s in research laboratories should be expanded. This should include opportunities to conduct research projects in the IMB, QBI and AIBN. The School and Faculty should review whether every biological and chemical sciences student should be required to take the Introduction to Research course.
7. The School Teaching and Learning Committee undertake an analysis of the employment outcomes of its recent graduates. A formal program of information sessions on a range of employment opportunities combined with opportunities to meet employers of the School's graduates should be provided to BSc (Biomedical) students towards the end of the second year.
8. Industry based employers of graduates should be invited to discuss employment opportunities with undergraduate and graduate students.
9. The School should explore the full range of options, eg postdoctoral teaching fellowships, contribution to teaching by postdoctoral fellows, professional teaching support staff as well as the appointment of Level A lecturers, which have been successfully used in other Schools to address the issue of increasing academic workloads. Any options that the School adopts should be developed in the context of faculty-wide plans and university policy in relation to opportunities for career development for Level A and other staff who have a predominant role in teaching.

9.2.1.2 Progress on implementation

The key actions that the School of Biomedical Sciences has implemented to address the above recommendations are:

1. The 6-year dual BSc/MBBS degree program was introduced in 2006 as one of the options for the cohort of students who are guaranteed a place in the MBBS program on entry from school, after extensive consultation across the University. Approximately 30 of the 50 students in this cohort opted to take the BSc/MBBS dual degree in 2006.
2. The plans for a Bachelor of Biomedical Science degree in the domestic market are being considered as part of the Bachelor of Science review.
3. A cost-benefit analysis was carried out in relation to the proposal for a Bachelor of Pharmaceutical Sciences program in 2005 and, although the analysis was positive, the proposal did not progress because of difficulties in reaching agreement with other faculties, despite lengthy consultation.
4. It is proposed that neuroscience teaching will be enhanced as part of the implementation of the BSc Review, including proposed majors in neuroscience in both the BSc and the BBiomSci programs. These majors will be developed in consultation with academic staff from the health, molecular, biomedical, psychological and behavioural disciplines.
5. The School Teaching and Learning Committee have actively supported the development of initiatives to revitalise and increase the practical teaching in the science and professional courses in the School since 2005. This has been funded by the funds made available by the Enhanced Student Charge (ESC) that was introduced for first year students in 2005. The ESC has funded significant increased staff in the practical classes and equipment to allow the introduction of new experiments that reflect modern science. A proposal to refurbish the teaching laboratories in the MacGregor and Otto Hirschfield Buildings is also a key component of achieving these aims.
6. A large number of Level 2 and 3 BSc students now have a research experience in research laboratories in the School of Biomedical Sciences and the associated research institutes in the Introduction to Research (BIOL3012) and/or Vacation Project (BIOL3044) courses and also the Advanced Study program.
7. Employment agencies have been involved in providing careers and employment advice to Level 1 and Level 3 students in the BSc program. Further efforts need to be made in obtaining career destination data in collaboration with the BACS Faculty.
8. See 7. above.
9. Level A lecturers (both on continuing and annual appointments), later year PhD students and postdoctoral staff have made a very significant contribution to major changes that have been made in the practical and other aspects of the Level 1 and 2 programs as part of the innovations implemented with the ESC funds (see 5. above) in 2005 and 2006, with implementation in Level 3 courses in 2007. This has allowed implementation of these changes with minimal impact on the workload of academic staff. These innovations have been led by the School Teaching and Learning Committee and the SBMS Educational Research Unit (established in 2005) and the appointment of a Level B lecturer to lead the focus on educational research as the basis for changes in the teaching program in the School.

9.2.1.3 Implications for the BSc review

The implications of these recommendations and their implementation for the BSc Review are:

1. The requirements of the dual BSc/MBBS degree program must be taken into account in the revised structure and curriculum of the BSc program.
2. Implementation of a BBiomSci degree for domestic (quota 100) and international students in 2007 would address this recommendation. This has been accepted by the BSc Review Steering Committee.
3. It is proposed that some of the aims of the BPharmSci program can be achieved by inclusion of pharmaceutical sciences as a double major in the BSc.
4. It is proposed that neuroscience will be a major in both the BSc and the BBiomSci programs as part of the BSc Review. These majors will be developed in consultation with academic staff from the health, molecular, biomedical, psychological and behavioural disciplines.
5. The support for revitalisation of the practical component of the courses for students in the BSc courses should be further increased as part of the BSc Review process. The proposal as part of the review process for a dedicated building for first class practical teaching facilities is important in achieving full implementation of this recommendation.
6. The BSc Review proposal that all students in the BSc will be offered an ongoing research mentorship and apprenticeship from Year 1 in research laboratories both in the Schools and in the associated research institutes will achieve this recommendation from the SBMS Review.
7. The involvement of industry and government employers in the BSc review and ongoing curriculum development is a key part of the Science Teachers Centre proposal and will achieve this recommendation in the wider context of science.
8. See 7. above.
9. Further changes to the Teaching and Learning program in the School as a result of the BSc Review will need to take into account potential increases in academic staff workloads, particularly for those who are mentor convenors, which is a new leadership role. Management of this role is being addressed by a Carrick Leadership Development Project (Project Director: Dr Fred D'Agostino, Arts Faculty) in which the BACS Faculty and SBMS staff will participate.

9.2.2 School of Molecular and Microbial Sciences (SMMS)

9.2.2.1 Relevant recommendations

The School of Molecular and Microbial Sciences was reviewed in 2005. The Review Panel made 4 recommendations in relation to teaching and learning and a number of comments in the 'Review Report in Detail'.

1. *'The Committee and the School acknowledge that the free choice offered to students and the very large number of 'biology' course offerings together contribute to a lack of coherence and inappropriate preparation for modern disciplinary and interdisciplinary teaching and learning programs. In consequence it is out of step with developments in other research-intensive universities in Australia and internationally'.*

   'We are also aware of the opportunity that exists as the university and the BACS Faculty move towards defining 'majors' associated with coherent programs of study'.

This led to **Recommendation 1:**

That the first year curriculum be restructured to have a common core of 3 biology courses (6 units) and 2 chemistry courses (4 units) as prerequisites for all second year biology and chemistry courses.

2. *'The advice that we have received is that there is a serious impediment to curriculum development and rationalization of the first year teaching program in particular that relates to EFTSU and subsequent funding between the BACS and EPSA Faculties and between the Schools of the BACS Faculty'.*

   This led to **Recommendation 2:**

   That the Executive Deans of the BACS and EPSA Faculties work towards a financial agreement associated with the introduction of the recommendations we are making for a new first year program in the BSc program for 2007.

   A financial agreement should seek the best academic outcomes for students without major or abrupt changes in the number of staff positions in Schools within the two Faculties

3. *'We identified a widespread concern that many BSc students were insufficiently prepared for advanced study in their chosen area of specialization as a result of the extreme flexibility of their course choices. The resulting heterogeneity in student background (eg the diversity of courses that a third level cohort had experienced at second level) is a complicating factor in the delivery of advanced course content. We are greatly encouraged by the commitment of School staff to delivery of top quality science education and note the willingness of staff to engage in a rationalization of course structure with the introduction of appropriate prerequisites'*

   This led to **Recommendation 3:**

   Develop a clear pattern of academic ownership of teaching disciplines, each determining the necessary content of courses from honours level downwards.

4. *The Committee noted student concerns regarding the significant differences in the demands placed upon them and which they naturally perceived to be unfair in terms of workload.*

   This led to **Recommendation 4:**

   Establish a consistent pattern of honours level teaching for each of the degree streams taught within the School. The extent to which coursework and different forms of assessment are used should be standardized.

Other comments

The Committee noted the willingness of IMB staff to engage in teaching within SMMS courses and recognition by SMMS staff of the possible advantages of engaging Institute and Centre staff in their teaching programs, enabling a reduction in teaching loads.

9.2.2.2 Implications for the BSc review

The SMMS Review Committee made recommendations in teaching and learning that could not be addressed by the School alone.

- The School was the first within BACS to comment on the excessive number of 1^{st} level biology courses within the BSc. The School is strongly supportive of the 3 biology, 2 chemistry model.

- In the SMMS Review submission we also argued that in addition to 'enabling sciences' that ought to be taken in 1st year there were 'enabling biological and chemical sciences' for biologists that ought to be taken at least to 2nd level. Although there was no specific recommendation from the Review Committee our view was endorsed (see comment **3** above). It remains our contention that more students should be taking biochemistry, molecular biology, cell biology, genetics and chemistry at 2nd level as a preparation for future specialisation. At present such courses tend to be 'crowded out' by specialised courses available from 2nd level onwards, particularly in the biomedical sciences. While considerable effort in the BSc Review process has so far been focussed on the development of a more coherent 1st level offering, this plethora of 2nd level courses has not received similar attention. If a more coordinated approach across the faculty to providing a 2nd year experience that builds a fundamental framework for later specialization is not developed then efforts made at 1st year to embed an enabling science background will be undone. A critical part of the BSc Review should be to resolve this problem.
- Recommendation 3 specifically addressed the issue of heterogeneity of course offerings and the lack of a coherent path through the degree to advanced study and specialization, by proposing a model of academic ownership of specific teaching disciplines. Coordination of courses and course content from Honours level down would provide the necessary overview to develop effective learning pathways. The development of a logical set of Majors that define distinctive discipline areas and the appointment of an academic team to oversee them, as is proposed in the current BSc Review model, meets this recommendation exactly and is wholly supported. The challenge will come in effectively coordinating course content within overlapping discipline areas.
- The School has maintained a comprehensive chemistry program which seeks to interface with both the biological and physical sciences. In order to achieve this at least four chemistry courses must be maintained at 2nd level. Similarly, at 3rd level the number of chemistry courses that should be taken to allow a student to emerge with a 'major' in chemistry is more than for one of the numerous biology majors. This argues for chemistry to be considered as a 'double major'. A consequence of this arrangement might be to lock out biology and physical science students from chemistry at 3rd level and this would undermine the strategic development of interdisciplinary science at UQ. The solution would be to develop an additional double major 'chemistry with a cognate science discipline'. This would allow students to combine chemistry with biological and physical science disciplines (eg chemistry and earth sciences, chemistry and pharmacology). Such combinations are a normal part of degree offerings in chemistry in the U.K.

9.2.3 School of Integrative Biology (SIB)

9.2.3.1 Relevant recommendations of the SIB review

The School of Integrative Biology (formerly School of Life Sciences) was reviewed in May 2004. The Review panel was strongly supportive of the School's performance and directions, and made 13 recommendations to guide future developments. Of these, the following key points are relevant to the BSc Review:

1. Reduce biology offerings at 1st year from 6 to 4 and ensure students receive broad biology grounding at 1st year.
2. Rationalize biology offerings at 2nd and 3rd year to ensure that duplication is removed, courses are more cross-cutting, that lab and field courses are maintained by appropriate funding models and that small niche areas of importance are protected (eg entomology and plant protection).

3. Increase breadth of education at the honours level through the introduction of appropriate coursework.
4. Take a leadership role in the development of the BMarSt and BEnvSc degrees. Focus more resources into the promotion and management of these degrees and implement a management model consistent with the BBiotech degree.
5. Increase International student enrolments.

9.2.3.2 Progress on implementation

1. The 3rd year curriculum of the School has been reviewed resulting in a reduction in offerings of 25% over 2 years.
2. New honours course implemented in 2005 to broaden experience of honours students in the School. Students are required to undertake readings of primary research literature selected by academics across three research themes other than the one they work within. Assessment is through written report and oral presentation. We have received excellent feedback from staff and students on these new measures.
3. The School has funded a HEW level 5 administrative assistant to provide support to the BMarSt and BEnvSc degrees. Academic coordinators for both degrees have been appointed. Marketing for both programs is being undertaken by the BACS Faculty. There has been no move towards a BBiotech management model for these degrees.
4. Our major study abroad offering was reviewed in 2005 and changes implemented in semester 1, 2006. The course is now based around a field excursion to Fraser Island that examines the unique Australian biota at an attractive destination for foreign students.

9.2.3.3 Implications for the BSc review

The proposed new first year will result in a reduction in biology offerings from 6 to 3. It will be very important that all students wishing to progress to a major in the biological sciences take all three of these first year courses to ensure they have a broad grounding in biology.

The proposed reduction in majors in the new degree structure will ensure that there is a rationalization of offerings. It will be important in the design of new courses that attention is paid to introducing more interdisciplinary content. In particular the external review team noted the desirability of ensuring ecological students receive molecular content and vice versa.

At the current time the two name degrees associated with the School are having limited success in attracting students, despite the success of competitor institutions in these areas. Moreover, UQ's research strength in both these areas is among the best in Australia by a number of different metrics. In order to make these degrees more successful a greater emphasis needs to be placed on marketing. The management model of the BBiotech degree is widely considered to be a key to its success. A similar approach should be considered for the other named degrees and was recommended by the external review.

The external review team commended the School on the quality of its teaching and its commitment to undertaking a significant amount of expensive laboratory and field education as an integral part of its program. A mechanism needs to be found to enable this form of teaching to continue in the new degree structure.

The School is involved in teaching a number of niche areas such as entomology and plant protection. Both are attractive to only small numbers of students and that makes them difficult to sustain. However it clear from industry that Australia needs small numbers of high quality graduates in these areas. The external review recommended that these areas be continued and that we produce the graduates that the Australian agricultural sector requires.

9.2.3.4 Review committee comments

Review submissions emphasised the quality of the teaching currently provided. The submissions also identified a number of dilemmas, some of them connected directly to the costs (both human and material) of delivering these quality teaching and learning outcomes:

- The School has initiated, or been strongly proactive in developing, a number of graduate coursework programs and 'named' degrees. However, it may be that not all of these programs are viable in the longer term. If they are to become viable, significant extra effort will have to be made in developing and marketing them to attractive new students to UQ.
- There is a heavy reliance on intensive laboratory and field-based teaching, which is a significant factor in the strong teaching quality ranking awarded by students to the School, but which is also disproportionately costly, time consuming and, in a situation of declining funding, unsustainable in the long term without cutting back the curriculum elsewhere or by finding additional sources of funding.
- The School has paid close attention to analysing and trying to maximize its share of existing teaching load and funding, but relatively little to finding new students. It has also tended to promote its work in isolation from the rest of the faculty, leading to duplication, contradiction and inefficiency.
- Because of the need to maximize HECS-load funding, courses (particularly at first level) are devised, taught and promoted not on the basis of best educational outcomes but on popularity and opportunities for retaining students in later years. Students should not be restricted in first year but should be encouraged to sample widely and think broadly.

Consequently, in the context of local student quota restrictions, and the overall declining funding for Australian universities, the Committee suggests that SIB should concentrate its teaching effort into fewer courses and graduate programs, ensure that these maximize outcomes both in course quality and in breadth and depth of student learning across each program, find new cohorts of international students, and decide how much intensive teaching is educationally essential and how it can be resourced appropriately.

The Review Committee faced one fundamental difficulty in arriving at its recommendation in the teaching and learning area. It is apparent that, within UQ and the BACS Faculty, most significant initiatives related to reform and modernization of teaching and learning practices now occur at the university and faculty level and not within the Schools. In particular, the Committee was made aware of a number of aspects of the teaching and learning process:

- a review of the third-level undergraduate teaching, laboratory teaching, and field-based teaching;
- a separate review of the faculty's first level course;
- a foreshadowed 'Six Sigma' externally-facilitated review of BACS itself; and
- ongoing implementation of new university and faculty policies on the shape and composition of honours programs.

Consequently, the Committee's recommendations in the teaching and learning area are intended to encourage active participation by SIB in these wider reforms, and position the School to take advantage of its strength in contributing to this process, while recognising that without goodwill and negotiations in good faith across the faculty and beyond, little can be achieved.

9.2.4 School of Psychology

The most recent School Review was conducted in 2001, and some of the recommendations are less relevant now than they were then.

9.2.4.1 Undergraduate teaching and curriculum recommendations

1. In order to meet students' expressed need for greater consistency in the provision of lecture materials, the School should review the use of web-enhanced teaching and the use of the web for handout material across different courses.

Web-based delivery, use of Blackboard etc is now standard. Introduction of Electronic Course Profiles has further standardized and upgraded materials.

2. The School should continue to encourage students who have not met the APS criteria by offering alternative career outcomes. It should not constrain its offerings only to those endorsed by the Society, since most undergraduate students do not continue to a professional career in psychology.

Registration as a Psychologist requires 4 years' accredited study and a further 2 years of accredited postgraduate coursework or supervised experience (this latter option is to be phased out in the next few years). Numbers in the postgraduate (clinical, organisational, and sport/exercise) programs are limited by availability of supervised externships and supervision for research projects, thus the issue of alternative career paths continues to be important.

- The School of Psychology, in collaboration with Social Work and Applied Human Services, has introduced a highly successful Master of Counselling, with BSc/BA entry, which will provide an alternative pathway for graduates with a major in psychology.
- From 2007 the School of Social Work & Applied Human Sciences will offer a postgraduate suite in Human Services which might also be attractive to students with a major in psychology.
- Negotiations are in progress with Queensland Government departments to offer short postgraduate diplomas for School Guidance Officers and Child Protection Officers
- The non-accredited single major in psychology in the BA (#16) is a popular choice especially for students in dual degrees eg BA/LLB and BA/BEc. From 2007 we will offer three streams in the single major: Cognitive Neuroscience; Social & Developmental; Applied. For graduates with a single major, psychology is not a career destination but the sequence provides skills and concepts which improve their professional performance in other areas. We anticipate that these more specialized plans within the single major will provide clearer outcomes for students who wish to pair their interest with interests in other areas.

3. The proposal to develop a fast-track fee-paying accredited sequence in psychology for students who have completed an undergraduate degree is endorsed, providing that the fee income is sufficient to prevent any additional teaching loads

This is not relevant to the BSc Review, although we are continuing to consider this as an option.

4. Discussions should take place between BACS and other Schools and Faculties teaching within the BSc program to ensure that procedures and mechanisms for program planning, course review, and student advising are optimally effective.

This recommendation appears to refer to previous ambiguities concerning the roles of the School and the Faculty in student administration. These problems have been successfully resolved.

5. The School of Psychology should as a matter of priority hold discussions with the SBMS to facilitate the development of improved program plans for neuroscience field within the BSc and greater involvement by the School of Psychology in neuroscience teaching.

This recommendation has to a great extent been overtaken by events. The School continues to have research and teaching strengths in both clinical neuropsychology and basic neuroscience, and we have a number of strong collaborations with the QBI, including the appointment of a joint Professor of Neuropsychology and a joint UQ Mid-Career Fellow in clinical neuroscience. The School is the only School of Psychology outside Victoria with accredited postgraduate professional courses in clinical neuropsychology. From 2007 a plan in cognitive neuroscience will be offered as part of the #16 major in psychology in the BA. We hope that a similar plan might be introduced in the BSc.

6. The Schools of Psychology and Computer Science and Electrical Engineering should jointly review the undergraduate program in cognitive science to identify possible new program structures to encourage greater numbers of students into undergraduate and graduate study in cognitive science

Majors in cognitive science were developed but have never attracted large student numbers. The cognitive science major within the BA will be discontinued from 2007, due to lack of student demand and staff involvement. The Schools of Psychology and ITEE both have interests in the Key Centre for Human Factors and Applied Cognitive Psychology, and staff are currently considering strategies to increase undergraduate student interest.

9.2.4.2 Outcomes of the BA review – 2006

The Review of the BA has been consistently positive about the undergraduate courses of the School of Psychology. It has adopted the existing #28 double major in psychology and has encouraged the School to revise its single majors. Attached is the course list for the double major and for the three streams to be available in the single major in the BA from 2007.

A single major in the BA is #16, while it is currently #20 in the BSc. The School of Psychology considers it essential that the APS-accredited double major is identical across the two degrees, and would also prefer to have consistency in the single majors if this is possible.

Psychology double major (#28)

Year 1

PSYC1020 #2 Introduction to Psychology: Physiological and Cognitive

PSYC1030 #2 Introduction to Psychology: Developmental, Social and Clinical

PSYC1040 #2 Psychological Research Methodology 1

Year 2

PSYC2010 #2 Psychological Research Methodology II

PSYC2030 #2 Developmental Psychology

PSYC2040 #2 Social & Organisational Psychology

PSYC2020 #2 Neuroscience for Psychologists

PSYC2050 #2 Learning & Cognition

Year 3

PSYC3010 #2 Psychological Research Methodology III

PSYC3020 #2 Principles of Psychological Assessment

#6 electives in PSYC3000

must include one from each of 3 of the following areas (all #2):

1. Applied

PSYC3062 Human Factors

PSYC3082 Psychotherapies & Counselling

PSYC3102 Psychopathology

PSYC3132 Health Psychology

PSYC3202 Organisational Psychology

2. Biological

ANAT3022 Neuroanatomy for Psychology

PSYC3222 Psychophysiology

PSYC3232 Behavioural Neuroscience

PSYC3262 Evolutionary Approaches to Human Behaviour

3. Cognitive

PSYC3172 Basic Processes in Cognition

PSYC3192 Perception and Attention

PSYC3052 Judgement and Decision-Making

4. Developmental

PSYC3092 Language Development

PSYC3152 Applied Topics in Lifespan Development

PSYC3282 Learning from Others

5. Social

PSYC3112 Social Psychology of Human Communication

PSYC3122 Attitudes & Social Cognition

PSYC3142 Intergroup Relations and Group Processes

PSYC3212 Personal Relationships

And #2 from

PSYC3042 Psych Research: Interpretation and Evaluation

OR an additional elective from the 5 areas above

NB electives may vary somewhat from year to year

Psychology single majors in the BA (#16)

Stream A (Cognitive Neuroscience)

Year 1

PSYC1020 #2 Introduction to Psychology: Physiological and Cognitive

PSYC1040 #2 Psychological Research Methodology 1

Year 2

PSYC2010 #2 Psychological Research Methodology II

PSYC2030 #2 Developmental Psychology

PSYC2020 #2 Neuroscience for Psychologists

Year 3

PSYC3020 #2 Principles of Psychological Assessment

#4 from:

- ANAT3022 Functional Neuroanatomy for Psychology
- PSYC2311 Developmental Disorders of Childhood
- PSYC3052 Judgement and Decision-Making
- PSYC3172 Basic Processes in Cognition
- PSYC3192 Perception and Attention
- PSYC3222 Psychophysiology
- PSYC3232 Behavioural Neuroscience
- PSYC3262 Evolutionary Approaches to Human Behaviour
- PSYC3272 Neuroscience of Social Behaviour

NB electives may vary somewhat from year to year

Stream B (Social & Developmental Psychology)

Year 1

PSYC1030 #2 Introduction to Psychology: Developmental, Social and Clinical

PSYC1040 #2 Psychological Research Methodology 1

Year 2

PSYC2010 #2 Psychological Research Methodology II

PSYC2030 #2 Developmental Psychology

PSYC2040 #2 Social & Organisational Psychology

Year 3

PSYC3020 #2 Principles of Psychological Assessment

#4 from: (must include at least #2 at Level 3):

- PSYC2311 Developmental Disorders of Childhood
- PSYC2321 Family Roles and Relationships
- PSYC2341 Psychological Problems of Adolescence
- PSYC2351 Psychology & Human Sexuality
- PSYC2361 Psychology of Law & Justice
- PSYC3042 Psych Research: Interpretation and Evaluation
- PSYC3112 Social Psychology of Human Communication
- PSYC3122 Attitudes & Social Cognition
- PSYC3142 Intergroup Relations and Group Processes
- PSYC3212 Personal Relationships
- PSYC3092 Language Development
- PSYC3152 Applied Topics in Lifespan Development
- PSYC3282 Learning from Others

NB electives may vary somewhat from year to year

Stream C (Applied Psychology)

PSYC1030 #2 Introduction to Psychology: Developmental, Social and Clinical

PSYC1040 #2 Psychological Research Methodology 1

PSYC2010 #2 Psychological Research Methodology II

PSYC2030 #2 Developmental Psychology

PSYC3020 #2 Principles of Psychological Assessment

#6 from: (must include at least #2 at Level 3):

PSYC2000 Psychology of Sport & Exercise

PSYC2311 Developmental Disorders of Childhood

PSYC2321 Family Roles and Relationships

PSYC2341 Psychological Problems of Adolescence

PSYC2351 Psychology & Human Sexuality

PSYC2361 Psychology of Law & Justice

PSYC3000 Advanced Sport & Exercise Psychology

PSYC3062 Human Factors

PSYC3082 Psychotherapies & Counselling

PSYC3102 Psychopathology

PSYC3132 Health Psychology

PSYC3202 Organisational Psychology

NB electives may vary somewhat from year to year

9.2.5 School of Geography, Planning and Architecture (SGPA)

9.2.5.1 Relevant recommendations

The School of Geography, Planning and Architecture was reviewed in August 2005. The Review panel was strongly supportive of the School's performance and directions, but made 30 recommendations to guide its future development. Of these, the following are the key points which are relevant to the BSc Review:

1. The School should retain its current discipline mix.
2. The strengths of the individual disciplines within the School should be recognised and reinforced.
3. The School should identify areas of disciplinary focus around which economies of scale and specialisation in teaching and research can be further developed.
4. Synergies beyond the School in teaching and research should also be enhanced.
5. The School should decide whether to grow spatial information systems as a discrete program or as a service function into other disciplines.
6. The School should audit teaching and research activities in Environmental Science/Studies to enable the best use of its resources in this area.
7. The School should ensure that the Geography program produces well rounded students with strengths across human, physical and economic geography.
8. Curriculum design should be framed to ensure that students have the knowledge and skills needed to meet the requirements of industry and the professions.

9.2.5.2 Progress on implementation

SGPA has put in place a draft implementation plan to respond to these recommendations. With particular respect to geographical sciences, the plan includes a raft of strategies that are designed to reflect and enhance best-practice in an empirically scientific based discipline. Key actions to date include:

- Reinforcing the integrity of geography as a recognisable discipline.
- Building linkages back into senior levels at high schools to promote this recognition.
- Identifying fields of specialisation within geography at which we excel and clearly structuring our programs to reflect these strengths:
  - Physical geography
  - Spatial information science
  - Earth systems science
  - Population and economic geography
- Developing a coherent structure and logical progression within our fields of specialisation.
- Placing emphasis on broadly based, contextual courses at first year level.
- Building linkages to other UQ disciplinary strengths through joint teaching - environmental science, marine studies, environmental management, planning, etc.
- Emphasising connections to other closely connected disciplines especially ecology, information technology and natural resources management.
- Embedding fieldwork in courses throughout our teaching programs, including international field based courses.
- Establishing 'Spatial Information and Earth Systems Science' as a recognised EPSA Faculty Research Strength.

9.2.5.3 Implications for the BSc review

The foregoing has a number of implications for the position of geography within the BSc and the way it is delivered:

- Geography has been a distinctive discipline for several centuries. It is typically delivered as a major in both the BA and BSc degrees at universities around the world, including the majority of Go8 and U21 universities. The School Review stressed the need to reinforce the integrity of geography as a recognisable discipline. As such, it is imperative that it be retained as a discrete major within the BSc at UQ.
- Geography is a broadly based discipline which depends upon an understanding of human and physical processes at global, regional and local scales. It also has its own methodological apparatus, including spatial information science, which we regard as integral to the discipline. This necessitates at least two foundation (first year) courses to establish the requisite background for students majoring in the field.
- A corollary is that courses in geography, especially at foundation level, are ideally placed to provide students in other majors with the breadth of understanding of global processes in the environment and their interactions with society.
- The goal of building synergies with other disciplines would be enhanced by a relatively open program structure across majors within the BSc, enabling students to select widely from available courses.
- Ensure that the program structure and course offerings available within the geography major provide the depth and breadth needed by geography graduates seeking to teach at high school level and enter other professional opportunities in the spatial sciences.

- A strong, clearly defined major in the BSc also provides the key avenue for high-flying students in geography, seeking a research career and delivering students to the faculty's area of research strength in 'Spatial Information and Earth Systems Science'.

9.3 Summary of the Consultation Process for the BSc Review

Timetable for Bachelor of Science Review to achieve targeted outcomes.

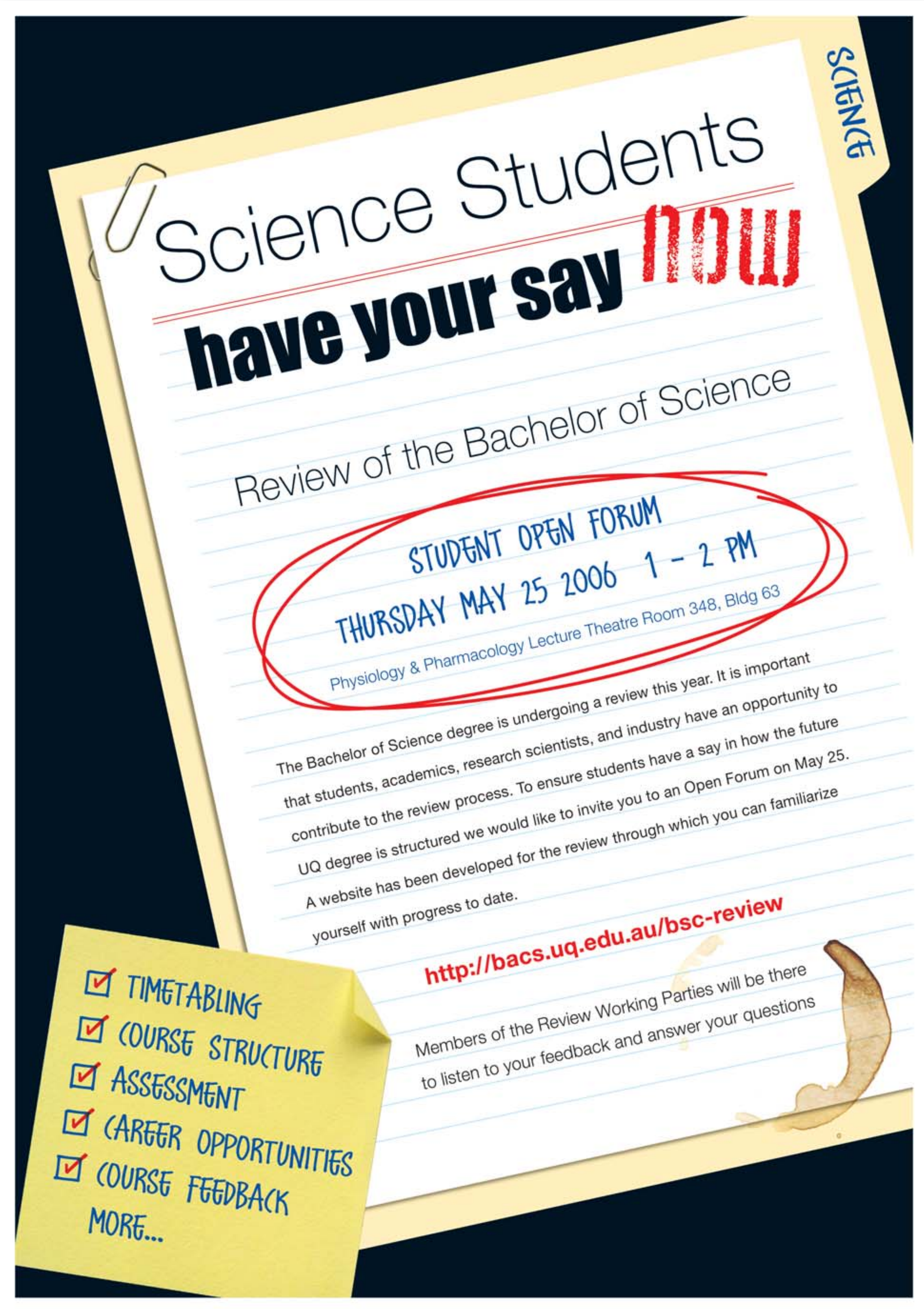
Table 9.1 Review timetable

Target Completion Date	Task	Meeting No.
1 November 2005	Collect BACS, EPSA & School position papers	
18 November 2005	Special Seminar – Dr Fiona Wood and Dr Leo Goedegebuure, University of New England Centre for Higher Education Management Policy	
28 November 2005	Open Forum	
December 2005	Form Committees and Working parties	
January 2006	Obtain agreement from all nominated Committee and Working Party members	
2 February 2006	**Meeting of Faculty Deans and Directors of Studies**	1
8 February 2006	Prepare first draft of Terms of Reference and Guidelines for Working Parties	
8 February 2006	**Meeting of Faculty Deans & Working Party Co-Chairs** Present Terms of Reference and Working Party guidelines to assist in preparation of Working Party Co-chairs approach to conducting their meetings	1
13 February 2006	Open Forum - SDVC Paul Greenfield, DVC (Academic) Michael Keniger, President of the Academic Board Mark Gould and Executive Deans to finalise the timeline for the Review and appoint the External Review Committee. It was decided that the External Review Committee would visit UQ on the week commencing 20 November 2006.	1
15 February 2006	**Meeting of Working Party Co-Chairs** Establish key areas each Working Party will address	2
17 February 2006	**Meeting of Steering Committee** Finalise Committee structure Finalise Terms of Reference and Guidelines for Working Parties	1
24 February 2006	Presentation of first draft of background data to inform the Committees	
1 March 2006	Finalisation of background data to inform the Committees. Document to be posted on the BSc Review website Identification of areas still needed to be collected.	
1 March 2006	**Meeting of Pedagogy Working Party**	1
1 March 2006	**Meeting of Student Experience Working Party**	1
2 March 2006	**Meeting of Honours & Careers Working Party**	1
3 March 2006	Address by SDVC Paul Greenfield, DVC(A) Michael Keniger and President AB Mark Gould, endorsing the Review to all BACS, EPSA and SBS staff. Executive Dean of BACS to introduce committees and explain the pathways for involvement of all staff	
7 March 2006	**Meeting of Structure of the BSc Working Party**	1
13 March 2006	**Meeting of Student Experience Working Party**	2
15 March 2006	**Meeting of Steering Committee and Working Party Co-Chairs**	1
15 March 2006	**Meeting of Pedagogy Working Party**	2
23 March 2006	**BSc Retreat Planning Meeting – Dr Norman Swan - Facilitator, Executive Deans, Co-chairs & Coordinators**	
24 March 2006	**Meeting of Structure of the BSc Working Party**	2
29 March 2006	**Meeting of Pedagogy Working Party**	3
31 March 2006	Meeting of Structure of the BSc Working Party	3

Target Completion Date	Task	Meeting No.
3 April 2006	**Meeting of Honours & Careers Working Party**	2
5 April 2006	**Meeting of Pedagogy Working Party**	4
5 April 2006	**Meeting of Student Experience Working Party**	3
7 April 2006	**Meeting of Structure Working Party**	4
11 April 2006	**Meeting of Structure Working Party**	5
11 April 2006	**Meeting of Pedagogy Working Party**	5
16 April 2006	**Meeting of Student Experience Working Party**	4
19 April 2006	**Meeting of Pedagogy Working Party**	6
21 April 2006	Progress Reports of Working Parties to be submitted to the BSc Review Manager	
26 April 2006	**Meeting of the Steering Committee, Working Party Co-Chairs and Coordinators**	2
27 April 2006	**Meeting of Structure of the BSc Working Party**	6
27 April 2006	**Meeting of Student Experience Working Party**	5
2 May 2006	**Meeting of Honours & Careers working Party**	3
3 May 2006	**Meeting of Pedagogy Working Party**	7
4 May 2006	**Meeting of Structure of the BSc Working Party**	7
8 May 2006	**Meeting of Student Experience Working Party**	6
10 May 2006	**Meeting of Working Party Co-Chairs and Coordinators and Retreat Facilitator, Dr Norman Swan -** to discuss program for the Committee Retreat	3
10 May 2006	**Meeting of Pedagogy Working Party**	8
10 May 2006	**Meeting of Structure of the BSc Working Party**	8
11 May 2006	Meeting of Steering Committee, Working Party Co-chairs and Coordinators and Dr Michelle Livett, Associate Dean, Academic Programs, University of Melbourne	3
16 May 2006	**Meeting of Student Experience Working Party**	7
16 May 2006	**Meeting of the Structure of the BSc Working Party**	9
17 May 2006	Summary of issues to be addressed at the Committee Retreat to be submitted to the Review Manager	
22 May 2006	Circulation of the program and Working Party documents for the Committee Retreat	
25 May 2006	Student Forum, Thursday 25 May 2006, 1.00 pm to 2.00 pm, Physiology and Pharmacology Lecture Theatre, Room 348, Bldg 63	
1 June 2006	**Meeting of Working Party Co-Chairs**	3
1 June 2006	**Meeting of Structure of the BSc Working Party**	10
5 June 2006	Deadline for submission of PowerPoint presentations, documents etc for Committee Retreat	
6 June 2006	**Meeting of Student Experience Working Party**	7
8-9 June 2006	**Committee Retreat – 2 day off-campus for all Committee members**	
6 June 2006	**Meeting of Pedagogy Working Party**	9
15 June 2006	**Post-Retreat Meeting**	
11 July 2006	**Meeting of the Steering Committee**	4
17 July 2006	**Meeting of Structure of the BSc Working Party**	11
18 July 2006	**Meeting of Pedagogy and Student Experience Working Party (PASE)**	1
25 July 2006	**Meeting of Structure of the BSc Working Party**	12
25 July 2006	**Meeting of Pedagogy and Student Experience Working Party (PASE)**	2
26 July 2006	**Meeting of the Steering Committee**	5
1 August 2006	**Meeting of Pedagogy and Student Experience Working Party (PASE)**	3

Target Completion Date	Task	Meeting No.
3 August 2006	**Meeting of Heads of Schools, Deputy Heads of Schools and T&L Chairs**	
11 August 2006	**Meeting of Steering Committee and Structure WP Co-Chairs**	6
11 August 2006	BSc Review Symposium Meeting	
15 August 2006	**Meeting of Steering Committee and Structure WP Co-Chairs**	7
15 August 2006	**Meeting of Structure of the BSc Working Party**	13
18 August 2006	Meeting of the BSc Review First Year Course Planning Team	1
18 August 2006	Deadline for documentation to be presented at the Curriculum Review Symposium	
21 August 2006	Meeting of the BSc Review First year Course Planning Team	2
22 August 2006	**Meeting of Steering Committee and Structure WP Co-Chairs**	8
23 August 2006	**Meeting of the Structure of the BSc Working Party**	14
25 August 2006	Deadline for PowerPoint Presentations for Curriculum Review Symposium	
28 August 2006	**Meeting of the Structure of the BSc Working Party**	15
30/31 August 2006	**BSc Review Symposium – 2 day on-campus for all staff to participate**	
4/5 September 2006	Meeting of Heads of Schools and T&L Chairs re 2nd and 3rd year Course Planning	
18 September 2006	**Meeting of Structure of the BSc Working Party**	16
19 September 2006	**Meeting of Steering Committee and Structure WP Co-Chairs**	9
21 September 2006	**Meeting of Structure of the BSc Working Party**	17
25 September 2006	Final reports from Working Parties to be submitted to the Review Manager	
3 October 2006	**Meeting of the Steering Committee**	10
9 October 2006	BSc Review Report Completed	
16 October 2006	**BSc Review submission handed to the Academic Board Office**	
17 October 2006	**Meeting of Steering Committee and Structure WP Co-Chairs**	11
20 - 23 Nov 2006	**External Review of the UQ BSc**	
4 December 2006	**Meeting of Steering Committee, 9.00 to 10.00 am, BACS Conference Room, Level 3, Computer Science Bldg (69)**	12
12 December 2006	Final report to the External Review Committee	
15 December 2006	Completed report of the Review Committee	
Jan to Dec 2007	Marketing Program for the new BSc	
February 2007	Replies from the BACS, EPSA &SBS Faculties to the Standing Committee	
19–23 February 2007	Meeting of Exec Deans BACS, EPSA &SBS to consider resource implications associated with recommendations	
March - June 2007	Processing of the Review outcomes through CAPP, APRC, Standing Committee and Academic Board and CRICOS coding for international prospectus, advertising program and course databases	
June - September 2007	Preparation of publications and planners associated with the new curriculum	
July 2007	Staff begin preparation of the new first year of the Bachelor of Science	
October 2007	DEST Deadline for Courses	
Semester 1, 2008	Introduction of the new **First year** of the Bachelor of Science	
Semester 1, 2009	Introduction of the new **Second year** of the Bachelor of Science	
Semester 1, 2010	Introduction of the **Third year** of the Bachelor of Science	

9.3.1 Advertising Poster for the BSC Review Student Forum



Section 10

The Place and Form of Honours

10.1 Overview of the BSc Honours Program

The BSc (Hons) is both administered and examined through independent bodies within three Faculties: Biological and Chemical Sciences (BACS), Social and Behavioural Sciences (SBS) and Engineering, Physical Sciences and Architecture (EPSA). Within BACS there are three Schools (School of Molecular & Microbial Sciences, SMMS; School of Integrative Biology, SIB; and School of Biomedical Sciences, SBMS) which enrol ~70% of all the BSc (Hons) students (Table 10.1). The School of Psychology (PSY) in SBS enrols ~15% of all BSc (Hons) students. The remaining 15% of students are divided amongst the School of Information Technology and Electrical Engineering (ITEE), the School of Physical Sciences (SPS), School of Geography, Planning and Architecture (SGPA) and the School of Engineering (ENG).

Table 10.1 Number of UQ enrolments in BSc (Hons) from 2003-2005*

	BACS			SBS	EPSA				
	SMMS	**SIB**	**SBMS**	**PSY**	**ITEE**	**SPS**	**SGPA**	**ENG**	
Year	Number of Students (%)								Total
2003	84	62	70	37	15	12	9	1	290
2004	68	76	71	38	10	15	13	2	293
2005	87	83	60	42	30	22	4	0	328
Total%	26	24	22	13	6	5	3	1	

** Note: the number of enrolled students do not match the data on graduations provided in Table 10.2 below as students can graduate mid-year or at the end of the year, transfer, or may withdraw.*

Table 10.2 Graduates in BSc (Hons) in leading Australian Universities 2002-2004*

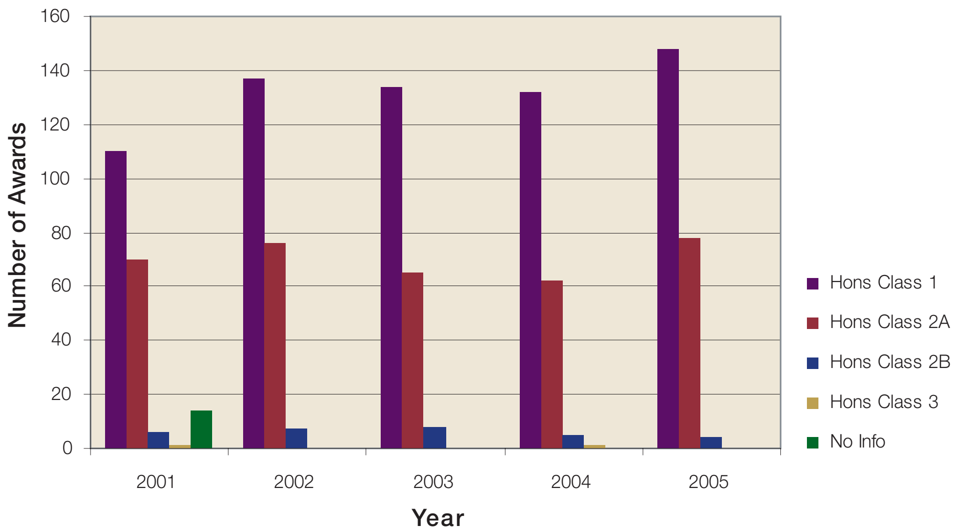
	University of Sydney	**University of Melbourne**	**The University of Queensland**	**University of Western Australia**
2002	256	189*	201	n.a.
2003	294	206	206	148
2004	282	237	200	172
Mean	278	211	202	160

** Data obtained from the Graduate Destinations Survey and University web resources. Please note that these figures are approximates only due to differences in reporting mechanisms between the Universities. For instance, UMelb has a large cohort enrolled in BBiomedSci. n.a., not available.*

The University of Queensland graduates about 200 students with a BSc (Hons) each year. While this number is comparable to that at the University of Melbourne it is considerably less than at the University of Sydney (Table 10.2). However, when these numbers are compared to the number of students graduating with a Pass degree in BSc it is clear that the University of Queensland is highly effective in attracting students into its Honours program. The University of Sydney had a total of 1065 graduates with a BSc Pass and Honours degrees in 2004. In comparison, the University of Queensland had a total of 726 graduates. Therefore, the University of Queensland had 28% of its cohort graduating with an Honours degree in 2004 compared to 26% at the University of Sydney.

Across all programs ~62% of students graduate with 1st class at the University of Queensland, while ~33% graduate with 2nd class (Figure 10.1). These percentage distributions have changed very little over the last 5 years (2001-2005).

Figure 10.1 Level of Award in B.Sc. (Hons) from 2001-2005



The strength of an Honours program is often reflected by the rate at which its graduates enter into postgraduate study, at least in the biological and biomedical sciences. In 2003 and 2004 ~70% of graduates with a BSc (Hons) continued on in full time study after graduation. In the BACS and SBS Faculties ~30% of the postgraduate population obtained their Honours degree from the University of Queensland (Table 10.3).

Table 10.3 Numbers of Honours students who progressed to a PhD or MPhil from 2001 onwards

	BACS			SBS	EPSA			
	SMMS	**SIB**	**SBMS**	**PSY**	**ITEE**	**SPS**	**SGPA**	**ENG**
PhD/MPhil*	171	160	108	141	246	153	87	308
BSc(Hons)+	58	50	40	39	4	17	5	11
Frequency	34%	31%	37%	28%	2%	11%	6%	4%

* *number of postgraduate research students enrolled since 2001*

\+ *number of postgraduate research students enrolled with an BSc (Hons) from UQ*

10.2 Honours Program in BACS

In 2003 a University-wide working party produced a set of recommendations (ultimately adopted as policy by the Academic Board) that dealt with issues concerning the Honours programs across the entire University. A major recommendation was the abandonment of Honours as a single #16 course, instead it was required to be broken down into separate smaller components each assessed individually on a 7 point scale.

In response to this and also to tackle disparities within the BSc (Hons) programs specifically within the BACS Faculty at that time, a working party was established in 2003 (chaired by A/Prof Susan Hamilton) to overhaul all Honours programs within BACS so as to introduce a single model assessed according to the same weighting scheme and with similar expectations of students. Two years later (February 2005), and after many iterations and meetings of the working party, the BACS Executive Dean and Heads of Schools all agreed to implementation of the new model. The most important change was that assessment of the BSc (Hons) program was made consistent across the Faculty.

The present structure (2006) comprises four components totalling #16 of credit:

Research Project	#10
Research Proposal	# 2
Seminar	# 2
Special Topics (Coursework)	# 2
Total	#16

Although there remains a liberal interpretation of the 'Special Topics' component (from advanced coursework lectures/examinations to literature reviews, statistical analysis exercises etc.), the current structure has seen major alignment of the BSc (Hons) program. Generally it has been well received, despite the changes that most disciplines were required to make.

10.3 Honours Program in EPSA and SBS

There is a smaller but significant cohort of BSc (Hons) students outside the BACS Faculty enrolled through the SBS and EPSA Faculties. Their unitised programs are assessed according to very different weightings as summarised in Table 10.4. This table shows a comparison across all three Faculties, illustrating the much greater coursework component in SBS and EPSA BSc Honours programs.

Table 10.4 Comparison of the BSc (Hons) Programs at UQ (2006)

	BACS (all programs)	SBS (Psychology)	EPSA (Maths, Physics, Earth Sci.)
Research Project	#10	#6	#6 to #8
Seminar	#2	#1	a
Research Proposal	#2		b
Coursework	#2	#9 [c]	#10 to #8 [d]

[a] *Compulsory but not assessed*

[b] *Assessment of Research Proposal embedded within Research Project (10%)*

[c] *Comprising #6 electives and #3 compulsory (ethics and multivariate methods)*

[d] *Dependent on units allotted to Research Project (total #16 for whole year).*

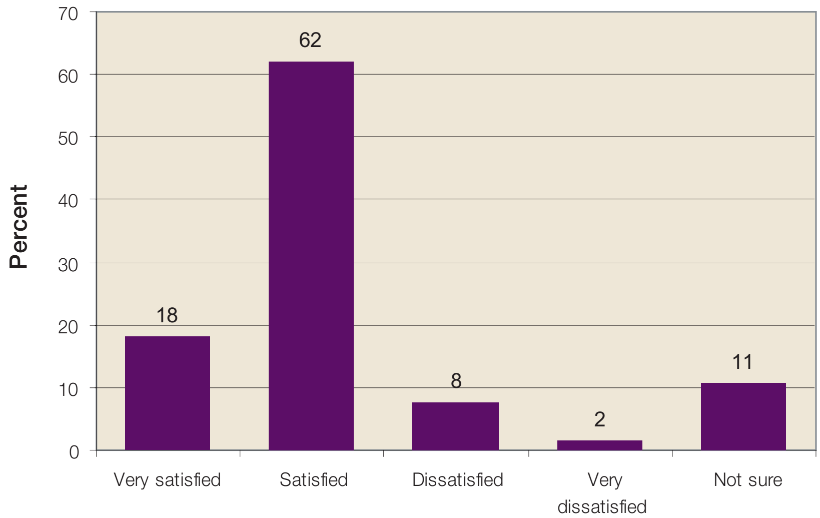
10.4 2006 BSc Review Student Survey Results

As part of the stakeholder consultation for the BSc Review both small student focus groups and a large scale on-line student survey was conducted. The complete report for this survey, including analysis of results, can be found in Supplementary Document: BSc Review Student Survey. A specific section of this survey was devoted to responses from current Honours students.

10.4.1 Satisfaction with experience of Honours year

Eighty percent of Honours students indicated that they were 'satisfied' or 'very satisfied' with their experiences of Honours to date (Figure 10.2)

Figure 10.2 Satisfaction with experience of Honours year in BSc.*



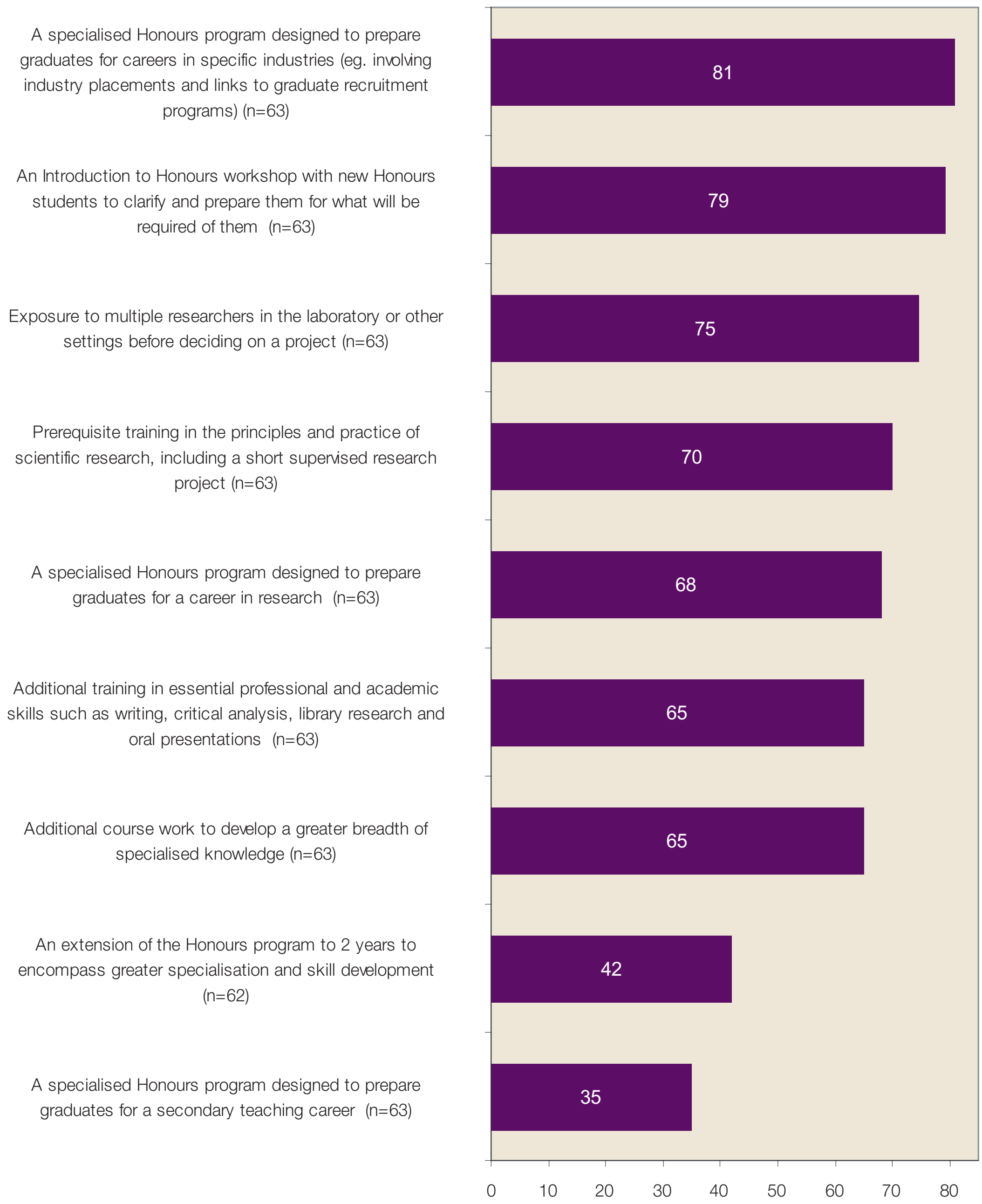
** Figures total slightly more than 100% due to rounding*

10.4.2 Views about improving the Honours program

Most Honours students (79%) felt that an 'Introduction to Honours' workshop to clarify and prepare students for what will be required of them in the program, would have improved their experience of the program (see Figure 10.3). Similarly, 70 percent felt that prerequisite training in the principles and practice of scientific research, including a supervised research project, would have improved their experience. Honours students were generally enthusiastic for more specialised Honours programs presented as possible program developments. Eighty-one percent felt that a specialised program to prepare them for careers in specific industries, including industry placements and graduate recruitment programs, would improve their experience of Honours. Two thirds (68%) felt this way about a specialised program to prepare graduates for a career in research. Only one third (35%) felt that a specialised Honours program designed to prepare graduates for a secondary teaching career would improve their experience of Honours.

Obviously, such survey data needs to be interpreted with caution. Many of the options listed in Figure 10.3 were favoured by many of the same students, but they are also incompatible in terms of fitting into a single year. Rather than supporting specific initiatives, these results are probably best interpreted as a general desire by Honours students to have the opportunity for a "career-based" experience during Honours that is in addition to the research experience that has to this point gained such a high level of satisfaction with the same students.

Figure 10.3 Views about improving the Honours program in BSc.



10.5 Future Directions of the BSc Honours Program

The consensus view from the three Faculties is that the current BSc (Hons) is an excellent program that equips our graduates to either enter the workforce or to continue on in postgraduate research. The underlying and guiding principle for design of an Honours program is considered to be “flexibility in delivery” within a defined framework. This ensures graduates in each of the Faculties are equipped with the necessary skills and attributes specific to their disciplines.

Three distinct models (Plans A, B and C) of the Honours program were proposed and debated at length. The fine details of these plans are provided in the Appendix 9. Plan A was retention of the current model, Plan B was the adoption of multiple streams of Honours (teaching, industry and research) and Plan C was the replacement of honours with a postgraduate Masters degree.

Plan A is clearly preferred within the context of the current Commonwealth funding rules for BSc Honours. It is widely known as the 3+1 model, referring to the 3 years for the initial degree followed by a separate 1 year for the Honours program. It is the model currently adopted by all Universities in Australia as well as in Singapore, New Zealand, Canada and Scotland. It has been a highly successful program which was recently unitised at UQ into four common components across Faculties: research project, seminar, proposal and coursework. The research project, at least in the wet sciences, is considered the backbone of the program and is the one that students find the most attractive and challenging. All three Faculties strongly support the current Honours program. It is generally agreed that this model should be retained with the proviso that "flexibility of delivery" is provided, especially with regard to the project component of the program. Opportunities currently exist for students to participate in research projects based in industry and it is important that we continue with and expand these offerings to more fully engage with industry. The Honours thesis should enable students to participate in special industry projects as an alternative to more traditional campus based principal research-based projects. These special projects could be offered as either part of the research component of the program or as one of the current coursework offerings.

Plan B consisted of various streams of Honours with the view to providing further choice to students and preserving valuable research resources for appropriate cohorts. The 1st stream would be identical to the current BACS honours program, the 2nd stream was an industry based program with the view to exposing students to lab research and training specific to industry and the 3rd stream was directed towards providing future teachers with necessary science-based research experience. While there was recognition in the value of these streams there was some concern with workload issues, logistical and financial constraints, and in maintaining standards across the streams. The decreased emphasis on the research project component of the honours was considered by some to be detrimental to the training and experience of the students in the 2nd and 3rd streams.

Plan C is widely known as the Bologna or the 3+2 model, referring to the 2-year Masters program following the 3-year undergraduate degree. This model is derived from the 1999 declaration signed by Ministers of Education from 29 European countries in the city of Bologna. The philosophy of this declaration was "harmonising the architecture of the European Higher Education system". This declaration has evolved and there are now 45 countries aligned to this model which is structured about a 3-year generalist undergraduate degree followed by a 2-year postgraduate Masters degree. The underlying theme is the ability of students to freely move between education systems in different countries without penalty. This model is highly attractive to the Faculties teaching into the BSc at UQ however the consensus view is that adoption of this model would be difficult within the framework of the existing Commonwealth funding arrangements. There is also considerable concern that this model would affect the flow of students into our program considering that only University of Melbourne is presently moving in this direction. However, it is unclear whether this University would continue to run Honours together with the Masters degree. At present we feel that it is in our best interests to remain engaged with future developments in this area without yet committing to either disregard or embrace. In this regards, UQ has established a central cross-Faculty committee to investigate the implications of the Bologna model.

Section 11

Future Directions for the BSc

As a result of the deliberations of the four Working Parties, and staff of the Faculties of BACS, EPSA and SBS, a vision for the future direction of the BSc at The University of Queensland has emerged. It takes into account the strategic direction of the University and the institutional initiatives which were in place prior to the review, aimed at improving the educational and personal development outcomes for all students (e.g. the UQ Teaching and Learning Enhancement Plan). The four Working Parties looked at different aspects of the BSc experience at UQ. The Structure of the BSc Working Party and Honours and Careers Working Party were largely concerned with the course combination and content of the BSc. The combined Pedagogy and Student Experience Working Party (PASE WP) looked at the process of teaching and learning within the BSc. The combined vision for the future UQ BSc is a result of vigorous debate and reflection on what it means to be a student in the 21st Century and how best this can be achieved in Australia, and specifically in The University of Queensland context.

11.1 Alternative Models for the BSc

The Structure of the BSc and Honours and Careers Working Parties considered the issues surrounding what the degree would look like in terms of courses, majors and pathways of study for students. Three alternative models for the three-year BSc were considered. Each model corresponded to a three-year degree program. The decision against recommending a four year undergraduate model was based on a range of considerations which are summarised in Table 11.1. It was nevertheless recognised that the total time to graduation with a PhD for BSc (Hons) graduates (typically 7-8 years) is shorter than in most other countries. It was agreed that an additional year would be desirable, but that replacement of Honours with a 2-year Masters or an increase in the duration of the PhD may be a better academic solution than addition of another year to the undergraduate program. The replacement of Honours with a longer Masters program was one of the options canvassed by the Honours WP and further discussion of this can be found in Section 10.

Table 11.1 Pros and Cons of the length of BSc

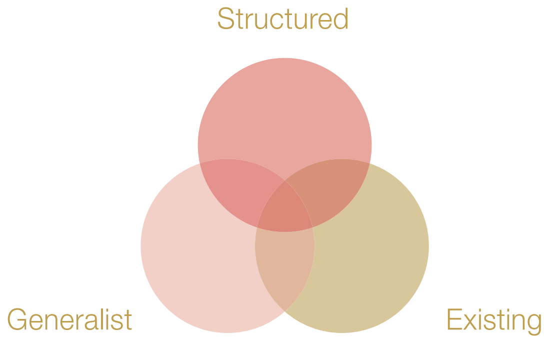
Option	Length	Pros	Cons
Option 1	3 year undergraduate degree plus 1 year elective Honours	3 year undergraduate program caters for students using the BSc to access a graduate program (MBBS, other)	3-year undergraduate program is too short to allow for both breadth (humanities etc comparable with the US system) and depth
		3 year undergraduate program caters for students with dual degree combinations	3 years plus 1 plus 3 year PhD is shorter than most programs world wide
		Current 1-year Honours is well established and recognised in Australia	Single 3-year degree graduates who do not progress to Honours or other study do not have good career options
		Student approval of the current system	
		3 years is long enough to provide depth in a discipline providing there is specialisation at year 3 and Honours is the "norm"	
		3 year undergraduate degree is cheaper for students than 4 year	
Option 2	4 year degree with on course Honours	All students would have better breadth and depth	More expensive for students
			May reduce attractiveness of dual degree combinations (5 years for BSc/BA)
			May reduce attractiveness of BSc as a springboard to graduate programs such as MBBS (unless entry rules changed)
			Current 4-year named degrees (e.g. BBiot) have not proved as attractive as the BSc. The 4 year BInfTech was cut back to 3 years

The three 3-Year models presented at the BSc Review Retreat represent different levels of breadth, specialisation and flexibility for the degree. A broadly based assessment of the current status of the BSc, using available student feedback, progression, graduation and lapse rates and benchmarking against other Australian universities, suggests *a priori* that the current BSc model has many good features, and that the model should not be discarded without careful consideration. It represents the most flexible, least structured program of the three, and offers the greatest potential for both specialisation and choice amongst courses and majors.

The second model is based approximately on the Bologna/University of Melbourne proposal for a broadly based generalist degree that mandates study outside of science, which is specifically designed as a foundational degree to be undertaken prior to more targeted postgraduate study. It is the least specialised of the three models.

The third model is a relatively structured degree with a smaller number of majors and courses, more stringent requirements for majors, and less specialisation than the existing BSc. It could be seen, in terms of breadth vs specialisation, to be intermediate between the two other models. Whilst the 3 models have their distinct features, there is still considerable overlap as depicted in Figure 11.1.

Figure 11.1 Schematic representation of the overlap between the 3 proposed models for the BSc



A summary of the key features of each model, together with appropriate background data, is provided below.

11.1.1 The existing model

The BSc has evolved to its current structure primarily as a result of external drivers over the past 40 years, including the change from year-long to semester-based courses, unitisation of courses, the removal in some areas such as biology of compulsory course prerequisites, increased student enrolments, and decreased Government funding, especially since 1989.

In the existing model, students undertake a program of study over three years, completing at least two-thirds of their program from the Science Part A schedule. The remaining one-third allows for students to take non-Part A courses from other Faculties within UQ, or more from the Part A schedule.

In 1999, the nomenclature "field of study" was introduced as a non-compulsory option for students, allowing them to graduate with one or two named fields (similar to majors). Fields were specified in all but a few instances by a list of level 3 courses from which a minimum of #8 units (4 courses) must be taken.

The BSc currently offers 40 fields of study, and the number of courses listed in these fields varies from a minimum of 5 (Biophysics) to 28 (Biomedical Science). Some exceptions such as Computer Science and psychology have further requirements for first and second level study, leading to a more structured program. Students are not compelled to nominate a field of study, in which case they graduate in an "undeclared" field.

Relevant data on the existing BSc model has previously been outlined in Section 2 but the following are reiterated, with respect to the existing BSc program as significant precursors to the proposed model for the BSc:

- Large numbers of BSc students do not include mathematics in their programs;
- Significant numbers do not study any chemistry/biology/physics;
- Only a small number of students take the full spectrum of level 1 biology;
- Large numbers of students study level 1 biology without having senior high school biology;
- Substantial numbers of students graduate without a nominated field of study;
- The number of lapsed students after Year 1, has remained at ~15% since 1998;
- A significant reduction in laboratory teaching has occurred since 1995;
- In the past two years there has been a move to lower OP cut-off in order to fill the BSc quota (see Section 4 for details).

11.1.2 A generalist degree model

The Bologna process is reported as aiming for an integrated educational system in Europe. The intended outcome is a widespread, common approach to the awarding of University qualifications through uniform degree structures and metrics. There will be a shared system of study credits ECTS (European Credit Transfer System) where 60 ECTS is the workload associated with a full time student enrolment over 1 year. ECTS is different to Australia's EFTSL measure in that ECTS is also linked to student attainment expressed as generic descriptions of learning outcomes and competencies that are associated with the various degrees.

The structure under consideration is a framework based on 3 cycles:

1. Bachelors level at a minimum of 3 and a maximum of 4 years full time study measured as a range of 180 – 240 ECTS
2. Masters level – an additional 60 – 120 ECTS
3. Doctorate

It is anticipated that in most, but not all countries the Masters degree will be two years following a three year Bachelor's degree. In a number of countries the 'professional' level qualification may be the Masters degree, and the Masters is also the pre-requisite for entry to doctoral studies. However at this time only Denmark, Ireland and the United Kingdom have national qualifications frameworks in place.[1]

The University of Melbourne is currently considering the development of a three-year generalist BSc, as one of five broadly based degrees, consistent with the Bologna model. Each is designed to provide a broadly-based education followed by more specialised postgraduate programs. While the full details are not yet available, key features of the BSc are likely to be:

- A requirement for students to undertake ~25% of study outside science
- Fewer, less specialised majors;
- An anticipated decrease in undergraduate student numbers and an increase in postgraduate enrolments;
- An exit point after three years that corresponds approximately to the current end of the second year of the BSc;
- A two-year Masters program containing advanced coursework and research as preparation for a PhD.

The challenges and opportunities for a university and faculty in developing a generalist degree include the following:

- For all programs
  - Developing appropriate Graduate Attributes and mapping them to sequences of study and individual courses
- Developing multidisciplinary partnership opportunities
  - within the BSc
  - within other generalist and specialist degrees
  - in providing pathways to specialist programs

For students, potential benefits are outlined below:

- Postponing choice of career focus
- Greater breadth of skills, knowledge and perspectives

[1] *DEST, The Bologna Process and Australia: Next Steps, April 2006*

[1] *BIO2010 Transforming Undergraduate Education For Future Research Scientists. (2003) The National Academies Press, Washington D.C. www.nap.edu*

- Improved cohort experience
- The possibility of more internationally aligned and recognizable qualifications

This model has not been further developed in the UQ context since a whole of University approach is clearly needed. However, in the context of the Review of the BSc, the Structure Working Party felt that it was important to recognize this as an alternative model for consideration. The Structured Model as outlined below could be seen as a first step towards a future generalist BSc degree at UQ. The implications of the Bologna Model for Honours is discussed in Section 10.

11.1.3 A structured model

Although student feedback showed that the flexibility of the existing degree was valued, students consistently requested greater coherence and clarity of sequence in the program. Guided by stakeholder input, the Structure WP considered the strengths of both the existing degree structure and the generalist model and sought to develop a third model which would deliver the following outcomes while still retaining considerable flexibility and choice that are seen as strengths of the current BSc program:

- Greater breadth of study across science
- More structured sequences of study (majors)
- Better articulated attributes for the degree and for each major

11.2 Adoption of The Structured Model for the New BSc

Subsequent discussions within the Structure WP and at the Review Retreat resulted in general agreement for adopting a new model for the BSc along the lines of the Structured Model. In doing so it was recognised and agreed that to deliver the desired outcomes the following changes would occur:

- Introduction of structured majors to better direct BSc students towards a coherent plan of study. The reintroduction of compulsory prerequisites and corequisites would guide students in these sequences of studies and some majors may also include a capstone course;
- The current number of fields of study would be substantially reduced (from the present 40) to a smaller number of broad-based majors;
- Majors would be justified against a defined set of criteria (see below);
- Majors attributes would be the guide to justifying course numbers, course structure, course content and pedagogy;
- Some courses at all year levels would require re-development to fit with the new structured approach.

In considering the biology-based part of the new BSc, the Structure WP took into account the recommendations of the report “BIO2010: Transforming Undergraduate Education for Future Research Biologists”.[2] The broad recommendations from “BIO2010” are given in Appendix 10 and key features include:

- An interdisciplinary approach to biology teaching
- Strong foundation in the mathematical, physical and information sciences
- Opportunities for research and inquiry-based learning

[2] *BIO2010 Transforming Undergraduate Education For Future Research Scientists. (2003) The National Academies Press, Washington D.C. www.nap.edu*

In planning for the quantitative/computational element of the new BSc (see later for details) the Structure WP was also guided by the recently released report "Towards 2020 Science".[3]

The central tenet of this report is that computer science will transform science, not just as a tool for doing "traditional" science, but as a technique for performing experiments and creating models.

11.2.1 Graduate Attributes for the BSc

A key component of the review process was a realignment of the Graduate Attributes to reflect the key outcomes of the renewed BSc. It was recognized that a graduate with a BSc from UQ should be equipped with the necessary skills and qualities they require as valued citizens to continue in a sustainable manner on their chosen career trajectories. Programmatic and staged development of the graduate attributes during the undergraduate study will be a core innovation of the new BSc. Each major will be mapped to a learning plan and each course and assessment item linked to the framework of graduate attributes. This will allow the students to easily monitor their progress along their learning paths and provide a new level of transparency and accountability to external reviewers. Each student will graduate with a clearly articulated suite of learning outcomes and experiences encapsulated in the attributes as mapped to the majors sequences of courses.

A new set of graduate attributes has been developed for BSc graduates which will support the Structured Model, and take into account likely future developments identified in this Review.

Science graduates should possess:

- **Scientific knowledge:** a broad-based understanding of science and scientific philosophy, interdisciplinary capacity, and an in-depth knowledge of the discipline
- **Research skills and information use:** the ability to think, define a problem, and to access, generate, synthesise, evaluate and use information
- **Quantitative and practical skills:** to become familiar with the techniques, technologies and industry practice of the discipline
- **Communication:** the ability to communicate verbally and in writing with other scientists and the general public
- **Professional conduct:** an understanding of professional, ethical and safety responsibilities
- **Intellectual curiosity & capacity for life-long learning:** to understand the importance of quality; retain and nurture curiosity; and the willingness and preparedness to undertake life-long learning.
- **An International Perspective:** to have an appreciation of science in a global community

11.2.2 Majors

It is proposed that the number of current fields of study be reduced substantially from the current 40 to 14 majors (see Section 2, Figure 2.6 for existing fields of study and numbers graduating in each field). The majors represent less specialised areas and more structured plans of study for students in first, second and third year than the existing fields. The advantages and disadvantages for students of more versus fewer majors were considered and these are presented in Table 11.2.

[3] *Towards 2020 Science. Microsoft Research Cambridge http://research.microsoft.com/towards2020science/downloads.htm*

Table 11.2 The pros and cons of more Vs fewer majors

	Advantages	Disadvantages
More Majors	• More choice for students • Marketing to "niche" areas • More precise description of students' area of specialisation	• More complex program design • Difficulties in program planning for students • Students may become excessively narrow • Proliferation of courses • Excessive overlap of majors • Pressure for named majors may be tied to marketing and development of new areas • 'Critical mass' of T&R academics associated with pastoral care activities in each major may be jeopardized.
Fewer Majors	• Simpler program design for schools & faculty • Simpler degree rules • Clearer program planning for students • Better cohort experiences • Greater breadth in students' background • Less proliferation of courses with small enrolments • Better chance to nurture via academic leadership committees • Dual majors can be used for finer description of area of specialization.	• Possible emergence of informal streams within majors, but without the clear planning advice associated with a formal major • Majors with large enrolments may be too large for a good cohort experience • Impression may develop that UQ no longer teaches a given discipline • Students may feel they are "forced" to take courses they do not want to take

The Structure WP examined the number and type of majors offered at tertiary institutions in the UK, USA, and Europe, and in Australia at the GO8 universities. Table 11.3 shows the numbers of BSc majors at the GO8 universities. The full list and titles can be viewed in Appendix 11.

Table 11.3 Numbers of majors at GO8 universities

The University of Queensland	40
University of Adelaide	16
ANU	34
University of Sydney	29
University of Melbourne	21
Monash University	32
University of NSW	32
University of Western Australia	39

The Institute of Higher Education, Shanghai Jiao Tong University publishes an annual Academic Ranking of World Universities (ARWU). This produces the Top 500 World Universities list and ranking is based upon academic or research performance. UQ is listed at 147. Nineteen UK universities which are also ranked in the top 150 on this list were selected for benchmarking of the current list of 40 UQ fields of study (Table 11.4). Table 11.5 shows the number of these universities that offer the respective UQ field of study.

Table 11.4 The nineteen UK universities against which the 40 UQ Fields of Study were benchmarked (alphabetical order)

UK University
Birmingham
Bristol
Edinburgh
Cambridge
Cardiff
East Anglia
Glasgow
Imperial College London
King's College London
Leeds
Leicester
Liverpool
Manchester
Nottingham
Oxford
Sheffield
Southampton
Sussex
University College London

Table 11.5 The number of UK benchmarking universities that offer the respective UQ major (taken from the existing list of 40 fields of study).

Mathematics	19
Chemistry	18
Computer Science	18
Biochemistry	17
Physics	17
Psychology	15
Zoology	14
Geology	13
Microbiology	13
Genetics	12
Neuroscience	12
Statistics	12
Pharmacology	10
Physiology	10
Biomedical Science	7
Ecology	5
Anatomical Sciences	3
Biological Chemistry	3
Earth Sciences	3
Bioinformatics	2
Marine Biology	2
Botany	1
Developmental Biology	1
Evolutionary Biology	1
Geographical Sciences	1
Materials Science	1
Molecular Cell Biology	1
Nanotechnology	1
Parasitology	1
Biophysics	0
Computational Biology	0
Computational Science	0
Drug Design and Development	0
Entomology	0
Exploration Geophysics	0
Geographical Information Science	0
Human Movement Science	0
Mineral Science	0
Tropical Marine Science	0
Wildlife Biology	0

Note: *This list is useful in that is highlights the most common names for the most common majors but it does not mean that majors with different or hybrid names do not exist at these institutions e.g. botany may be offered under the name of "plant sciences". Some may also be offered in a different degree (e.g geographical sciences).*

This information formed part of the process, outlined in full below, which was used to determine the reduced list of majors for the new UQ BSc. The list was developed by ranking the existing list of 40 BSc fields of study according to the following criteria:

1. Does the field represent a distinct way of thinking about modern science?
2. Is the field well recognised by employers: One measure used to quantify this is how many jobs are advertised on the Career One website specifying expertise related to each major?
3. Is the field so narrow that it could be better placed as an informal stream under a broader field?
4. Would it be recognised as a major at another world class university?
5. Is the field so broad that it cannot be readily defined as a major within the BSc and would be more appropriate as a separate degree?
6. Does the field lend itself to a clear, distinguishable pathway of study from years 1-3?
7. Is the major strongly linked to a research theme?
8. Is the field in the top ~20 in terms of numbers of graduating students in 2003-5?
9. Is the field more appropriate as an area of specialization at the graduate level?

Following discussions at the BSc Review Retreat, Review Symposium and subsequent to the Symposium, a list of 14 Majors and 6 Double Majors was agreed upon which, in line with the objectives, is a significant reduction from the current 40 Fields of study.

Proposed Single Majors for the BSc	
Biochemistry and Molecular Biology	Geology and Earth Sciences
Biomedical Science	Mathematics and Statistics
Chemistry	Microbiology
Computer Science	Physics
Ecology	Plant Sciencs
Genetics	Psychology
Geographical Sciences	Zoology

Double majors are proposed for interdisciplinary areas that require combinations of courses from disciplines such as biophysics, bioinformatics and computational science. There is also support from some disciplines for extended double majors which are extended sequences of study in a single discipline. Psychology is one example. Psychology is also constrained by professional registration requirements.

Proposed Double Majors for the BSc
Bioinformatics
Biomedical Science
Biophysics
Chemistry and Chemical Biology
Computational Science
Psychology

The working party also considered a proposal from the School of Biomedical Sciences for a separate Bachelor of Biomedical Science (BBiomedSci) named degree which is envisaged as a 4-year degree with a quota of 100, targeted at students wishing to undertake research in biomedical science. The specific details of this proposed degree along with the discussion of existing named degrees can be found in (Section 11.11 and Apendix 17). The number of students coming to UQ with strong interest in a degree in biomedical science for various reasons far exceeds 100. It has therefore been agreed to offer single and double majors in biomedical science within the BSc.

11.2.2.1 Graduate Attributes for Majors and Double Majors

The Structure WP agreed that the development of specific, customised clearly articulated graduate attributes for each major would be useful for students. This is a framework for guiding students and informing the planning of courses. The Graduate Attributes for each major and double major are listed below:

Biochemistry & Molecular Biology Major

Biochemistry is the study of molecules that are made by living things. It underpins all areas of contemporary biological science including molecular biology, cell biology, structural biology, physiology, pharmacology, molecular genetics, biological chemistry, microbiology, immunology and neurobiology.

Learning Outcomes

Core Learning Skills

The ability to monitor major scientific advances and impacts in science generally

- Ability to assimilate new ideas, discoveries and theories in biochemistry
- Ability to work with (analyse, synthesize, extrapolate, generalise) knowledge across the major themes in biochemistry including synthesis, degradation and structure-function relationships of biomolecules, molecular genetics and genomics, cell growth, development and regulation.

Core Laboratory Skills

Record keeping, instrument operation, data presentation, safety as a foundation for supervised laboratory work in diverse environments

- Ability to analyse and interpret data from biochemical experiments
- Ability to plan and execute biochemical experiments in a supervised environment.

Core Quantitative Skills

Mathematical and statistical

- Ability to apply the relevant methodologies to the analysis and presentation of biological and chemical data

Effective Communication

- Ability to communicate biochemical issues to experts and non-experts
- Ability to evaluate, extract and review information from the scientific literature
- Ability in written and oral communication

Biomedical Science Single and Double Majors

Biomedical Science is a broadly multidisciplinary science that forms the basis of our understanding of how the human body functions and responds to disease and the environment.

Biomedical scientists use the methods of biological research grounded in the core principles of chemistry, physics, mathematics and biology to study the molecular basis of life and its applications to medicine and industry. This major field is multidisciplinary and as such includes the disciplines of biochemistry, molecular biology, cell biology, genetics, bioinformatics, physiology, anatomy, developmental biology, neuroscience, biophysics, immunology, microbiology and pharmacology. Quantitative and analytical rigour underpins the Biomedical Science and forms a key element of course structures.

Learning Outcomes

Graduates in the Biomedical Science major will be trained in an inter/multidisciplinary environment with a focus on the quantitative and analytical aspects of modern research in the broad context of human biology and framed around the Graduate Attributes of the BSc at UQ. They will develop a diverse range of transferable skills that will provide them with unique opportunities for competitive entry into a larger variety of workplace environments.

Scientific Knowledge

- define, describe and explain body function at the level of systems, organs, tissues, cells and molecules
- describe how integration between systems, organs, tissues, cells and molecules is required to achieve homeostasis
- explain the changes that occur during development of organs and tissues
- define and describe how disruption of normal process result in disease states
- define and describe how drugs and toxins affect normal and diseased cells and tissues.
- possess current and balance in-depth knowledge in the selected biomedical science streams

Research Skills and Information Use

The major will place a strong emphasis on the following:

- appreciate the basis of scientific experimental design
- appraise, compare and make conclusions from experimental data
- generate, synthesize, critically challenge and evaluate information across the discipline of Biomedical Science
- critically review, analyse and evaluate scientific literature
- obtain and integrate information in a multidisciplinary manner
- work in a collaborative environment to manage, organize and prepare stream specific presentations

Quantitative, Technological and Practical Skills

A key goal of this major is for graduates to have demonstrable appreciation of and competence in the latest techniques, technologies and industry practices in the biomedical science.

- demonstrate technical competence across a broad range of practical skills in biomedical science

- understand and implement key experimental principles that underpin the biomedical sciences
- demonstrate a high level of quantitative, technological and practical skills in specific streams in biomedical sciences
- translate/transfer quantitative/practical skills between disciplines in the biomedical sciences
- high degree of competence in the information technology skills that underpin the practice and teaching of biomedical science

Independence and Creativity

Strategies to challenge the students to develop independence and creative approaches will be embedded at all levels within the major.

- argue, assess and evaluate new problems in the biomedical sciences
- create, design and implement evidence-based approaches to solving new problems in biomedical sciences
- interact with and educate peers in key aspects of one's own research area

Effective Communication

A programmatic development of context specific communication skills will be a core feature of this major.

- communicate effectively as biomedical scientists in personal, professional and public outreach forums.
- describe, explain, instruct and argue in written form
- oral communication including narrative, debating and presentation of data and scientific concepts
- demonstrate a high level of scientific and information literacy
- capacity to examine, question and interpret scientific findings to the general community
- collaborate effectively in small and large teams

Ethical and Social Understanding

Sound ethical, moral and social understanding are integral to the study of biomedical science.

- recognize the value of diversity and tolerance in the modern biomedical science community
- implement rigorous moral and ethical principles at both professional and community levels
- appreciate the value of collaboration at both professional and community levels
- awareness of the responsibility to interpret scientific findings and ethical issues to the general public
- implement occupational health and safety responsibilities at the highest standards
- awareness of the legal and ethical issues that surround biomedical sciences
- appreciate and engage in the international community of biomedical science

Intellectual Curiosity and the Capacity for Life-Long Learning in the Biomedical Sciences

The learning community that will result from the cohort experience and staff/student/peer interactions with engage the intellectual curiosity of the students and develop strategies for life long learning.

- appreciate that intellectual curiosity is a key driver of scientific enquiry
- understand that the biomedical sciences are constantly evolving
- value life-long learning as an integral aspect of a profession in the biomedical sciences
- manage and implement strategies for personal life-long learning

The Biomedical Science *double major* provides an in-depth understanding and breadth of the major that will encompass at least 2 of the following streams: anatomical sciences, physiology, developmental biology, biochemistry & molecular biology, microbiology, neuroscience, pharmacology and toxicology.

Chemistry SIngle Major and Chemistry and Chemical Biology Double Major

Chemistry is a central science. Chemistry encompasses the synthesis and study of molecules and materials, the exploration of their properties and the development of ways to use them in real life. This involves an understanding of the mechanisms of reactions and processes that occur at the molecular level. An understanding of the principles of chemistry underlines disciplines such as biochemistry, engineering, food science, materials science, nanotechnology and pharmacy.

A student with a *Chemistry Single Major* would have detailed knowledge of one sub-discipline of Chemistry or a broad knowledge across the full range of the discipline. Course choice would be informed by the other areas of science that were being studied.

A *Chemistry and Chemical Biology Double Major* would have detailed knowledge of more than one sub-discipline of Chemistry and a broad knowledge across the full range of the discipline. Course choice would be informed by a decision to emphasize either biological or materials/nanotechnology or chemical areas.

Learning Outcomes

Chemistry Graduates should Possess:

Scientific Knowledge

- an understanding of the key chemical principles in the core areas: physical, inorganic, organic, biological and materials chemistry
- knowledge of synthesis, structure and properties of molecules and materials and their applications in real life
- knowledge and understanding of the mechanisms of reactions and processes that occur at the molecular level and how these relate to macroscopic properties
- an awareness of the central role of chemistry and how it underlines disciplines such as biochemistry, engineering, fool science, materials science, nanotechnology and pharmacy.

Research Skills and Information Use

- knowledge of modern chemical methods and techniques
- knowledge of modern instrumentation used in the analysis of chemical components of mixtures, molecular structures and physicochemical properties of compounds
- kills in appropriate information technologies such as online searching and web-based information gathering
- the ability to think, define a problem, evaluate, and use information as acquired through assignments and laboratory sessions

- an ability to make astute and accurate observations of a phenomenon and to interpret and explain these observations and the ability to apply scientific knowledge to solving problems.

Quantitative, Technological and Practical Skills

- core laboratory skills in experimental chemistry at a level appropriate for effective participation in research and development
- ability to interpret scientific data from experiments and assignments, to generate hypotheses and design meaningful experiments to test them, to evaluate precision and accuracy of scientific data
- the ability to work in teams, to share and interpret results.

Communication Skills

- the ability to communicate in writing and orally on scientific concepts with other scientists and to explain chemical phenomena clearly to the wider community.

Professional Conduct

- ability to work safely in a laboratory environment
- understanding of the highest professional and safety responsibilities.

Intellectual Curiosity and the Capacity for Life-long Learning

- a critical and problem-solving-based approach to chemical questions and an analytical unbiased approach to the interpretation of data
- an appreciation of chemistry as a human endeavour at national and international levels.

Ecology Major

The Ecology Major will educate students in applied and pure ecology. They should be capable of exploring and understanding the factors that influence the distribution and abundance of organisms using evolutionary, behavioural, physiological, field-based, quantitative and molecular theories and methods.

Learning Outcomes

In-depth Knowledge and Understanding of the Major

- Knowledge of ecological principles at the level of individual, population, community and ecosystem
- A broad overview of knowledge about ecology in marine, terrestrial and freshwater environments with an emphasis on Australian examples.
- Detailed knowledge of the specific ecology of at least one of the above environments
- Ability to identify organisms in the field from at least one of the above environments and/or from at least one major taxonomic group
- An understanding of how both physical and biotic environmental conditions determine the distribution and abundance of organisms
- Awareness of the potential and realised contributions to ecology from other biological sciences (molecular genetics, physiology, evolution, behaviour, taxonomy) and non-biological sciences (mathematics, statistics, geology, chemistry, physics, information technology)

Core Skills

- Ability to collect ecological data and information in a field situation
- Ability to analyse and synthesise ecological data
- Ability to develop, apply and interpret appropriate ecological models
- Ability to apply ecological knowledge to solve or understand environmental problems (for example, conservation biology, sustainable use and development, pest control, environmental change)

Effective Communication

- Ability to present the results of ecological study in the forms of scientific papers and research reports
- Ability to present ecological data in graphical and statistical form
- Ability to synthesise and integrate ecological information from a variety of sources
- Ability to present findings of ecological studies orally
- Ability to work in a team with differing specific skills to solve ecological problems

Independence and Creativity

- Problem-solving skills: ability to design a program of ecological research or investigation to answer a specific theoretical or practical problem
- Ability to think originally about ecological issues

Critical Judgment

- Ability to evaluate, criticise and synthesise ecological arguments

Ethical and Social Understanding

- An understanding of the historical development of ecological thinking
- An understanding of the philosophy of science and of the varying approaches that can be applied to ecological science
- An understanding of the ethical issues associated with ecological research and in dealing with ecological issues
- An understanding of the social context of ecological and environmental problems

Genetics Major

Genetics is a multidisciplinary field that investigates the mechanisms of inheritance that determine the characteristics of cells, organisms and populations. Genetics underpins many of the recent advances in the medical, agricultural, and ecological sciences.

Learning Outcomes

Scientific Knowledge

- A broad-based understanding of the history and development of genetics, its interdisciplinary nature
- An in-depth knowledge of the principles of genetics, including a detailed appreciation of the different levels of genetic analysis and their purpose.

Research Skills and Information Use

- the ability to think, define a problem in genetics, and to access, generate, synthesise and evaluate, and use information to investigate the problem and its solutions.

Quantitative, Technological and Practical Skills

- familiarity with the techniques, technologies and industry practice of genetic analysis
- developed laboratory-based skills in molecular genetics methods as they apply to cell biology
- understanding of computational and analytical approaches associated with population and quantitative genetics, and the application of genomic technologies.

Communication Skills

- the ability to communicate with other scientists and with the general public accurate and clear information about issues in genetics.

Professional Conduct

- an understanding of the highest professional, ethical and safety responsibilities in areas such as genetic testing and genetically modified organisms.

Intellectual Curiosity and the Capacity for Life-long Learning

- the ability to channel their curiosity, and their willingness and preparedness to undertake life-long learning in the pursuit of quality scientific endeavour.

Microbiology Major

Microbiology is the investigation of bacteria, archaea, viruses and lower eukaryotes (protests, algae, fungi, slime molds); this constitutes the vast majority of the biodiversity on earth. It is an integrative discipline that uses a variety of fundamental approaches including genetics and genomics, cell biology, biochemistry and ecology to describe the biology of microorganisms. The remarkable metabolic diversity of prokaryotic organisms is central to understanding biogeochemical processes and has major importance in biotechnology and environmental management. Infectious disease and its control is a central area of Microbiology. This involves an understanding of mechanisms of pathogenicity, the biology of host defense responses to infection and development of methods of disease control. Microbes are attractive model systems and their investigation is linked to the understanding of fundamental processes in chemical biology, cell biology and evolution.

Learning Outcomes

Scientific Knowledge

- Learning about microbes, their structure, composition, genetics, biochemistry, physiology and replication. To be built on a solid understanding of the basic enabling principles of biology, chemistry, mathematics and physics.
- Learning about the impact of microbes on, and relevance to, human, animal and plant health and disease.
- An understanding of the value of microbiology to our culture
- Learning about microbial diversity, including lower eukaryotes
- Learning about the biotechnology applications of microbes in medical, agricultural, industrial and environmental settings.

- In-depth knowledge and understanding of Immunology and Infectious Diseases and the process of scientific research.
- The fundamentals of immune cell biology and immunogenetics, the principles of applied immunology, essential clinical immunology (immunodeficiency, autoimmunity, immunopathology).

Research Skills and Information Use

- Application of biochemistry, genetics, molecular biology, structural biology and bioinformatics to the study of microbiology.
- Learning of the contribution of different laboratories and individuals worldwide to our knowledge of microbiology and immunology.
- Learning of the contribution of microbiology research to society such as developments in environmental sciences, biotechnology, infectious disease control and the discovery of new therapies or prophylactic treatments.

Quantitative, Technological and Practical Skills:

- Understanding of the principles underlying microbial techniques
- Practical training that is fed by active research programs.
- Ability to apply analytical and problem solving skills to complex issues in microbiology

Communication Skills

- Communication skills appropriate for entry into a science based workplace
- Communication skills appropriate for informed debate on science issues relating to microbiology
- Ability to contribute to informed debate on ethical issues in the area of microbiology
- Ability to work constructively within a peer group setting
- Written critiques of the scientific literature

Professional Conduct

- Appreciation of the way different science disciplines integrate
- Appreciation of the collegial and international aspects of science
- Appreciation of the role and process of scientific investigation
- The ethical application and impact on society of knowledge gained through an understanding of microbiology.

Intellectual Curiosity and the Capacity for Life-long Learning

- Continued learning of the contribution of microbiology research to society such as developments in environmental sciences, biotechnology, infectious disease control and the discovery of new therapies or prophylactic treatments.

Plant Sciences Major

Students will be provided with advanced knowledge of the central concepts in Plant Biology, from Ecology to Biotechnology; skills in experimentation, analysis and scientific reasoning applied in these areas.

Learning Outcomes

Scientific Knowledge

A broad-based understanding of the special features of plants that underpin their essential role in sustaining all biological life and make them ideal model systems for genetics and development.

- How they impact on human society and the global environment
- How they work (function)
  turning light into life and energy (photosynthesis)
  surviving tough times and excelling in good times (physiology & adaptation)
  interacting with microbes and animals (symbiosis and pathology)
  communicating (hormones and genetic signalling)
  reproducing (sex & dispersal)
  providing a treasure-trove of bioactive molecules (chemistry, biochemistry and human health)
- How they are constructed (structure)
- How they have evolved and differ (diversity)
- How they interact with each other and with other organisms (ecology)
- How they are improved and applied for profit and sustainability (biotechnology)

Research Skills and Information Use

The ability to think, define a problem, and to access, generate, synthesise and evaluate, and use information. A student graduating within the major of Plant Sciences will possess:

- Familiarity with experimental design methodology
- Experience in problem solving
- Ability to formulate scientific hypotheses based on available information
- Familiarity with information technology sources and data banks
- Experience in organising and filtering information

Quantitative, Technological and Practical Skills:

Familiarity with the techniques, technologies and industry practice of their discipline. A student graduating within the major of Plant Sciences will possess:

- Hands on experience in a broad spectrum of research techniques used in Plant research specific to the discipline area (identification, physiology, pathology, population ecology, genetic transformation, breeding, etc) broadly used in other disciplines (DNA technology, biochemistry, statistics, etc)

Communication Skills

The ability to communicate with other scientists and with the general public. A student graduating within the major of Plant Sciences will possess:

- Scientific writing skills
- Experience in public discussion and debate
- Experience in communication of research results and scientific facts to scientific audiences, community and non specialist forums

Professional Conduct

An understanding of the highest professional, ethical and safety responsibilities. A student graduating within the major of Plant Sciences will possess:

- Awareness of the different ethic codes of conduct governing scientific research in general and in plant research in particular
- Awareness of national and regional regulations governing the work with genetically modified plants
- Awareness of national and regional regulations governing the movement and importation of plant material
- Awareness of safety procedures to be employed when conducting plant work or plant research

Intellectual Curiosity and the Capacity for Life-long Learning

The ability to channel their curiosity, and their willingness and preparedness to undertake life-long learning in the pursuit of quality scientific endeavour. A student graduating within the major of Plant Sciences will possess:

- Awareness of available sources to keep a continuous update on the latest developments in plant research
- Awareness of the importance of plants for human health, sustainability and welfare and thus of the importance of plant improvement and environmental sustainability via a range of currently available and future means
- Understanding of the links between Plant Science to other disciplines

Zoology Major

Zoology is the scientific study of animals, including their diversity and evolution, development, structure, physiology, and behaviour. Zoology examines animal life from all environments, including marine, freshwater, terrestrial, tropical, temperate and polar. Zoologists explore the relationships and interactions of animals and their physical and biological environments at individual, population, and ecosystem levels, and utilise modern comparative and experimental approaches. The study of Australia's unique fauna provides exciting and rewarding opportunities for zoologists to understand and appreciate animal life. Entomology and Parasitology are speciality areas within Zoology, and concerns the study of two diverse and economically important groups of animals, the insects and parasites respectively.

Learning Outcomes

In-depth Knowledge

Understanding of the evolutionary processes generating the diversity of animal life on earth

- A broad overview of the diversity of animals in the earth's environments including terrestrial, freshwater and marine environments with an emphasis on Australian examples.

- Detailed knowledge of the taxonomic relationships among the major groups of animals
- An ability to identify all of the major animal groups in the field, with a degree of specialisation in a chosen group of animals
- An ability to use a variety of tools and approaches to understand the interactions between animals and their environment
- Appreciation of the problems posed by the need to manage certain species with regard to their impact on human agriculture and health, and the need to conserve others.
- An understanding of the principles of genetics, physiology, behaviour and ecology as they related to animals.
- In the specialty of entomology, a knowledge of the nature and human impacts of insect-plant, host-parasite and insect-human interactions

Skills

- Ability to collect data and information in a field situation relevant to terrestrial, marine or freshwater habitats, with a degree of specialisation to a particular taxon or environment
- Ability to analyse and synthesise data relevant to animal studies
- Knowledge of the ethical issues associated with animal experimentation and an ability to keep animals under laboratory conditions
- An ability to identify the major animal groups in the field, with a degree of specialisation in a chosen group of animals
- In the specialty of entomology, an ability to solve or understand environmental and insect management problems (for example, conservation biology, sustainable use and development, pest control including insecticide use and GMO, environmental change)

Effective Communication

- Ability to present the results of studies in the forms of scientific papers and research reports
- Ability to present, analyse and interpret experimental data
- Ability to synthesise and integrate biological information from a variety of sources
- Ability to present findings of research and scientific literature studies orally
- Ability to work in a team with differing specific skills to solve biological problems

Independence and Creativity

- Problem-solving skills: ability to design a program of zoological research or investigation to answer a specific theoretical or practical problem
- Ability to think originally about topical zoological or entomological issues

Critical Judgement

- Ability to evaluate, criticise and synthesise arguments in zoological science

Ethical and Social Understanding

- An understanding of the philosophy of science and of the varying approaches that can be applied to biological sciences with a particular focus on whole-animal studies
- An understanding of the ethical issues associated with research on animals
- An understanding of the unique nature of Australia's fauna and the need to appreciate and protect its biodiversity

- An understanding of the social context of zoological and entomological problems
- Exposure to and opportunity to interact with the professional societies for zoologists and entomologists

Computer Science Major

Computer science is about the how and why of computing: the underlying theory and factors driving efficiency of hardware and software. This major covers practicality and theory. The field of computer science in the BSc provides excellent undergraduate training for the professional computer scientist as well as training for those students wishing to proceed to postgraduate studies. In addition to teaching that is aimed at the computer professional, computer science courses are used in a number of scientific fields including bioinformatics and computational science. The computer science program was accredited by the Australian Computer Society in 2003, at the professional level. It may be necessary to request re-accreditation since the proposed new major structure reduces the total number of courses compared with the existing field of study.

Learning Outcomes

- a broad-based understanding of the science, philosophy and application of computers, and depth in selected areas.
- ability to form new knowledge by application and extension of existing theories and practical techniques, including but not limited to algorithm analysis, programming, understanding of levels of abstraction from hardware to high-level software specification and application of this understanding to providing novel solutions
- ability to quantify design trade-offs including choice of algorithms and data structures, alternative system designs covering choices of hardware and software architecture
- ability to work from user requirements to specification, design and implementation, as well as to report on finished work
- understanding of copyright, fair use, models of software ownership and the distinction between original and derived work both in their own practice and the practice of others
- understanding of the limits of current knowledge, the value of keeping up with new developments and an understanding of knowledge discovery and creation

In-Depth Knowledge of the Field of Study

- A comprehensive understanding of the current state of the art of computer science, including a thorough appreciation of programming in high-level languages, of creating and suing information systems and computer systems, and of the technical aspects of information technology.
- A thorough understanding of how computer science interacts with society at large, and the effects on society of this interaction.
- The ability to understand with depth and accuracy the impact of computer science within an organization.
- A detailed appreciation of the impact of computer science on the global scale.

Effective Communication

- A clear ability to research, collect, analyse and organise information and ideas effectively in written form.
- An ability to analyse and present information and ideas effectively in oral form
- The ability to argue persuasively, based on a solid research and/or analytical foundation

- The ability to interact well with others in a group in order to work towards a common goal
- The ability to select and use the appropriate level, style and means of communication, whether in written or oral form, in communicating to a particular audience
- The ability to engage effectively and appropriately with information and communication technologies.

Independence and Creativity

- The ability to work and learn independently
- The ability to problem-solve on both individual assignments and group projects.
- The ability to identify technical problems and apply appropriate research and analytical strategies to address them.
- The ability to be a creative thinker and apply critical reasoning in information system contexts.
- The ability to take direction but to also provide additional creative input.
- The ability to assume leadership and demonstrate initiative.

Critical Judgement

- The ability to develop critical judgement skills to enable the analysis of both existing computer systems and those under development
- The ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.
- The ability to define and analyse problems in relation to arising circumstances
- The ability to apply critical reasoning to issues through independent thought and informed judgement, and the use of evidence

Ethical and Social Understanding

- An understanding of how contemporary society and culture is shaped by computer science, and therefore and awareness of the social and civic responsibility of the computer scientist
- An understanding of the ethical and civic responsibilities regarding interactions with colleagues and clients
- An appreciation of the philosophical and social contexts of computer science as a discipline
- A knowledge and respect of ethics and ethical standards in relation to all aspects of the duties and responsibilities of a computer scientist
- An awareness of cultural and social diversity in the workplace

Geology & Earth Sciences Major

Geologists combine different disciplines to discover mineral and fossil fuel resources, mitigate hazards and environmental impact, and examine the interacting systems of the solid Earth, atmosphere, hydrosphere, and biosphere as they evolve through time.

Learning Outcomes

Scientific Knowledge

- A broad-based understanding of science and scientific philosophy, interdisciplinary capacity, and an in-depth knowledge of geology and earth materials and processes.

Research Skills and Information Use

- The ability to think, define, and characterize a geological and complex spatial/temporal problem, and to access, generate, synthesise and evaluate, and use information.

Quantitative, Technological and Practical Skills

- Familiarity with the techniques, technologies and industry practice of their discipline
- The ability to generate and interpret spatial information, and integrate this with temporal evolution of a complex system
- The ability to generate and interpret geochemical, geophysical, and structural data in the context of geological exploration and environmental characterization of a system.

Communication Skills

- The ability to communicate with other scientists and with the general public.

Professional Conduct

- An understanding of the highest professional, ethical and safety responsibilities.

Intellectual Curiosity and the Capacity for Life-long Learning

- The ability to channel their curiosity, and their willingness and preparedness to undertake life-long learning in the pursuit of quality scientific endeavour.

Geographical Sciences Major

Geographical Science investigates the spatial patterns of physical (eg. climate, geomorphology, hydrology) and human (eg. settlement patterns, population dynamics) phenomena at local, regional, continental, and global scales, how those patterns change through time, and their causes and consequences.

Learning Outcomes

Scientific Knowledge

- A broad-based understanding of the sciences, interdisciplinary capacity, and an in-depth knowledge of the geographical sciences with emphasis on spatial and temporal patterns.

Research Skills and Information Use

- The ability to think, define a problem, and to access, generate, synthesise and evaluate, and use information.

Quantitative, Technological and Practical Skills

- Familiarity with the techniques, technologies and industry practice of their discipline, including field, laboratory and data management skills.

Communication Skills

- The ability to communicate with other scientists and with the general public in both oral and various and appropriate written communication.

Professional Conduct

- An understanding of the highest professional, ethical and safety responsibilities.

Intellectual Curiosity and the Capacity for Life-long Learning

- The ability to channel their curiosity, and their willingness and preparedness to undertake life-long learning in the pursuit of quality scientific endeavour.

Mathematics and Statistics Major

The mathematics and statistics major develops the central techniques of mathematics and statistics and their computational implementation. It leads to advanced courses emphasising recent mathematical and statistical developments and their applications in physics, bioinformatics, finance, cryptology, ecology and biology.

Learning Outcomes

- Mathematics and statistics play fundamental roles in all the sciences. The qualities developed in a program with a strong component of mathematics & statistics and their applications will be:

Scientific knowledge

- A specialised knowledge of at least one branch of mathematics or statistics, and an appreciation of the place of that specialised knowledge in the context of modern mathematics and statistics and, more broadly, in the context of modern science.
- A general appreciation of the relationship between hypothesis and experiment, especially as it relates to the mathematical and statistical sciences.
- An appreciation of the importance of mathematics as a language for deductive and inductive reasoning, an ability to argue logically and consistently, and an ability to choose and apply appropriate methods of proof.
- A broad understanding of the major developments and recent achievements of mathematics and/or statistics, and their place as ongoing international human endeavours.
- An appreciation of the breadth and power of mathematics and/or statistics, their applications to other fields, and their ability to affect our culture and technology.

Research skills and information use

- An ability to synthesize mathematical and/or statistical knowledge in a creative way in order to formulate and solve complex problems.
- An appreciation of the concept of a mathematical model and of the importance of successive approximations in mathematical modelling and in science more generally.
- An ability to use a variety of mathematical and/or statistical software packages.

Communication skills

- An ability to communicate mathematical and/or statistical concepts and arguments, both orally and in writing, and an ability to select and use the appropriate level, style and means of communication.
- An ability to appreciate and utilise new technologies effectively in mathematical and/or statistical problem solving and in communicating outcomes.

Professional conduct

- An acknowledgement of and respect for ethical standards, especially in the application of mathematics and/or statistics to other fields.

Intellectual curiosity and the capacity for life-long learning

- An ability to think critically, to analyse complex arguments, to judge when a problem is well-posed, and to evaluate the validity, relevance and usefulness of available information.
- An ability to work and learn effectively, both independently and in a team.

Physics Major

Physics is the study of matter, energy and their interactions. Physicists use theoretical and experimental methods to explore new concepts and test the predictions generated from their ideas. Physics courses develop specialised skills from both historical and cutting edge areas of physics in preparing students for the next generation of science. Physics enhances our understanding of the other natural sciences and plays a key role in their advancement.

Physics is the natural science that seeks to understand all physical phenomena ranging from inside the atom to the cosmos. The major not only prepares for careers in professional physics fields from research to general education but also in other natural sciences such as the earth, chemical and biological.

Scientific Knowledge

- A fundamental and in-depth understanding of physics and its philosophy.
- A broad-based understanding of the role of physics in science and scientific philosophy.

Research Skills and Information Use

- The ability to think critically, identify a problem and access, generate, synthesise and evaluate and use information.
- Ability to apply fundamental physics knowledge, analytical and quantitative skills and logical processes, formal reasoning and critical evaluation to solve physics and cross-disciplinary problems.
- Ability to apply physics insights unconventionally to arrive at new knowledge, that is skill at developing innovative hypotheses for advancing an understanding of the natural world. (For example the challenge of understanding the existence and role of dark matter in the universe).

Quantitative, Technological and Practical skills

- Skills in practical techniques, the latest technologies and interpreting results and applications of physics experiments.
- Development of professional laboratory skills: record keeping, instrument operation, data presentation.

Communication Skills

- The ability to communicate knowledge to the physics community, members of other scientific disciplines and the general public.

Intellectual Curiosity and Lifelong Learning

- An individual who has learned the importance of quality, retained and nurtured and exercised their curiosity and their willingness and preparedness to undertake lifelong learning.

Professional Conduct

- An understanding of the highest professional and ethical responsibilities in scholarship and communication.
- Practice of transparency in data acquisition processing and dissemination of results.
- Knowledge and application of safety requirement for the physics discipline.

Psychology Major and Double Major

Psychology is the science of human behaviour. Topics include perception, sensation, motivation, development, cognition, learning, communication, social behaviour, and abnormal behaviour. Students develop analytical thinking skills, problem-solving, and evaluation skills.

Learning Outcomes

Scientific Knowledge

- A broad-based understanding of science and scientific philosophy, interdisciplinary capacity, and an in-depth knowledge of their discipline.
- A critical understanding of the key theoretical approaches and empirical findings in the core areas of basic psychology (cognitive, developmental, social and biological psychology), and provide basic skills in applying this understanding in real-world contexts
- A broad understanding of psychology as the scientific study of human behaviour that will permit graduates with the Australian Psychological Society-approved psychology sequence either to go on to further study or to gain employment in a diverse range of settings
- A deeper level of understanding in areas of the student's choosing (cognitive, developmental, social and biological psychology, and the applied and professional areas of psychology).

Research Skills and Information Use

- The ability to think, define a problem, and to access, generate, synthesise and evaluate, and use information
- A deep understanding of the basic research methodologies used across the range of the discipline of psychology. This includes the study of statistics within the context of psychological research, research design, and the understanding of psychological test construction and interpretation.

Quantitative, Technological and Practical Skills

- Familiarity with the techniques, technologies and industry practice of their discipline
- Basic skills in the design and execution of small scale-research studies, as well as basic skill in analysis, interpretation and communication of research data within a coursework context
- Basic skills in interpersonal communication, psychological assessment, and survey design.

Communication Skills

- The ability to communicate with other scientists and with the general public
- The ability to communicate and critically discuss their understanding of the psychological research literature and of the research process using the conventions of the discipline, in both oral and written modes.

Professional Conduct

- An understanding of the highest professional, ethical and safety responsibilities
- Appreciation of the ethical issues involved in psychological research with humans, including understanding of concepts of informed consent, dual relationships, and coercion
- Appreciation of the ethical issues involved in psychological research with other animals, including understanding of harm minimisation.

Intellectual Curiosity and the Capacity for Life-long Learning

- the ability to channel their curiosity, and their willingness and preparedness to undertake life-long learning in the pursuit of quality scientific endeavour.
- active learning skills, including familiarity with learning technologies and archiving systems
- a critical and problem-solving-based approach to psychological questions.

Bioinformatics Double Major

Bioinformatics is a multidisciplinary science which applies computers to enhance our understanding of biology. Computational biology is changing the way we manage our health and the environment and how research in biological science is conducted. Biologists everywhere will increasingly require a working knowledge of this area as industries move more deeply into genetic technologies and the use of computing to simulate biological processes.

In addition to biology, study in the area of computational biology teaches skills in modern mathematics and computing, including optimisation, statistics and visualisation that will enable graduates to generate meaningful solutions from complex or large data sets. Industries searching for bioinformatics and computational biology graduates include: health, agriculture, biotechnology, pharmaceuticals and environmental management. Graduates with this kind of expertise are particularly sought after in the areas of drug design and patent management, gene therapy, plant, animal and fish breeding and farming, and environmental management for their ability to translate biological data into practical optimised solutions. The bioinformatics double major provides a broad foundation in the general sciences and delivers professional skills required in modern applied biology.

Graduates in Bioinformatics are interdisciplinary trained and do acquire transferable professional skills which are highly sought after in modern applied biological and biomedical sciences.

In-Depth Knowledge of the Field of Study

- a comprehensive and well-founded knowledge of the field of study through solving problems.
- an understanding of how other disciplines relate to the field of study through applying computational biology techniques to related problems in other fields.
- an international perspective on the field of study through using internationally accepted standards of scientific rigour and notation.

Effective Communication

- the ability to collect, analyse, and organise information and ideas, and to convey those ideas clearly and fluently, in both written and spoken forms.
- the ability to interact effectively with others in order to work towards a common outcome through cooperative learning strategies.
- the ability to select and use the appropriate level, style and means of communication.
- the ability to engage effectively and appropriately with information and communication technologies through practical use of pen, ink, and computers.

Independence and Creativity

- the ability to work and learn independently as well as cooperatively in teams.
- the ability to generate ideas and adapt innovatively to changing environments.
- the ability to identify problems, create solutions, innovate and improve current practices.

Critical Judgement

- the ability to define and analyse problems
- the ability to apply critical reasoning to issues through independent thought and informed judgement
- the ability to evaluate opinions, make decisions and to reflect critically on the justifications for decisions.

Ethical and Social Understanding

- an appreciation of the philosophical and social contexts of the discipline.
- a knowledge and respect of ethics and ethical standards in relation to a major area of Study through the experience of a discipline where the concepts of right and wrong are supported by universal and absolute standards.
- a knowledge of other cultures and times and an appreciation of cultural diversity through team working in a field of study taken by students with diverse backgrounds and interests.

Biophysics Double Major

Biophysicists use the methods of physics, chemistry, mathematics and biology to study how living organisms work. They investigate how the brain processes and stores information, the heart pumps blood, muscles contract, plants use light in photosynthesis, genes are switched on and off and many other questions. Biophysicists are especially interested in the physics and physical chemistry of biological processes and make far greater use of qualitative measurement and analysis.

Biophysics is a multidisciplinary molecular science which applies physics, chemistry and mathematics to enhance an understanding of the mechanisms underlying biological systems. The biophysics double major provides a broad foundation and also allows for specialisation in professional fields from research to industry and government departments.

Graduates in Biophysics will be interdisciplinary trained and will acquire transferable skills providing them with unique ability to blend into a large variety of working environments.

Scientific Knowledge

- A fundamental and in-depth understanding of biophysics and its philosophy and the role of physics, chemistry and mathematics in its development.
- A broad-based understanding of the role of biophysics in science and scientific philosophy.

Research Skills and Information Use

- The ability to think critically, identify a problem and access, generate, synthesise and evaluate and use information.
- Ability to apply fundamental biophysics knowledge, analytical and quantitative skills and logical processes, formal reasoning and critical evaluation to solve biophysics problems.
- Ability to apply biophysics insights unconventionally to arrive at new knowledge, that is skill at developing innovative hypotheses for advancing an understanding of the natural world.

Quantitative, Technological and Practical skills

- Skills in practical techniques, the latest technologies and interpreting results and applications of biophysics experiments.
- Development of professional laboratory skills: record keeping, instrument operation, data presentation.

Communication Skills

- The ability to communicate knowledge to the biophysics community, members of other scientific disciplines and the general public.

Intellectual Curiosity and Lifelong Learning

- An individual who has learned the importance of quality, retained and nurtured and exercised their curiosity and their willingness and preparedness to undertake lifelong learning.

Professional Conduct

- An understanding of the highest professional and ethical responsibilities in scholarship and communication.
- Practice of transparency in data acquisition processing and dissemination of results.
- Knowledge and application of safety requirement for the biophysics discipline.

Computational Science Double Major

Computational Science graduates should possess:

- a broad-based understanding of the science, philosophy and application of computers, especially in mathematical domains.
- ability to form new knowledge by application and extension of existing theories and practical techniques, including but not limited to algorithm analysis, programming, data structure design, approximation of real-world mathematics and reduction of mathematical techniques to computation
- ability to quantify design trade-offs including trading performance for accuracy and selection of alternative techniques
- ability to quantify and codify problems in at least one scientific discipline, to produce computational solutions
- ability to work from mathematical specification of a problem to a computational solution, as well as to report on finished work
- understanding of ethics issues
- understanding of the limits of current knowledge, the value of keeping up with new developments and an understanding of knowledge discovery and creation

11.2.2.2 Structure of Majors

The current university rules concerning majors has been previously outlined in Section 2.1. For the new BSc, it is recommended that majors comprise #20 of courses, of which #8 are at level 3 and the remaining #12 at levels 1-2 depending on the major. Units at levels 1 and 2 may count towards multiple majors, as may some units (#2) at level 3 in the case of two single majors and double majors (see below). It should be noted that students are required to complete #48 for a degree of which #32 must be taken from the Part A science courses. At least #12 must be taken at level 3. One course is equivalent to #2 unless otherwise specified.

The term double major will be used to specify study of #28 in two or more complementary but distinct areas for which the combination is significant. The existing model of the BSc does not allow for fields to be combined to form double majors. Double majors are recommended for cross-disciplinary areas that are too large to fit within the model for a single major.

Students can currently graduate with two single fields of study and should be able to graduate with two single majors (e.g. a BSc with majors in Physics and Chemistry) or a double major in the new program. Courses offered at level 1 and 2 will be established to encourage students to lay the foundation for as many majors as possible. Alternatively, students should be readily able to find space for non-science study (up to a total of #16) while still graduating with one major. It should be noted that the requirement for up to #16 non-science units needs to be retained to accommodate dual degree programs.

It is proposed that all students be required to declare a major and that the reduced specialization in first and second year courses will result in students having the content knowledge to be able to choose two majors or a double major at third level. Discussions within the Structure WP and with the current BACS Faculty administration team suggest that students should be channeled into a broad area of interest, e.g Biology, Computer Science, Mathematics, Chemistry, Earth Sciences, Geography, or Physics in first year, and declare a major at the commencement of their second or third year of study. It is likely that students would be better placed after their second year of study to select a major from those that fit within the plan of study taken at Level 2.

Figure 11.2 (Fold out sheet) shows the prescribed courses which will define the majors in the EPSA Faculty.

Figure 11.2 List of courses that define the respective majors in the Faculty of Engineering, Physical Sciences and Architecture.

Faculty of Engineering, Physical Sciences and Architecture - 1st, 2nd, 3rd Year Courses

Mathematics and Statistics Major		**1st year courses**	**2nd year courses**			**3rd year course**	
	MATH1051	Calculus and Linear Algebra I	MATH2000	Calculus and Linear Algebra II	BIOL3014	Advanced Bioinformatics: Biological Sequence and Microarray Data Analysis	
	MATH1052	Multivariate Calculus and ODE's	MATH2100	Applied Mathematical Analysis	COMP3506	Algorithms and Data Structures	
			MATH2200	Scientific Computing and Numerical Analysis	MATH3090	Financial Mathematics	
		#4 at level 1.	MATH2210	Introduction to Computational Biology	MATH3101	Bifurcation and Chaos	
			MATH2301	Abstract and Linear Algebra and Number Theory	MATH3102	Methods and Models of Applied Mathematics	
			MATH2302	Discrete Mathematics II: Theory and Applications	MATH3103	Algebraic Methods in Math Phys #	
			MATH2400	Mathematical Analysis	MATH3104	Mathematical Biology	
			PHYS2100	Dynamics, Chaos, and Special Relativity	MATH3201	Scientific Computing: Advanced Techniques and Applications	
			STAT2003	Probability and Statistics	MATH3202	Operations Research and Numerical Optimization	
			STAT2004	Statistical Modelling and Analysis	MATH3203	Visualization and Modelling in Scientific Computing	
					MATH3301	Graph Theory and Geometry *	
					MATH3302	Coding and Cryptology	
					MATH3303	Algebra and Number Theory	
					MATH3306	Set Theory and Mathematical Logic *	
					MATH3401	Complex Analysis	
					MATH3402	Functional Analysis	
					MATH3403	Partial Differential Equations	
					MATH3404	Optimization Theory	NOTES
					MATH3500	Research project in Mathematical Sciences	Streams in pure and applied mathematics and statistics are decided by choice of 2nd and 3rd year courses
					STAT3001	Mathematical Statistics	
					STAT3002	Applied Statistics	# Course offered in odd years only
					STAT3003	Experimental Design	* Course offered in even years only
					STAT3004	Stochastic Processes and Models	

Physics Major		**1st year courses**				**3rd year courses**	
	PHYS1001	Mechanics and Thermal Physics	PHYS2020	Thermodynamics and Condensed Matter Physics	PHYS3020	Statistical Mechanics	
	PHYS1002	Electromagnetism, Optics, Relativity and Quntum Physics I	PHYS2041	Quantum Physics	PHYS3050	Electromagnetic Theory III	
	PHYS1171	Physical Basis of Biological Systems	PHYS2082	Astrophysics and Space Science II		and 4# from:	
	PHYS1090	Introductory General Physics	PHYS2090	Optical Physics			
			PHYS2100	Dynamics, Chaos and Special Relativity	PHYS3040	Quantum Physics	
			BPHY2XXX	Biophysics	PHYS3071	Computational Physics	
			PHYS2810	Electronics and Circuit Theory	PHYS3080	Astrophysics III	NOTES
		#4 level 1 MATH also required.			BPHY2XXX	Special Topics in Biophysics	A second major in Maths is possible with double counting of level 1 and 2 courses permitted (No other majors combinations are possible due to Math requirements?)
				#4 level 2 MATH (2000 and 2001) also required as co-requisites.	PHYS3810	Experimental Physics IIIA	
					PHYS3820	Experimental Physics IIIB	

Computer Science Major		**1st year courses**		**2nd year courses**		**3rd year courses**
	CSSE1000	Introduction to Computer Systems	COMP2303	Network and Operating System Principles	COMP3506	Algorithms and Data Structures plus
	CSSE1001	Introduction to Software Engineering I	CSSE2002	Programming in the Large		
						#6 from level 3 BInfTech and BE lists which includes, but is not limited to:
				plus #2 from an extended list offered in the BE and BInfTech including but not limited to:		

					COMP3201	Computer Graphics	
			COMP2304	Programming for Engineering Systems	COMP3402	Concurrent and Real-Time Systems	
			COMP2506	Human-Computer Interaction	COMP3301	Operating Systems Architecture	
			CSSE2003	Software Engineering Studio	COMS3000	Information Security	
			INFS1200	Introduction to Information Systems	COMS3200	Computer Networks I	
			INFS2200	Relational Database Systems	COMP3702	Artificial Intelligence	
					CSSE3002	The Software Process	NOTES Computer science currrently have all BInf Tech courses (level 1 - 3) and many of the BE (computer systems and software) and available to computer science majors. All courses are currently under review as part of a school restructure.
				[to go further with INFS, need to take one of INFS1200/2200 in a free elective slot]	CSSE3003	Software Specification	
					INFS3101	Ontology and the Semantic Web	
				#2 level 1 MATH1061 Discrete Mathematics also required	INFS3200	Advanced Database Systems	
					INFS3202	Web Information Systems	
					INFS3204	Service-Orientated Architectures	

Geology and Earth Sciences Major		**1st year courses**		**2nd year courses**		**3rd year course**	
	ERTH1000	Planet Earth: Its Global Environments	ERTH2050	Field Geology	ERTH3001	Ore Deposits and Exploration Geology	
	ERTH1001	Planet Earth: Elements of Earth Science			ERTH3020	Introduction to Exploration Geophysics	
				and #6 from	ERTH3021	Techniques of Exploration Geophysics	
					ERTH3050	Field Geology: Mapping in Metamorphic Terrains	
			ERTH2002	Palaeobiology	ERTH3060	Applied Structural Analysis: Underground and Surface Techniques #	
			ERTH2003	Sedimentary Petrology and Stratigraphy	ERTH3101	Isotope Geochemistry	
			ERTH2004	Deformation and Structural Geology	ERTH3103	Sedimentary Environments and Facies Models *	
			ERTH2005	Mineralogy	ERTH3104	Global Tectonics and Crustal Evolution *	
			ERTH2006	Igneous and Metamorphic Petrology	ERTH3110	Marine Geology and Oceanography *	
					ERTH3130	Geochemistry of Surficial Environments *	
					ERTH3203	Energy Resources and Fossil Fuels Geology #	
					ERTH3205	Igneous and Metamorphic Petrology and Geochemistry	NOTES # Course offered in odd years only * Course offered in even years only
					ERTH3212	Geology of Coral Reefs	
					ERTH3230	Environmental Geology and Groundwater #	

Geographical Sciences Major		**1st year courses**		**2nd year courses**		**3rd year course**
	GEOS1100	Environment and Society	GEOM2000	Introduction to Remote Sensing of Environment	GEOM3001	Advanced Remote Sensing of Environment
	GEOM1000	Geographical Information and Analysis	GEOS2100	Physical Geography	GEOM3002	Advanced Geographical Information Systems
			GEOM2001	Geographical Information Systems	GEOM3005	Computing in Geographical Information Systems
			GEOS2101	Climatology and Hydrology	GEOS3101	Advanced Climatology
			GEOS2103	Biogeography and Geomorphology	GEOS3400	Special Topics
			GEOG2205	Global Population Issues	CONS3017	Landscape Ecology
			GEOG2206	Medical Geography	ENVM3200	Coastal Processess and Management
			GEOM2002	Geographic Information Systems for Mgmt and Planning	ENVM3201	Catchment Processes and Management
			ENVM2200	Resource Management and Environmental Planning	ENVM3202	Coral Reef Processess and Management
					ENVM3203	Environment Impact Assessment
					ENVM3204	Great Barrier Reef: Environment, Science and Management
					ENVM3205	International Field Studies
					GEOG3205	Applied Demography
					GEOS3102	Global Change: Problems and Prospects

Developing majors with this defined structure is consistent with the responses from the BSc Review Student Survey in which students indicated the desire for a more defined pathway to majors. It is also consistent with Goal 2 of the UQ Teaching and Learning Enhancement Plan.

11.3 Guidelines for Curriculum Development Under the Structured Model

In the development of the curriculum from Levels 1-3, the following will be taken into consideration:

1. Many of the valuable recommendations from BIO2010[2] and other sources, which pertain both to content and pedagogy, will be incorporated.
2. Mapping graduate attributes from programs to majors to courses will be carefully monitored. In areas such as communication, laboratory skills, problem solving etc, this will have consequences for course structure and pedagogy. This will be managed by a majors curriculum team.
3. Cross-disciplinary study between the biological, physical and social sciences will be explored at every opportunity.
4. Optimal integration between the BSc curriculum and the proposed Honours program (Section 10) should be sought. For example, where Honours provides for another layer of specialized coursework, this may be displaced from third level as a result of the increase in breadth required. If the University subsequently opts for a 2-year Masters program to replace Honours, this will be very compatible with the Structured Model and the offerings at third level will need to be revised to accommodate this model.
5. Associated pedagogical development will incorporate wide ranging opportunities for students to engage in the practice of science through laboratory, field work and industrial experiences. Opportunities for interactions with students and staff will be embedded into the curriculum.

This final point supports fully supports Goal 1 of the UQ Teaching and Learning Enhancement Plan and the model for incorporating an undergraduate research experience for students from first year, which is one of the significant initiatives foreshadowed by the review process.

11.4 All Level 1 Courses

Level 1 courses will be developed according to the following principles:

1. All BSc students will have the equivalent of Year 12 level in biology, chemistry, mathematics B and physics on graduation from the BSc (note that maths B is a compulsory entry requirement). This is a new initiative. At present, students are not required to attain competence in all these areas and this reflects the commitment of the BSc stakeholder at UQ to ensuring BSc students are equipped with an appropriate breadth of education prior to graduating with a science degree.
2. Introductory courses will be available for students in chemistry, physics, biology and mathematics. This will facilitate achievement of Principle No 1 (above).
3. An introductory course in biology will be offered to students who have not completed Year 12 biology and who do not wish to enroll in any other biology course. This course will provide a broad based overview of biology and will particularly target student in physical sciences, mathematics and psychology. Students wishing to undertake biology courses towards a major will be permitted to enroll directly in one or more of the Level 1 BIOL courses without having completed Year 12 biology.

4. As is the case currently, the introductory courses in physics and chemistry will be compulsory for students who have not completed the relevant Year 12 subject and wish to proceed to further study in the area. Similary the introductory mathematics course will be taken by students who completed maths B but not maths C at high school and wish to continue with further studies in mathematics and physics.
5. First year courses, excluding introductory courses, will build on the senior secondary syllabus and not repeat it, so that students recognise these courses as new, university-level courses distinct and clearly differentiated from secondary study.
6. The two new compulsory courses, (i) "Foundations of Science" and (ii) Analysis of Scientific Data and Experiments, will involve consolidation of Year 12 mathematics. They will also provide an introduction to the principles of science and provide a basis for the requirement that BSc graduates will have increased quantitative skills. The compulsory courses are an opportunity to induct students to the scholarship of science and will be the focal point for both this,and cohort building experiences.
7. Terminating level 1 courses will be minimised.
8. Interdisciplinarity will be emphasised in all courses.
9. The majors will be designed such that most students will have the space and flexibility to take some non-science courses (electives) if desired. This is assisted by the limited offering of only 2 first year courses in the following broad first year areas of interest: computer science, mathematics, chemistry, geography, earth sciences and physics. The exception is biology which is offering 3 first year courses.
10. A substantial reduction in biology courses (6 to 3) will be made in order to ensure greater breadth of study at level 1, space for introductory courses if needed, and space for the compulsory foundational/quantitative courses.
11. First year courses (including but not limited to the compulsory courses) will endeavour to promote formation of student cohorts through formalised social interactions, formative and summative assessment items, and other mechanisms to encourage students to become part of the community of scientists. This directly supports Goal 4 of the UQ Teaching and Learning Enhancement Plan .

Based on the above guidelines, the proposed Level 1 Courses (not including introductory courses) are as follows:

	New or Retained	Existing
Foundations of Science (compulsory)	1	0
Analysis of Scientific Data and Experiments (compulsory)	1	1
Mathematics	2	4
Computer Science	2	4
Chemistry	2	2
Physics	3	3
Biology	3	6
Earth Science	2	2
Geographical Science	2	2
Psychology	3	3
TOTAL	21	27

The features of the new course are (1) a significant reduction in courses [Biology (from 6 to 3), Mathematics and Computer Science (from 4 to 2)] and (2) the introduction of two compulsory courses.

11.5 New Level 1 Compulsory Courses

Discussions within the Structure of the BSc, Student Experience and Pedagogy Working Parties took into account the recommendations of the report "BIO2010. Transforming Undergraduate Education for Future Research Biologists[2]" in developing two new first level compulsory induction/ quantitative courses. The key features of these courses are that they will:

- Provide an introduction to the principles of science and demonstrate the importance of interdisciplinary study, and
- Provide an introduction to quantitative, i.e. mathematics, computational, informatics and statistical knowledge required by scientists

A Working Party of representatives from the physical and biological sciences was established to develop the courses so that they fulfil the following criteria:

1. Establish and apply quantitative skills in modelling and applied mathematics;
2. Provide basic computer science skills in programming & algorithms in the context of all sciences including but not limited to biology via problem-based learning;
3. Emphasize interdisciplinarity and team teaching by all disciplines, including biology, chemistry, geography;
4. Be relevant to all students in biological, physical, geographical, computer and mathematical sciences;
5. Present a brief introduction on the history and philosophy of science.

Two critical success factors were identified during planning and development of the (i) Foundations of Science and (ii) Analysis of Scientific Data and Experiments courses which have had a substantial influence on how the course will be delivered. First, students will need to be exposed to mathematical and computational concepts within a context that is relevant to them. Second, given the diversity of student backgrounds, and the fact that these courses are compulsory, careful attention will need to be paid to the pace of delivery. Therefore, it is proposed that the courses be broken down into several modules, each focused around an example of a problem in science and showing how mathematical and computational approaches can be applied as part of the solution.

Team teaching will expose students to how multidisciplinary science is undertaken from the start: A scientist will introduce the example; a mathematician, computer scientist or computational scientist will develop the theory needed to solve the problem; and the class will work in groups to arrive at a solution.

Whilst the two compulsory courses will be established, if a discipline offers an equivalent course, required for professional reasons, this may be substituted for the compulsory quantitative course. Psychology currently has a compulsory quantitative and methods course at first year. This is required for the degree to be accredited by the Australian Psychological Society. Psychology students will do only the Foundations of Science course and will be exempt from the Analysis of Scientific Data and Experiments course on the basis of its similarity in terms of the statistics content in PSYC1040 Psychological Research Methodology I.

11.5.1 Foundations of Science course

This course will be an induction to science, covering what it means to be a scientist: how scientists work; how knowledge is developed; professional practice and ethics. It will build an understanding of the overall picture of the processes of science and current big issues in science by examples, which should be used to develop computational, computer science and mathematical basics required for developing numeracy in applied sciences.

Coverage of the big-picture issues will aim at giving a system-level view of science as a whole, to promote a multi-disciplinary perspective and an understanding of how science meets the broader needs of society. Intertwined with this system-level view, there will be a few teasers, hot topics in current scientific research, to encourage students to think beyond the introductory sequence.

Careful choice of examples as motivators for mathematical and computational techniques will address the induction goals. The examples should also make the course as relevant as possible to the full range of science disciplines covered at UQ. A mechanism for ensuring this breadth is to use multiple examples wherever possible, to illustrate the generality of the principles being developed. This implies a team-teaching approach.

Mathematical, computational and computer science techniques and principles will be developed in line with the recommendations of *BIO2010*[2].

On a global level, there is a well documented “flight from science” highlighted by a significant reduction in the numbers of students taking the “enabling sciences”, particularly mathematics. One of the more alarming (but less well-documented) consequences of this “fright of numbers” is that the basic mathematical and quantitative skills of many students in the Life Sciences is below the level required for the quantitative data acquisition and analysis that underpins fundamental scientific activity, education and research. Thus one of the most pressing challenges facing modern undergraduate science education is to embed the interdisciplinarity that underpins modern research into the teaching of science. There is an urgent need to overcome the common perception of both educators and students that the life, physical, quantitative and information sciences are completely separate disciplines that can be studied in isolation from each other. The result of this disconnect is that students fail to realise the relevance of these sciences in their chosen disciplines, which in turn places them in their career paths with serious deficits.

It is critical to recognise that first year at university is very much a transition phase for students and represents not only a paradigm shift in the way they acquire, process and value information, but also a significant milestone in their progression to adulthood. We recognise that students entering the BSc at UQ have level B maths, yet we continually find that students have poor numeracy skills as evidenced in various forms of summative assessment. This suggests that for whatever reasons, students typically find it difficult to relate mathematical (and other) principles that they have learned at school to the learning activities in the first year at university. Thus the delivery of the Foundations of Science course should acknowledge and reinforce the content that the students have already learned in High School. It is essential to “value-add” to their existing knowledge base by contextualising and embedding it in their chosen professional paths.

Thus in the planning of both the compulsory first level courses one should look back to the high school curriculum and forwards to the second year courses in order to pitch the course at the appropriate level that will benefit both the students and the academics teaching into the second level courses.

11.5.1.1 Delivery of the Foundations of Science course

Two critical success factors were identified during planning and development for this course which have had a substantial influence on how the course is to be delivered. First, students will need to be exposed to mathematical and computational concepts within a context that is relevant to them. Second, given the diversity of student backgrounds, and the fact that this course is compulsory, careful attention needs to be paid to the pace of delivery. Therefore, it is proposed that the course will be broken down into several modules, each focused around an example of a problem in science and how mathematical and computational approaches can help solve it. Modules will also address the induction issues, including the professional, ethical practice of science.

Team teaching will expose students to how multidisciplinary research is conducted from the start. A biologist or other scientist will introduce and motivate the example. A mathematician, computer scientist or computational scientist will develop the theory needed to solve the problem, and the class will work in groups to arrive at a solution.

Modules covering a basic introduction to scientific methods, exponential growth and DNA sequence analysis will be used as a starting point for discussion. Other modules could cover a range of topics such as genotypic selection, with emphasis on fitting scientific problems to the range of computational and mathematical techniques we need to cover. It is hoped to expand the examples to include coverage of big-picture issues, such as ecology and environment.

11.5.1.2 Sample modules

Induction

Working in groups will, in part, cover the professionalism requirement for the course. The approach to problem-solving in which relevant theory is understood in the context in which it is applied, addresses understanding how knowledge is developed, and how scientists work. Ethics will be covered separately. One approach is to take on a problem which is in the news such as global warming, tobacco and health, or stem cell research, and have the students (in groups) develop a response to the public debate in the form of a poster.

Time required: 1 week of lectures; poster presentation.

Timing: Lectures in the first week, poster due at the end to allow time to understand the issues; mid-semester tutorial or workshop to encourage progress.

Exponential Growth

In this module motivational examples may be taken from a number of sciences. In biology, population growth can be assessed. The same issue can be looked at from a different angle in geography. In physics, exponential decay can illustrate that the same principles apply in a different way.

The content can be developed by modelling a real-world scenario, and reducing it to finite difference equations. Computer programming can be introduced as a technique for solving the problem, as can statistical inference.

Students working in groups can present their results using graphs, and by reporting critically on the validity of the approach.

Time required: 2 weeks of lectures and pracs; results presented in workshops.

Timing: lectures in weeks 2-3, results in week 3.

Gene Sequencing

This module will be based on a biological example and is aimed at building algorithmic skills, extending programming taught in the exponential growth module. It is intended as motivator for students to become interested in research.

The general principles of gene sequencing must be related to topics being taught in first level biology courses: the genetic code, DNA and RNA, why pattern matching is useful. Next, some computational techniques will be introduced: more programming principles including algorithms and data structures, efficiency measures, pattern matching techniques (exact matches, approximate matches, standard algorithms).

To put it all together, students should see a standard algorithm at work, and code their own variation.

Students working in groups should present their findings in a workshop.

Time required: 3 weeks of lectures and practicals; results presented in workshops.

Timing: lectures in weeks 4-6, results in week 7.

11.5.1.3 Theory and techniques to cover

By the end of the course, it will be expected that the students will have covered:

1. Induction: working as a scientist, how knowledge is developed, professionalism and ethics;
2. Numeracy, developed through practical examples within each module;
3. Modelling – especially to give the mathematically-inclined students a handle on application;
4. A sufficient range of mathematical techniques to build on for future empirical and theoretical work, including some calculus, series, sequences and elements;
5. Elements of statistical inference;
6. Algorithmic techniques including elements of efficiency analysis, conversion of real-world and mathematical problem descriptions to code and data structures, testing and justification of techniques;
7. Programming in a real language – one that can apply in many situations, and which provides the concepts for learning other languages;
8. Familiarity with public databases relevant to areas of science.

All of these should be covered in a style which emphasises integration of theory and practice from the computational and mathematical side with other sciences and communication skills. Communication should be in the context of presenting results; basic skills should be developed through courses offered by the library.

Applications from the sciences can include but are not limited to:

1. Gene sequencing
2. Natural selection and drug resistance
3. Examples from physiology (blood flow rates, oxygen diffusion)
4. Genetic drift
5. Radioactive half-life
6. Population growth
7. Evolution, planetary catastrophe and extinction
8. Global problems – climate change, land degradation, desertification

11.5.1.4 Detail versus effectiveness

It is important to realize that given the range of expectations of the course, namely, induction to science; introduction to quantitative and computational methods; sufficient breadth of examples to appeal to all scientists; enough new material to encourage the traditionally mathophobic students, that it would be a mistake to attempt to cover a wide range of skills and techniques.

It may be better to cover a small number thoroughly than a large number without any deep understanding. Accordingly, a list of possible topics is provided here with the understanding that only those necessary for compelling examples will actually be covered. The goal is to produce students ready to make intelligent choices about future course selection, and to know when and how to consult someone else about skills they have not mastered (e.g., if they are doing an experiment requiring a computer analysis of data, they should either be able to do it themselves in the best case, or at least have the vocabulary to ask someone else for help).

Some ideas of what may be needed in level 2 courses are also provided, as a guide as to how far it would be useful to go in the two compulsory courses.

Possible Topics to Cover

By the end of the course, we expect students to have covered a reasonable subset of the following, driven by examples:

1. Series, sequences – especially Taylor Series which naturally leads to numerical approximations of DEs etc. (see below), Euler's method etc
2. Linear algebra, matrices, particularly as it applies to simultaneous equations
3. Optimisation (linear programming, problem formulation)
4. Basic calculus, including exponential growth and how it applies to a number of sciences, interpretation of equations, integration
5. Cycles, processes that cycle – important in all sorts of physical systems – remind them about sin/cos and complex numbers

Possible Topics at Level 2

The mathematics standard required for an understanding of biological processes is quite simple. Essentially it requires a familiarity with the form of various equations. For the general Second Year Biology Courses we would want the students to be able to understand the form and be comfortable with the manipulation of the following equations.

1. Nernst Equation
2. Goldman Hodgkin Katz equation
3 Henderson Hasselbalch equation
4. Exponential rise and decay
5. Statistics: mean, median, mode, standard error, standard deviation, normal distribution
6. Receptor binding equations

11.5.2 Analysis of Scientific Data and Experiments Course

11.5.2.1 Course rationale

This course will develop techniques to support evidence-based science through experimental method and modelling. The course will carry on from the first course, Foundations of Science, emphasizing examples which are meaningful to the full range of science students, and taking into account that the majority are biologists.

The four themes to be developed in the course are

- Experimental Design
- Data Management
- Visualization and Exploratory Data Analysis
- Statistical Inference

11.5.5.2 Course structure

The overall structure of the Scientific Data and Experiments course will be example-driven.

Experiments and data will come from a number of sources:

Examples from researchers at UQ.

These provide good examples of real experiments and data but also showcase to students the types of research being undertaken at UQ.

Examples from student laboratory work in other courses

We have found it effective to have students work with data from their own experiments. With a more streamlined first-year program we will aim to draw directly on data from laboratory work in biology, chemistry, physics, etc.

Examples from the scientific literature

As indicated in the learning objectives below, a key goal of the course is to build on the first course by showing the role of data analysis and statistics in scientific research and publication.

In each case the examples will show students the relevance and importance of experimental design and data analysis to their own areas of interest.

11.5.2.3 Content selection and pedagogy

The approach in the course will to cover a small range of analytical techniques, sufficient to cover interesting examples, rather than to attempt to cover the maximum possible range of techniques. Students should complete the course with a clear idea of how to quantify and test ideas experimentally, but not a comprehensive mastery; mastery of these techniques should be pursued in subsequent courses.

Problem-based learning will be the major strategy employed, given the focus on relevant examples. Team teaching will be an important feature of the course as examples should be meaningful, and derive from other courses the students are likely to be taking.

Presented here samples of the examples which could be covered. Detail should vary according to the personnel assigned to the course

11.5.2.4 Course outcomes

By the end of the course, students will be expected to

1. Understand the nature of scientific data and the need for statistical analysis.
2. Know how to represent, store and access data in a relational database.
3. Identify factors related to the design of a scientific study, including sample size and power, the need for comparative designs, and ethical considerations.
4. Appreciate the role of data analysis and statistics in scientific research and publication.
5. Demonstrate a foundational knowledge of statistical methods by being able to carry out simple statistical procedures by hand.
6. Use software appropriately and confidently for visualization and exploratory data analysis and to make relevant statistical conclusions.

7. Effectively and appropriately communicate insights from data as evidence within a given context for both a professional and lay audience.

11.5.3 Proposed Earth Systems Science Course

A proposal to encourage students to take an Earth Systems science course addressing global scale science was also raised in the review process. There is strong support from most BSc stakeholders that in order to achieve the goal of interdisciplinarity and a broad-based education in science, not only is basic knowledge in biology, chemistry and physics needed but also a matching understanding of the core 'big ideas' in the Geographical and Geological sciences is essential. However, whilst this course is recommended, it was not agreed that this should be included as a compulsory first level course, but rather, that it should form a non-compulsory second level offering.

It is proposed that the curriculum would include the following core elements:

- Earth, atmosphere and oceans – evolution, materials, processes, present state, future scenarios.
- Plate tectonics
- Earth 'catastrophies' and extinction events
- The hydrological cycle
- Geomorphological and pedological processes and patterns
- Global biogeography (biomes, realms, etc)
- Humans as agents of global environmental change – past, present and future.
- Contemporary big picture issues in global systems – eg climate change, global warming and sea level rise, land degradation and desertification, water – quantity, quality, distribution and conflicts.
- Techniques and resources for assessing and monitoring earth systems (eg. remote sensing)

11.6 The Undergraduate Research Apprenticeship Experience

In addition to the development of the new compulsory first level courses described above, the BSC Review has also been the catalyst for the development of proposals for an Undergraduate Research Apprenticeship Experience Model from both BACS and EPSA. One of the major outcomes of the combined Pedagogy and Student Experience Working Party (see later for full report) is that students should have: (i) the opportunity to be critical thinkers who value the opportunity for open-ended inquiry and (ii) who have some insight into how scientific knowledge is generated. The two proposals outlined below have been developed in parallel, however, the EPSA model is more advanced in that they have outlined a detailed plan of how the model will be implemented. The BACS model, on the other hand, outlines the rationale and strategy behind conceptualizing the idea rather than fine detail of implementation. In both cases, the common theme is support for a program that involves mentoring of undergraduates from the time they start university and the opportunity to be involved in laboratory research in from Year 1 of their degree and this concept was strongly endorsed at the BSc Review Symposium.

11.6.1 BACS Model for the Undergraduate Research Apprenticeship Experience

The undergraduate experience is arguably the most important in shaping the future career trajectories of our students. This is the period where students translate their high school experiences into professional career decisions, as their individual curiosity and motivation are maturing. It is here that early exposure to the widest possible range of disciplines and practical experiences will have the most impact. In the face of a reduction in the number of students entering both undergraduate science and research as a career option, we must urgently initiate strategies to engage and retain students in science. This can be achieved by a research experience in a mentored apprenticeship model in the context of an authentic laboratory/field during their formative undergraduate years. Such an experience is critical to:

- Achieve an increased level of student engagement to complement other strategies for motivating students who are in large first year classes
- Show students the functional/practical relevance of the core content of their course material
- Provide students with a personal experience of doing science so that they can plan their future studies from a more informed perspective
- Minimize the attrition rate from the first year science cohort
- Provide a mentored cohort experience to engage and support under-represented groups such as indigenous and international students
- Actively build on the tremendous investment in institutes at UQ by increasing the direct involvement of these research academics in the undergraduate science program
- Increase the number of students proceeding to postgraduate education as the next step to a worthwhile and personally rewarding career trajectory in science.

The undergraduate science curriculum is a critical determinant in the future career path choices of our students and preparing them for these careers. It is the time when we educate our scientists, health professionals, primary and secondary teachers, university academics and future postgraduate students. This represents a crucial inflection point in the education continuum. The undergraduate curriculum must provide students with the necessary skills and knowledge-base that they require in order to confidently interact with industry, research organizations and government so that their transition from university into the professional sector is seamless. To achieve such an important endpoint, we must transform our teaching praxis and to maximize the development of the scientific talent of our students.

The current BACS proposal addresses a strategy to enhance the engagement of our undergraduate students in science by implementing a *mentored apprenticeship model*. This approach is based on the success of our Advanced Studies in Science Program (see Section 7) and similar programs in the USA. The aim is to provide all undergraduate science students at UQ with an equal opportunity to engage in an inquiry-based and authentic research experience during the entire 3 years of their undergraduate studies

A strong and visible connection between research and undergraduate education is critical if student learning is to be based on discovery guided by mentoring, rather than the passive transmission of knowledge (Boyer Report, 1999). The earlier this occurs in the undergraduate career the better. This was most clearly articulated in the most powerful recommendation stemming from the US National Research Council (NRC; 1999) report entitled ‘Transforming Undergraduate Education in Science, Mathematics, Engineering and Technology.’ In this report the NRC stated that “Institutions of higher education should provide diverse opportunities for all undergraduates to study science, mathematics, engineering, and technology as practised by scientists and engineers, and as early in their academic careers as possible.”

In the Australian context, we held a conference at UQ entitled “Science Teaching & Research: Which way forward for Australian universities?” (University of Queensland, 2004) that came to a similar conclusion. We identified the following key issues to address: (i) an alarming decline in university enrolments in the traditional enabling sciences such as chemistry, physics and mathematics; (ii) a corresponding further decline in high school science enrolments; (iii) increasing university student/staff ratios that are reducing the quality of the undergraduate science experience; and (iv) the likely inability of the current enrolments and structures to cope with the projected future demand for scientists.[4] A key to solving these issues is the engagement and retention of students in the undergraduate and postgraduate science environment.

At UQ we have long recognized the need for students to experience the research environment. As a result, we initiated the very successful Advanced Studies in Science program that has been available for the last five years and provides a mentored research experience for a small elite cohort (~40 per year) of our best science students at UQ, over the 3 years of their undergraduate program. This proposal extends and builds on that program by providing a model that will be accessible to all undergraduate UQ science students. The key feature of the proposed model is a three-year experience of cutting edge research in science, mentored by UQ's successful researchers. Here the students enter into an 'apprenticeship' that commences in first year and continues throughout their undergraduate program. The advantage of this model is that it also fosters small cohort interactions of the undergraduate students, not only within their peer groupings across all of the undergraduate research experience program, but also with young scientists at the levels of Honours postgraduate students and the university research community in general.

11.6.1.1 The Mentored Apprenticeship Model

In the review of the BSc, we have been provided with a unique opportunity to address some of the significant issues confronting the scientific community. In particular, it is our responsibility to provide the graduates with the opportunity to be motivated by scientists who are instilled with a curiosity-driven approach to practical science and are prepared to make a lifelong contribution to the enhancement of the wider community. This proposal extends elements of the UQ Advanced Studies program (which will still continue for an elite group of students) combined with the University of Michigan's Undergraduate Research Opportunity Program (UROP)[5] to an apprenticeship model, contextualized for Australian students and research, throughout the 3 years of the undergraduate BSc program. The key feature will be the active involvement of the undergraduate students at each level in the activities of the host research groups. This will provide an apprenticeship approach to bringing the students directly into the culture of science research and the opportunities for both mentor/mentee and peer interactions at all levels encompassed by the research team. This experience will break down the traditional barrier between students and research academics, will supplement the traditional practical components of their other courses so that they are 'doing' more science and provide an opportunity to talk more about science. All of this will provide a programmatic development of the enculturation of the undergraduate students into the science research community.

The proposal is to introduce a #1 unit course, which will be open to all students, in each of years 1 and 2 of the BSc program (designated RESE1XXX and RESE2XXX). This will then be followed by a research project carried out in a research laboratory in year 3 (summer semester between years 2 and 3 or in either semester of year 3). These proposed courses will complement research-led learning activities in the lecture and practical components of the other courses that the students are studying at each level. It is anticipated that approximately 20% of the entire student cohort (~200) will take up this opportunity, in the first instance.

In the first semester of year 1, the students will attend a series of seminars by inspiring researchers from a broad range of fields of science, with opportunities to meet informally with the speaker after the seminar. This will be held in the first semester of year 1 (as is currently a feature of the Advanced Study Program in Science).

[4] *http://www.brightminds.uq.edu.au/TRC/report.htm*

[5] *http://www.lsa.umich.edu/urop/about/*

Examples of student activities in the host laboratory in second semester year 1 and in year 2 are:

- Attend research group meetings
- Participate in journal clubs
- Be involved in general laboratory duties, such as preparing solutions, cataloguing, stocking of laboratories
- Data management
- Additional activities relevant to the individual's capabilities and level of engagement

In addition, in order to create a cohort experience, the Faculties will host the following for the year 1 and 2 students:

- Regular guest lectures and linked student gatherings
- Workshops and debates

In year 3 (or the preceding summer semester), the students will undertake a research project (#2 unit course) in the host laboratory, using the model of the current summer vacation research projects.

The Faculties will host a *student conference* (with key features organized by the students themselves) with presentations by the students of their year 3 project results, as well as reports by the year 1 and 2 students on the research activities of their host laboratories. This again builds on the successful model that is used for the Advanced Study Program in Science.

11.6.1.2 Catering for cohort diversity

One of the most powerful aspects of this model is that it provides a mechanism to cater for the cohort diversity at UQ. The Sciences at UQ have an impressive record of attracting high numbers of OP1-3 students and key to retaining our position is the development of new approaches to enhance the science student experience. In considering such strategies it is important to realize that the undergraduate BSc cohort falls into three broad categories:

1. Those students who are seeking a general education with no clear career goal
2. Those students who are positioning themselves to enter a professional degree (e.g. medicine, pharmacy, physiotherapy, law, etc), and
3. Those students who see science as a worthwhile career and will proceed to Honours and probably a PhD.

There is a significant cohort of almost 30% of the BSc students who elect to participate in dual degree programs (e.g. BSc/BA, BEng/BSc, BSc/BLaws, BSc/BEduc). These students may be in any of the above categories and highlight the rich and diverse backgrounds of our students. These factors will require us to be increasingly sensitive to the needs of the diverse student body to ensure they receive a quality and appropriate undergraduate experience at UQ. We must put significant programs in place to ensure that we attract and retain the best students in science.

In addition, there are two key target sub-cohorts that the mentored apprenticeship model can specifically accommodate. The first is *Indigenous students* who at the present time comprise ~3.0% of the Queensland State population but only 0.01% of the university student body. Success in addressing this issue is critical to underpin the social cohesion of the Australian community. We must allow indigenous students to bring their rich cultural background to the learning process and to provide role models for other students. This is a challenge in the context of large undergraduate classes where individuals can become alienated. The chance to get individual mentoring and small group peer interactions via "apprenticeships" is a powerful pathway for us to provide pathways where success in the area of research engagement can help to drive a positive overall learning experience for these students.

The second sub-cohort is the *International students*. In the introduction to the Review of the Bachelor of Science degree, our success in attracting high quality international students was emphasized. These students bring a wealth of cultural backgrounds to the university and help to internationalize the learning experience for Australian students. Their contribution further highlights our responsibility to make this student body feel welcome and appreciated from their first day on campus. However, most of these students choose to enroll in professional courses rather than basic research programs, which deprives us of a pool of potentially excellent post-graduate scholars.

International and domestic students now make a significant contribution to our income and it is our responsibility to ensure that both the perception and the reality of the student experience is one of "value for money". This is not easy to sell when the student is faced by large impersonal classes with little hope of significant small group work until the last year of their undergraduate program. If we are to continue to attract the best students either locally or internationally we need new ways to differentiate the UQ experience. Indeed, if the static and slightly declining numbers of students entering our postgraduate programs is a reflection of undergraduate education, they suggest that the existing system is under stress and therefore vulnerable to further contraction. The consequences for the tertiary sector and the wider community are serious. The personal mentor/ apprentice approach will provide the international students with the opportunity to actively engage in the research community and integrate into the broader university community.

11.6.1.3 Participating research scientists

Over the last five years, the scientific milieu at UQ has undergone significant change. The most dramatic evidence of this change is seen in the emergence of Institutes. Indeed, the three faculties of BACS, EPSA and SBS have given rise to four new research Institutes on the St Lucia campus: the Queensland Bioscience Precinct which includes the Institute of Molecular Bioscience and CSIRO (2001; 47 research group leaders), the Sustainable Minerals Institute (2004; 47 group leaders); the Australian Institute of Bioengineering and Nanotechnology (due for completion August 2006) and the Queensland Brain Institute (due for completion mid-2007). Both these latter institutes are expected to have staffing compliments of approximately 200 scientists each, at full capacity. Collectively these developments add a scientific workforce that is comparable to the combined staff of both BACS and EPSA. In addition, the new UQ Clinical Sciences Institute at the Royal Brisbane Hospital complex is due for completion in late 2007 and the Social Science Research Centre will commence operations in the same year. The academic teaching and research staff in the Schools of the relevant Faculties and the almost equal number of scientists in these research institutes will have the opportunity to participate in the research apprenticeship and mentorship model for the undergraduate science students. Both the students and the research groups will have reciprocal benefits from the ongoing and programmatic development of their research experience, under the mentorship of the research staff.

The main research experience available to our undergraduate cohort at present is BIOL3012, a 2 unit course in year 3 where students undertake a ~70 hour project in a host lab. Currently there are approximately 180 students undertaking this course each year. Students that complete this course frequently go on to do Honours in the host laboratory. The problem with this approach is that the students are significantly under-prepared for the research experience, both from a practical and psychological perspective. This typically results in levels of productivity and research satisfaction that are lower than one would expect at the third year level. The key advantage of the mentored apprenticeship model is that it allows both the academics and students to establish a working partnership from the first year such that those students that proceed to a project in the third year will be excellently placed to perform a true research project.

Thus, under this proposal, the students will be able to progressively develop their research skills in both their other undergraduate courses and the undergraduate research experience proposed here. This should have a significant impact on the major challenge for the review of the Bachelor of Science degree in finding new pathways for the critical investment in research at UQ particularly in the institutes to impact in a significant way on undergraduate science education and on the critical shortage of research scientists to sustain these developments. In particular, it will provide a mechanism to tap directly into the expertise of the research staff, the excellence of the infrastructure and their prominence on the scientific world stage to both engage and enthuse our students, with reciprocal benefits for students at all levels and the collective research activity at UQ.

11.6.1.4 The Undergraduate Research Opportunity (University of Michigan Model)

As alluded to above, our mentored apprenticeship model adapts and contextualizes key elements from the University of Michigan's program called the Undergraduate Research Opportunity Program (UROP)[6] that was initiated in the late 1980s. The aim of this program was to improve the retention and academic achievement of under-represented students. This has now developed into a national award-winning program that enhances the undergraduate educational experience through the integration of student learning and research. Because of the initial success of the UROP, it is now offered to all first and second year students regardless of their background.

UROP provides a hands-on learning experience for first and second year students through research partnerships with academic research staff in all disciplines. Students develop research and academic skills through academic mentors, research work, research seminars, skill building workshops and peer advising.[7] The UROP commenced in 1989, and the number of student/academic research partnerships have now grown to approximately 1000 first and second year students and 500 academic researchers collaborating in the discovery process. The UROP program enables academic researchers to meet students where they are to develop a mentor/mentee partnership.

A longitudinal assessment of the impact of the program on student learning has found that UROP students:[8]

1. Are more proactive about their education and more engaged in the university's academic life;
2. Learn how to process and evaluate information;
3. Gain research competency in a discipline and;
4. Are more likely to pursue graduate and professional school.

The concept of an undergraduate research experience for first and second year students has been embraced by the US Higher Education system. Such initiatives have also become part of the US funding system and have been championed by the National Science Foundation[9], the Howard Hughes Medical Institute[10] and the National Institutes of Health.[11] Dr Rita Colwell, who is an Honorary Professor in BACS, gave this scheme considerable support during her tenure as NSF Director (1998-2004).

11.6.1.5 References

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[7] *http://www.lsa.umich.edu/urop/about/*

[8] *http://www.lsa.umich.edu/urop/about/evaluation/*

[9] *http://www.nsf.gov/*

[10] *http://www.hhmi.org/*

[11] *http://www.nih.gov/*

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11.6.2 EPSA Undergraduate Research Model: Connecting First Year Undergraduates to Research Activities in the Faculty of Engineering, Physical Sciences & Architecture

EPSA1001 Course Plan

This proposal was developed by Dr Lydia Kavanagh on behalf of the Teaching and Learning Committee of the Faculty of Engineering, Physical Sciences & Architecture. Extensive consultation with teaching and research staff in EPSA schools and research centres was undertaken by Dr Kavanagh during 2005 and this proposal represents a consensus on interests and actions that will expose and connect the Faculty's research to its undergraduate students.

11.6.2.1 Course Aims

This course aims to provide 1st year students in the faculty of Engineering, Physical Sciences & Architecture (EPSA) with an opportunity to be inducted into the culture and practice of research within various disciplines across the fields of Engineering, Physicals Sciences, and Architecture. The faculty teaches into and aims to reach students enrolled in its disciplines in the following undergraduate degree programs:

- Bachelor of Architecture
- Bachelor of Arts
- Bachelor of Engineering
- Bachelor of Environmental Management (Sustainable Development)
- Bachelor of Environmental Science (Earth Resources)
- Bachelor of Information Technology
- Bachelor of Multimedia Design
- Bachelor of Science
- Bachelor of Regional & Town Planning

11.6.2.2 Learning Objectives

In completing this course, students should be able to:

1. Gain a broad understanding of the nature of research, and research-led practice within particular fields of study, especially:
   - Describe why research is undertaken, and the nature of significant areas of inquiry and discourse within the various disciplines;
   - Examine how research informs practice, and how practice informs research;
   - Appreciate disciplinary methods of research design, literature review, experimental design, critical analysis, and reporting;
   - Develop scientific research literacy and the basic skills of effective information literacy;
   - Investigate the range of research conducted across various fields of study within EPSA, including:
     - Who conducts research? – Postgraduates, early career researchers, postdoctoral researchers, academics;
     - What they research and why? – the range of topics;
     - What makes a good researcher? – ethics, codes of conduct;
   - Identify significant elements of successful research:
     - Generating areas of interest/significance
     - Sources of funding
     - Planning and implementing research projects
     - Intellectual Property (IP)
     - Research space
     - Team research
     - Mentors
   - Gain an introductory overview of what the outcomes of research – communication and commercialisation.

2. Become familiar with the contexts of research within the University of Queensland, and in particular, the various research activities that take place within the Faculty's schools and research centres.

11.6.2.3 Schedule

Week 1: Introduction to Research and EPSA1001

The LECTURE covers:

The 1st lecture will set the tone for the rest of the semester. Rather than too many facts/figures, we need to inspire students and emphasise the excitement of discovering something!

Definitions: Carefully and explicitly define 'research' – we are talking about scientific enquiry/investigating a problem (both by consulting what is known in an area and doing 'hands on' investigations). Many school leavers will equate 'research' with 'looking things up in a book'. However, the new Qld science syllabus may produce students who understand 'research' as 'scientific enquiry'. Could ask the students straight up to give a definition of the term 'research', and get a feel for their background.

Also: a bit of context (history) designed to illustrate that our society is based on science and technology, the nature of science - what counts as valid knowledge (epistemology), why we conduct research, and 'Pure' vs. 'Applied' research definitions. Finish with images/footage of different fields: launching scramjets, working in Antarctica, wandering around a volcano, high-tech lab etc. to give them something to aspire to.

Need to be upfront about *course expectations* in this first lecture:

- The level of input required from the student and the support that they will receive;
- The details of ALL forms of assessment;
- That students agree to 10 hrs 'work' in the research centre they choose ('work' may be quite basic e.g. data entry, washing glassware, autoclaving, and/ or solids analysis); and
- The benefits – researchers take an interest in keen students who make a good impression; such students also have a greater chance of becoming PASS leaders, tutors, summer vacation students, PhD students etc.

The WORKSHOP covers:

Introduction to the different EPSA research centres via colour-coded, key word table. More detailed information to be on Blackboard site with classes of activity (e.g. If you work here you will spend time in a laboratory.) Appropriate centre personnel to be present to answer any queries.

Assessment tasks for students to work on:

1. blog entry:
   - thoughts on the definition of 'research' – did lecture change this?
   - aspirations for course and their future (revisit this at end of semester to determine if initial aspirations match the reality)
2. selection of research centre (A1 Assessment Task 1)

Week 2: Reviewing the Literature/ The Peer Review Process

The LECTURE covers:

- Nature / life-cycle of scientific information
- Style of scientific writing
- Searching and locating articles – effective and efficient use of library resources
- Peer review process with respect to submission of journal article
- Critical analysis – critiquing Vs summarising

The need for and value of critical thinking is to be stressed. Refer to fraudulent research as interesting way to communicate this.

The WORKSHOP covers:

1. Research strategies – looking for articles on similar topics or by same author etc
2. Review of an article from their chosen EPSA centre or popular science article (eg New Scientist, Scientific American etc). To be submitted at end of session to another student for take-home review
3. Assessment task (A2) to be explained.

Week 3: Hypothesis Development/ Asking Critical Questions

The LECTURE covers:

Definitions: Don't start talking about "hypotheses" straight away – instead talk about the importance of "questions" (in scientific jargon, a testable question = 'your hypothesis')

Tie this session back in with *first topic:* "Why do we conduct research?" which leads to "How do we conduct research?" which leads to "Starting with a testable question". Lead into experimental design as next topic.

Key Concepts to cover:

- What is a hypothesis? (Students and even scientists often say "I have a theory" when what they REALLY mean is "I have a hypothesis".)
- How do scientists formulate questions?
- There is NO one right way to develop a hypothesis, just as there is no one right scientific method – big role here for creativity, intuition, induction…
- AS WELL AS examining what is known i.e. the need to examine the peer-reviewed literature, identifying gaps in literature (refer back to 2nd topic) analysis and synthesis (role for both reductionist and holistic approaches)
- This 'fluid' nature – as opposed to a rigid formula – does make research challenging. But it also makes for a very interesting and rewarding career!
- Note the questions we come up with are very context dependent – influenced by society we live in, the values we hold, our beliefs. We strive for objectivity but we are subjective creatures.
- Creativity, idea generation.

Illustrate all these ideas by looking at famous researcher – What problem did they work on?; why did they work on it?; why was it important. Use case study that shows how researcher used intuition, was lead into a few blind alleys, was influenced by their own beliefs etc.

The WORKSHOP covers:

1. Famous researchers – students *investigate* a famous researcher from supplied list or own choice. Provide recommended resources too.
2. Perhaps also give students an example of what the snapshot (of their research centre) should look like?

Assessment tasks for students to work on:

blog – who did they pick and why, why is this researcher important, what was the researcher's 'big' question and why was it important. Is this knowledge still valid today?

Week 4: Experimental Design

The LECTURE covers:

- Exploratory vs defined-question investigation
- Deciding what the variables are
- Relating what you want to investigate to what you can measure (quantitative and qualitative)
- Broad – depending on area of research
- Influencing factors and noise – when do you have convincing data (ties in with next section on analysis)

The WORKSHOP covers:

Small concrete experimental design activity to introduce skills –not necessarily related to a research centre. Controversial issues such as ethanol fuel and tsunami prediction to be used. This needs to be a primary research task or a perhaps a larger activity related to research centre of interest.

Week 5: Results Analysis

The LECTURE covers:

Data processing, critical comparison, speculative / testing. Cyclic: design and analysis.

Key concepts to cover:

- concrete problem analysis [primary research task]
- driven by groups
- complexity vs. simplicity
- irrelevant information
- Does it make sense? Does it fit your intuition? If not, is it correct? [NB some science can be anti-intuitive (e.g. anything quantum) so you can't always trust your instincts]
- correlation vs. causation

The WORKSHOP covers:

Learning Activity: What is being analysed? Data / concepts / theory? Bring problem > dot point analysis

Session Outcome: Team synthesis of analysis methods and expected outcomes. Dot conclusions (revised)

Assessment tasks for students to work on:

- Take home task: Develop main dissemination points and present
- Assessment task (A3) to be explained.

Week 6: Field Trip/ Site Visit

Week 6 will be teaching free.

Suggested, based on Bright Minds program success, that the students take a tour of a research centre such as the IMB. This tour to be conducted by a postgraduate rather than a centre director i.e. someone the students can relate to and who is very enthusiastic about heir work.

Students to produce a 1-page summary or blog reflection (Pass/ Fail) to prove attendance.

Weeks 7/ 8: Disseminating Scientific Information

The LECTURE covers:

Key concepts to cover:

- Identifying the target audience – needs, interest, language including style, specialist vs. lay audience
- Tailoring the message – broad areas to include, relevance to audience
- Generalisation from detail – translation / interpretation

Many ways of communicating and would be good to communicate ‘how to’ for at least written and oral:

- Written – journals, conf proceedings, books, specialist/trade publication, newspapers and mags, press release etc
- Oral – lecture, conference presentation, forum, interview, TV and radio etc
- Electronic – web etc
- Art / culture – eg Angstrom Art

The WORKSHOP covers:

1. Review articles on same subject but for different audiences – goes into blog
2. Blog entry questions: Who is the audience? Is the flow logical? Impact? What level of jargon present and was it appropriate?

Assessment tasks for students to work on:

Session 7: Writing

Session 8: Conference presentation

Week 9/10: Funding/ IP and Commercialisation

The LECTURE covers:

Key concepts to cover:

- What is IP – short overview
- Commercialisation – 2-3 anecdotes (reflect on own knowledge of how things are commercialised)

- Research Funding:
  - Need funding to bring to completion
  - appropriate agency, appropriate strategy, selling your project
  - being clear on significance/outcomes

The WORKSHOP covers:

1. No workshop for week 9. Perhaps work on research centre project and get feedback on progress.
2. Blog reflection for week 9: Students to pick topic from list (EPSA diverse) and reflect on outcomes, significance, methodology and budget.
3. Week 10 workshop requires students in teams to develop a marketing strategy for a product which is at a particular stage of development. Students will need to identify an appropriate company or agency to approach for funding/ fabrication/ manufacture, timing, and markets (primary, secondary).
4. Blog week 10 involves students assessing their choice of a series of research outcomes/ processes (e.g code in commercial computer language) with respect to:
   - what needs protecting and how is it protected
   - what are implications of others using idea if unprotected

Assessment:

Schedule

Assessment type	Weight (%)	Week out	Week due	Details
Workshop results	P/F	At w/ shop	At w/ shop	Deliverable: Results of workshop Other: To ensure workshop attended
Field/ lab report	P/F	6	8	Deliverable: 2 page overview Other: To ensure field trip attended
Blog entry	3 (7x) 21 total	Week before	2, 3, 4, 8, 9, 10, 12	Deliverable: 1-page blog entry answering set questions and including reflection Subject: Preceding key note lecture/ workshop Other: Blog to allow inclusion of pictures/ diagrams/ links etc.
A1 Research centre o/view	12	1	3	Deliverable: 1-page Subject: Details of chosen EPSA research centre
A2 Bibliography	12	3	5	Deliverable: End-note file and print-out Subject: Chosen EPSA research centre Other: To contain books, articles and URLs
A3 Critical review of article	15	5	7	Deliverable: 5-page review of relevant article Subject: Relating to chosen EPSA research centre Other: Chosen from bibliography
A4 Virtual conference	10-p/ card 30-paper	1	13	Deliverable: Paper and 'Postcard' Subject: Pulling together semester's work on EPSA research centre/ topic/ experiment Other: To be published with ISBN for use with next year's course

A1 Research Centre Overview (details)

After initial selection, students are to visit a couple of potential research centres and talk to relevant researchers.

Students to prepare *overview* of their chosen research centre (a one-page 'snapshot')

a. analysis of info about centre – nature of research, staff and resources and how it operates
b. why have they chosen this centre
c. how they might engage with the centre (10 h requirement)

A2 Bibliography (details)

Task enables student to demonstrate:

- ability to find a variety of info resources
- competency in using bibliography management software and managing (storing) information resources

Requirements:

Students to prepare an annotated bibliography of 10 references on a specific topic (none from research centre) using databases, catalogues, Google and Endnote. The references should be:

- annotated (who is target audience, writing style, where and how the article was found)
- alphabetical order
- Harvard style

Assessment criteria:

Endnote file (2 marks)

Bibliography requiring 4 different information sources, correct style, alphabetical order etc (10 marks)

A3 Critical review of article (details)

Critical review (not summary) of article – don't limit the article choice but limit questions instead (research centres can suggest some of their more accessible articles).

- Is the abstract/intro motivating, satisfying, convincing?
- Create a representation (eg concept map / flowchart) of the work
- Comment on flow of logic in the paper
- Identify assumptions underlying the work
- Identify whether there are things that have not been covered
- Generate own questions from commonsense and own experience
- Need papers supplied by research centres

A4 Virtual conference (details)

Centre Report

Task:

- Visit centre/mentor for 1hr/wk for 10 weeks
- Catch up on what has been done
- Laboratory experience – data entry etc

What student will do:

- Write paper on what discovered – tell story of what seen / done
- Present: postcard / oral
- Model on "a day in the life"? - "a semester in the life of…"?

These will be published on web or on CD (catalogued in library).

Matching Students and Centres

Course coordinators will need to prepare a list of areas of interest for the students, to facilitate students being matched with an appropriate centre. Get list of keywords off the centres to assist matching centre to student e.g.

Keyword (Area of Student Interest)	Key Tasks Students in this centre will…	Centre	Brief Centre Description (based on EPSA website, research portfolio etc)
Statistical analysis		Centre for X	
		Centre for Y	
		Centre for Z	
Nanotechnology		Centre for X	
		Centre for B	
Modelling		Centre for Z	

- Don't have to wait until 1st week – could get students to look at in advance.
- Students could nominate several areas of interest - and may only get their 2nd or 3rd preference.
- The course may need to have a **quota**, based on how many students centres and/or schools are prepared to take? However the aim is to accommodate all interested students. How do we select students if number applicants > number spaces? NOT by GPA, but by a written submission of why they want to do the course. Looking for evidence of *commitment* and *enthusiasm*.

Need to determine:

- Which centres want to be involved
- How many students they can take – emphasising the need for a quality, long-term commitment.
- Who is the liaison person in each centre – 1 point of contact
- Which postgraduates are prepared to be mentors

Will want to have centres on board by June 2007, and stress the need for an on-going commitment. Prepare a *brief* for the centres, invite them to presentation, outlining the benefits to them, and flag this course is supported by the exec deans etc. Directly address questions such as:

- Why should the centres participate? e.g. early identification/ grooming potential quality postgraduates, improved learning outcomes translates to …, better retention means greater pool of postgraduates available etc
- Why should the postgraduates participate as mentors? Portfolio work – looks good on resume? Perhaps have training session / briefing (1 hr?) for postgraduates.

Centre Responsibility	Centre Benefit	Student Responsibility	Student Benefit

Other Comments:

- Don't just focus on centres – also seek interested mentors within schools and not just working at uni.
- Research is very different to coursework – might help capture those students who aren't interested in doing postgraduate studies because "I've had enough of uni!"… yet take on an industry job that is basically the same as doing postgraduate work!
- Vacation scholars to present their experience to following year's intake – especially what they got from their time with the centre and ongoing experience
- Blackboard: hot topics section; discussion board with threaded topics
- Mentoring – use 2nd and 3rd year students who have done the course – O' week
- Have a BBQ in first week, invite along former students and postgraduates as well as academics. Encourage students to maintain the social network.
- We could use this course to attract prospective science/engineering students to UQ by offering it either in whole or part as part of a schools liaison and outreach activity. This may assist both recruitment and retention of UQ undergraduates. Advertise it at TSXPO, Science Teachers Conferences, Guidance Officers Conferences. Could even build links between this course and the Student Research Scheme (where school kids do work experience in a lab). There may also be synergies with the iCampus project?
- Course may be applicable to BACS students. Should discuss in light of current curriculum review and development.
- Workshops may be 1 or 2 hours in duration.
- Students MUST meet with mentors, can't be unreliable. Perhaps have them agree a 'contract'.
- On going development:
  - bring students together again (BBQ)
  - develop alumni page
  - students who do well considered as PASS leaders, tutors, vacation students, mentors
  - centre meetings/ papers to be open to students.

This proposal is considered to be one of many activities within the Faculty that will embed the research activities of the Faculty into the undergraduate student experience. Other activities include existing summer vacation research placements that are offered to selected students, and inquiry and project based learning that leads to presentation and communication of outcomes to peers and professional including conference and journal publications.

11.7 Outline of all Level 1 Courses

The proposed level 1 courses are as follows:

Compulsory Courses

SCIEXX1	Foundations of Science
SCIEXX2	Analysis of Scientific Data & Experiments

Introductory Courses

BIOL1XXX	Introductory Biology
CHEM1XXX	Introductory Chemistry
PHYS1090	Introductory General Physics

Part A – Core Courses

BIOL1XX1	Genes, Cells and Evolution
BIOL1XX2	Biodiversity and Ecology
BIOL1XX3	Biological Form and Function: Cells to Organisms
CHEM1XX1	Chemistry: Energetics and Reactivity
CHEM1XX2	Chemistry: Structure and Reactions
ERTH1000	Planet Earth: Its Global Environments
ERTH1001	Planet Earth: Elements of Earth Science
GEOS1100	Environment & Society
GEOM1000	Geographical Information and Analysis
MATH1051	Calculus and Linear Algebra I
MATH1052	Multivariate Calculus and ODE's
CSSE1000	Introduction to Computer Systems
CSSE1001	Introduction to Software Engineering I
PHYS1001	Mechanics & Thermal Physics
PHYS1002	Electromagnetism, Optics, Relativity and Quantum
PHYS1171	Physical Basis of Biological Systems
PSYC1020	Introduction to Psychology: Physiological and Cognitive Psychology
PSYC1030	Introduction to Psychology: Developmental, Social, and Clinical Psychology
PSYC1040	Psychological Research Methodology I

Faculty Research Experience Courses

BIOL1017	Perspectives in Science (Advanced Study Program in Science [ASPinS])
RESE1XXX	Research Experience

See Appendix 12 for content description which has been submitted to date, for the above courses,

11.8 Outline of Level 2 Courses

Part A - Core Courses

Biology and Chemistry

BIOM2007	Physiological Processes (SBMS)
BIOM2008	Integrative Physiology (SBMS)
BIOM2041	Introductory Pharmacology (SBMS)
BIOL2XX2	Cell Structure and Function (SBMS, SMMS, SIB)

BIOL2008	Cell Differentiation and Development (SBMS, SMMS, SIB)
BIOM2019	Human Biomedical Anatomy (Summer Course) (SBMS)
BIOC2XX1	Biochemistry and Molecular Biology (SMMS)
BIOL2XX7	Microbiology (SMMS)
CHEM2XX1	Concepts in Organic and Biological Chemistry (SMMS)
CHEM2XX2	Concepts in Inorganic and Bioinorganic Chemistry (SMMS)
CHEM2XX3	Quantitative Biomolecular Science (SMMS)
CHEM2XX4	Physical and Surface Chemistry (SMMS)
BIOL2XX3	Ecology (SIB)
BIOL2XX4	Evolution (SIB, SMMS)
BIOL2XX6	Genetics (SIB, SBMS)
BIOL2XX8	Plant Biology (SIB)
BIOL2XX9	Zoology (SIB, SBMS)
BIOL2X12	Biostatistics and Experimental Design (SIB, SPS)
BIOL2X13	Ecology Field Studies (SIB)

Computer Science

COMP2303	Network & Operating System Principles
CSSE2002	Programming in the Large
MATH1061[12]	Discrete Maths

And an extended list offered in the BE and BInfTech including but not limited to:

COMP2304	Programming for Engineering Systems
COMP2506	Human-Computer Interaction
CSSE2003	Software Engineering Studio
INFS1200	Introduction To Information Systems
INFS2200	Relational Database Systems

Earth Sciences & Geology

ERTH2050	Field Geology
ERTH2002	Palaeobiology
ERTH2003	Sedimentary Petrology & Stratigraphy
ERTH2004	Deformation & Structural Geology
ERTH2005	Mineralogy
ERTH2006	Igneous & Metamorphic Petrology
GEOM2000	Introduction to Remote Sensing of Environment
GEOM2001	Geographical Information Systems
GEOS2100	Physical Geography
GEOS2101	Climatology & Hydrology

[12] MATH1061 will be taken in year 2 by computer science majors. It is coded as year 1 as the majority of students in this course are BInf Tech, BE and other assorted degree students. Less than 30% of student enrolled in this course in 2006 are BSc students.

GEOS2103	Biogeography & Geomorphology
GEOG2205	Global Population Issues
GEOG2206	Medical Geography
GEOM2002	Geographic Information Systems for Mgmt & Planning
ENVM2200	Resource Management and Environmental Planning

Mathematics and Statistics

MATH2000	Calculus & Linear Algebra II
MATH2100	Applied Mathematical Analysis
MATH2200	Scientific Computing & Numerical Analysis
MATH2210	Introduction to Computational Biology
MATH2301	Abstract & Linear Algebra & Number Theory
MATH2302	Discrete Mathematics II: Theory & Applications
MATH2400	Mathematical Analysis
PHYS2100	Dynamics, Chaos, and Special Relativity
STAT2003	Probability and Statistics
STAT2004	Statistical Modelling & Analysis

Physics

PHYS2020	Thermodynamics & Condensed Matter Physics
PHYS2041	Quantum Physics
PHYS2082	Astrophysics & Space Science II
PHYS2090	Optical Physics
PHYS2100	Dynamics, Chaos & Special Relativity
BPHY2XXX	Biophysics
PHYS2810	Electronics & Circuit Theory

Psychology

PSYC2010	Psychological Research Methodology II
PSYC2020	Neuroscience for Psychologists
PSYC2030	Developmental Psychology
PSYC2040	Social & Organisational Psychology
PSYC2050	Learning & Cognition
PSYC2311	Developmental Disorders of Childhood
PSYC2321	Family Roles & Relationships
PSYC2341	Psychological Problems of Adolescence
PSYC2351	Psychology & Human Sexuality
PSYC2361	Psychology of Law & Justice

Faculty Research Experience Courses

BIOL2017	Perspectives in Science Research (ASPinS)
RESX2XXX	Research Experience

See Appendix 13 for content description which has been submitted to date, for the above courses.

11.9 Outline of Level 3 Courses (Majors)

Part A - Core Courses

Biology and Chemistry

BIOM3XXX	Molecular and Cellular Physiology (SBMS, SMMS)
NEUR3001	Molecular and Cellular Neuroscience (SBMS, SIB, SMMS)
DEVB3002	Molecular Mechanisms of Development (SBMS, SIB, SMMS)
BIOM3002	Integrated Biomedical Anatomy (SBMS)
BIOM3XXX	Systems Pharmacology (SBMS)
BIOL3XXX	Endocrinology and Metabolism (SMMS, SBMS, SIB)
BIOM3005	Cardiovascular Science (SBMS)
NEUR3002	Integrated Brain (SBMS, SMMS)
DEVB3001	Developmental Neurobiology (SBMS, SIB)
BIOM3003	Functional Anatomy and Biomechanics (SBMS)
BIOM3XXX	Advanced Pharmacology and Toxicology (SBMS, SMMS)
BIOM3XXX	Biomedical Experimentation (SBMS)
MICR3002	Virology (SMMS, SIB)
MICR3XX3	Molecular Microbiology (SMMS)
MICR3004	Microbial Diversity and Biotechnology (SMMS, SIB)
BIOL3003	Immunology (SMMS, SBMS)
MICR3001	Microbes and Human Health (SMMS)
PARA3002	Molecular and Applied Parasitology (SMMS)
BIOC3XXX	Genetic Engineering (SMMS, SBMS)
BIOL3XXX	Human Molecular Genetics and Disease (SMMS, SBMS)
BIOL3XXX	Genomics and Bioinformatics (SMMS)
BIOC3XXX	Molecular Cell Biology (SMMS, SBMS)
BIOC3XXX	Protein Structure and Function (SMMS)
CHEM3XX1	Advanced Analytical Methods in Chemical and Biochemical Sciences (SMMS)
CHEM3XX2	Inorganic Chemistry (SMMS)
CHEM3XX3	Synthesis and Mechanisms in Organic Chemistry (SMMS)
CHEM3XX4	Physical and Computational Chemistry (SMMS)
CHEM3XX5	Determination of Molecular Structure (SMMS)
CHEM3XX6	Medicinal Chemistry (SMMS, SBMS)
CHEM3XX7	Materials Chemistry and Nanotechnology (SMMS)

BIOL3XXX Plant diseases (SIB, SMMS)
BIOL3XXX Plant Development and Cell Biology (SIB, SMMS)
BIOL3XXX Plant Molecular Biology and Biotechnology (SIB, SMMS)
BIOL3XXX Ecophysiology of Australian Plants (SIB)
BIOL3XXX Animal Ecophysiology (SIB)
BIOL3XXX Marine Vertebrate Biology (SIB, SBMS, SMMS)
BIOL3XXX Animal Behaviour (SIB, CMM)
BIOL3XXX Applied Insect Biology (SIB, SMMS)
BIOL3XXX Identification and Diversity of Insects (SIB)
BIOL3XXX Arthropods and Human Health (SIB, SMMS)
BIOL3XXX Marine Invertebrates (SIB, SMMS)
BIOL3XXX Advanced Evolutionary Biology
BIOL3010 Ecological and Evolutionary Genetics (SIB)
BIOL3XXX Ecology Theory and Methodology (SIB)
MARS3XXX Marine Ecology (SIB)
ZOOL3XXX Molecular Ecology (SIB)
BIOL3XXX Conservation and Wildlife Biology (SIB)
BIOL3XXX Rainforest Ecology Field Studies (SIB)
BIOL3XXX Coral Reef Ecology Field Studies (SIB)
BIOL3XXX Outback Ecology Field Studies (SIB)

Computer Science

COMP3506 Algorithms & Data Structures

Plus a selection from level 3 BInfTech and BE lists which includes, but is not limited to:

COMP3201 Computer Graphics
COMP3402 Concurrent & Real-Time Systems
COMP3301 Operating Systems Architecture
COMS3000 Information Security
COMS3200 Computer Networks I
COMP3702 Artificial Intelligence
CSSE3002 The Software Process
CSSE3003 Software Specification
INFS3101 Ontology & the Semantic Web
INFS3200 Advanced Database Systems
INFS3202 Web Information Systems
INFS3204 Service-Orientated Architectures

Earth Sciences & Geology

ERTH3001 Ore Deposits & Exploration Geology
ERTH3020 Introduction to Exploration Geophysics
ERTH3021 Techniques of Exploration Geophysics

ERTH3050 Field Geology: Mapping in Metamorphic Terrains
ERTH3060# Applied Structural Analysis: Underground & Surface Techniques
ERTH3101 Isotope Geochemistry
ERTH3103* Sedimentary Environments & Facies Models
ERTH3104* Global Tectonics & Crustal Evolution
ERTH3110* Marine Geology & Oceanography
ERTH3130* Geochemistry of Surficial Environments
ERTH3203# Energy Resources & Fossil Fuels Geology
ERTH3205 Igneous & Metamorphic Petrology & Geochemistry
ERTH3212 Geology of Coral Reefs
ERTH3230# Environmental Geology & Groundwater

Geographical Sciences

GEOM3001 2 Advanced Remote Sensing of Environment
GEOM3002 2 Advanced Geographical Information Systems
GEOM3005 2 Computing in Geographical Information Systems
GEOS3101 2 Advanced Climatology
GEOS3400 2 Special Topics
CONS3017 Landscape Ecology
ENVM3200 Coastal Processes and Management
ENVM3201 Catchment Processes and Management
ENVM3202 Coral Reef Processes and Management
ENVM3203 Environment Impact Assessment
ENVM3204 Great Barrier Reef: Environment, Science and Management
ENVM3205 International Field Studies
GEOG3205 Applied Demography
GEOS3102 Global Change: Problems and Prospects

Mathematics & Statistics

BIOL3014 Advanced Bioinformatics: Biological Sequence and Microarray Data Analysis
COMP3506 Algorithms and Data Structures
MATH3090 Financial Mathematics
MATH3101 Bifurcation and Chaos
MATH3102 Methods & Models of Applied Mathematics
MATH3103# Algebraic Methods in Mathematical Physics
MATH3104 Mathematical Biology
MATH3201 Scientific Computing: Advanced Techniques and Applications
MATH3202 Operations Research & Numerical Optimization
MATH3203 Visualization and Modelling in Scientific Computing
MATH3301* Graph Theory and Geometry
MATH3302 Coding and Cryptology

MATH3303	Algebra and Number Theory
MATH3306*	Set Theory and Mathematical Logic
MATH3401	Complex Analysis
MATH3402	Functional Analysis
MATH3403	Partial Differential Equations
MATH3404	Optimization Theory
MATH3500	Research project in Mathematical Sciences
STAT3001	Mathematical Statistics
STAT3002	Applied Statistics
STAT3003	Experimental Design
STAT3004	Stochastic Processes and Models

Physics

PHYS3020	Statistical Mechanics
PHYS3050	Electromagnetic Theory III
PHYS3040	Quantum Physics
PHYS3071	Computational Physics
PHYS3080	Astrophysics III
BPHY3XXX	Special Topics in Biophysics
PHYS3810	Experimental Physics IIIA
PHYS3820	Experimental Physics IIIB

Psychology

PSYC3000	Advanced Sport and Exercise Psychology
PSYC3010	Psychological Research Methodology III
PSYC3020	Principles of Psychological Assessment
PSYC3042	Psychological Research: Interpretation & Evaluation
PSYC3052	Judgment and Decision-Making
PSYC3062	Skills and Human Factors
PSYC3071	Psychology of Disability
PSYC3082	Psychotherapies and Counselling
PSYC3092	Language Development
PSYC3102	Psychopathology
PSYC3112	The Social Psychology of Human Communication
PSYC3122	Attitudes and Social Cognition
PSYC3132	Health Psychology
PSYC3142	Intergroup Relations and Group Processes
PSYC3152	Applied Topics in Lifespan Development
PSYC3172	Basic Processes in Cognition
PSYC3192	Perception and Attention
PSYC3202	Industrial and Organisational Psychology

PSYC3212	Personal Relationships
PSYC3232	Behavioural Neuroscience: Learning and Emotion
PSYC3252	Forensic Psychology
PSYC3262	Evolutionary Approaches to Human Behaviour
PSYC3272	The Neuroscience of Social Behaviour
PSYC3282	Perspectives on Social & Observational Learning

** and # - Courses offered in odd and even years*

Faculty Research Experience Courses

BIOL3017	Further Perspectives in Science Research (ASPinS)
BIOL3012	Research Project
BIOL3044	Summer Vacation Project

See Appendix 14 for content description which has been submitted to date, for the above courses,

Figure 11.3 (foldout page) shows the complete list of existing BACS courses and Figure 11.4 (foldout page) shows the proposed courses for the new BSc. Table 11.6 shows a summary of the changes.

Figure 11.5 shows the complete list of courses for the Psychology major.

Appendix 15 outlines the course plans for each of the majors.

Figure 11.3 List of existing courses offered by the Faculty of Biological and Chemical Sciences.

Existing - Faculty of Biological and Chemical Sciences - 1st 2nd and 3rd Year Courses

Faculty Courses		1st year courses		2nd year courses		3rd year course				Summer Vacation		
	BIOL1017	Perspectives in Science		BIOL2017	Perspectives in Science Research	BIOL3017	Further Perspectives in Science Research			BIOL3042	Summer Vacation Project	
	STAT1201					BIOL3012	Introduction to Research			BIOL3044	Summer Vacation Project	
	PHYS1171			1		BIOL3012	Introduction to Research	repeat		2		
	3					BIOL3013	Special Project					
						BIOL3013	Special Project	repeat				
						BIOL3043	Introduction to Research A					
						BIOL3043	Introduction to Research A	repeat				
						7						
Biomedical Sciences		1st year courses		2nd year courses		3rd year courses						
	BIOL1015	Human Biology		BIOL2008	Cell and Developmental Biology	BIOM3001	Human Endocrinology			BIOM2019	Human Anatomy	repeat
	BIOL1015	Human Biology	repeat	BIOM2006	Principles of Biomedical Sciences	BIOM3002	Human Biomedical Anatomy			1		
				BIOM2007	Human Physiology	BIOM3003	Functional Musculoskeletal Anatomy					
	2			BIOM2008	Integrative Physiology	BIOM3004	Human Reproduction and Fertility					
				BIOM2019	Human Anatomy	BIOM3005	Cardiovascular Science					
				BIOM2034	Human Histology and Embryology	BIOM3006	Human Physiology and Pharmacology in Disease					
				BIOM2041	Principles of Pharmacology and Toxicology	BIOM3008	Biomedical Pharmacology					
						BIOM3009	Pharmacokinetics and Molecular Toxicology					
				7		BIOM3043	Introduction to Pathology					
						BIOT3002	Drug Design and Development					
						DEVB3001	Developmental Neurobiology					
						DEVB3002	Molecular Mechanisms of Development					
						NEUR3001	Molecular and Cellular Neuroscience					
						NEUR3002	The Integrated Brain					
						14						
Molecular and Microbial Sciences		1st year courses		2nd year courses		3rd year courses		Chemistry 3rd year				
	CHEM1090	Introductory Chemistry		BIOC2012	Biochemistry: Molecular Components of Cells	BIOC3001	Metabolism and Nutrition	CHEM3001	Synthesis and Mechanism in Organic Chemistry			
	BIOL1014	Molecular and Microbial Biology		BIOC2014	Cellular Biochemistry in Health and Disease	BIOC3002	DNA and Protein Technology	CHEM3002	Electronic Structure and Reactivity of Transition Metal Complexes			
	CHEM1020	General Chemistry		BIOL2009	Genetics I: Molecular Genetics	BIOC3003	Human Molecular Genetics and Disease	CHEM3003	Reactivity and Properties of Molecular Systems			
	CHEM1030	Chemical Bonding and Organic Chemistry		BIOL2012	Immunology and Infectious Disease	BIOC3004	Structural Biology: Macromolecular Structure	CHEM3004	Determination of Molecular Structure			
				BIOT2002	Issues in Biotechnology	BIOL3002	Ecology of Disease	CHEM3007	Chemistry of Materials and Self Assembled Systems			
	4			CHEM2001	Analytical and Metal Ion Chemistry	BIOL3003	Advanced Immunology	CHEM3008	Medicinal Chemistry			
				CHEM2002	Biophysical Chemistry	BIOL3004	Genomics and Bioinformatics	CHEM3009	Analytical and Environmental Chemistry			
				CHEM2041	Concepts of Organic and Biological Chemistry	BIOL3005	Biological Chemistry					
				CHEM2056	Physical and Surface Chemistry	BIOL3006	Molecular Cell Biology	7				
				MICR2008	Microbiology	BIOL3014	Advanced Bioinformatics					
						BIOT3004	Commercialisation of Biotechnology Products					
				10		MICR3001	Microbes and Human Health					
						MICR3002	Virology					
						MICR3003	Molecular Microbiology					
						MICR3004	Microbial Biotechnology					
						PARA3001	Marine Parasitology					
						PARA3002	Molecular and Applied Parasitology					
						17						

Integrative Biology	1st year courses		2nd year courses			3rd year course					
	BIOL1011	Genetics and Evolution	BIOL2006	Biostatistics and Experimental Design		BIOL3000	Conservation and Wildlife Biology		ENVM3301	Industry Placement (Environmental Science)	repeat
	BIOL1012	Animal Biology	BIOL2007	Genetics II: Organismal Genetics		BIOL3008	Aquaculture and Marine Biotechnology		BOTN3011	Botany Project B	repeat
	BIOL1013	Plant Biology and Biotechnology	BIOL2010	Ecology		BIOL3009	Arthropods and Human Health		ZOOL3009	Zoology Project B	repeat
	BIOL1016	Ecology and Environment	BOTN2001	Plant Evolution and Diversity		BIOL3010	Ecological and Evolutionary Genetics		3		
			BOTN2002	Functional Plant Biology		BIOL3011	Plant Microbe and Insect Interactions				
	4		BOTN2003	Plant Science Field Studies		BIOL3015	Rainforest Ecology Field Studies				
			BOTN2003	Plant Science Field Studies	repeat	BIOL3016	Outback Ecology Field Studies				
			BOTN2004	Plant Diseases		BIOL3018	Applied Ecology and Ecosystem Processes				
			ENTM2010	Urban Entomology		BOTN3002	Plant Development and Cell Biology				
			ENTM2010	Urban Entomology	repeat	BOTN3004	Plant Identification				
			ENTM2011	Insect Science		BOTN3005	Ecophysiology of Australian Plants and Ecosystems				
			ENTM2011	Insect Science	repeat	BOTN3006	Plant Molecular Biology and Biotechnology				
			MARS2011	Indo-Pacific Marine Biodiversity and Conservation		BOTN3010	Botany Project A				
			MARS2014	Marine Science		BOTN3010	Botany Project A	repeat			
			ZOOL2028	Invertebrate Biology		BOTN3011	Botany Project B				
			ZOOL2029	Vertebrate Biology		BOTN3011	Botany Project B	repeat			
			ZOOL2030	Experimental and Physiological Zoology		ENTM3001	Identification and Diversity of Insects				
						ENTM3002	Applied Insect Ecology				
			17			ENTM3003	Insect Morphology				
						ENTM3003	Insect Morphology	repeat			
						ENTM3004	Entomology Project A				
						ENTM3005	Entomology Project B				
NOTE: Courses listed are for Semester 1 and 2 and the Summer Semester. Red means the course is repeated (Semester 1 and 2 or Summer Semester)						ENTM3004	Entomology Project A	repeat			
						ENTM3005	Entomology Project B	repeat			
						ENVM3301	Industry Placement (Environmental Science)				
						MARS3001	Coral Reefs				
						MARS3004	Coral Reef Field Ecology				
						MARS3011	Marine Ecology				
						ZOOL3001	Evolutionary Biology				
						ZOOL3002	Animal Behaviour				
						ZOOL3005	Animal Ecophysiology				
						ZOOL3006	Fish Biology				
						ZOOL3008	Zoology Project A				
						ZOOL3008	Zoology Project A	repeat			
						ZOOL3009	Zoology Project B				
						ZOOL3009	Zoology Project B	repeat			
						ZOOL3010	Marine Mammals, Reptiles and Birds				
						37					

Centre for Marine Studies	1st year courses	2nd year courses	3rd year course	
			MARS3005	Coral Reef Ecosystems
			MARS3006	Tropical Fisheries Biology and Management
			MARS3007	Aquaculture
			MARS3010	Coastal Zone Management
			MARS3102	Marine Microscopy and Microanalysis
			MARS3103	Marine Neurobiology
			6	

Year 1	13	Year 2	35	Year 3	88	Summer Semester	6	TOTAL	142
Minus repeated courses and CMS courses	12		32		72		2	TOTAL	118

Figure 11.4 List of proposed courses offered by the Faculty of Biological and Chemical Sciences.

Proposed - Faculty of Biological and Chemical Sciences - 1st, 2nd, 3rd Year Courses

Faculty Courses		1st year courses	2nd year courses			3rd year course	Summer Vacation	
	BIOL1017	Perspectives in Science (ASPinS)	BIOL2017	Perspectives in Science Research (ASPinS)	BIOL3017	Further Perspectives in Science Research (ASPinS)	BIOL3044	Summer Vacation Project
	RESE1XXX	Research Experience	RESE2XXX	Research Experience	BIOL3012	Research Project	1	
	1		1		2			

Biomedical Sciences		1st year courses		2nd year courses		3rd year courses		
			BIOM2007	Physiological Processes (SBMS)	BIOM3XXX	Molecular and Cellular Physiology (SBMS SMMS)	BIOM2019	Human Anatomy
			BIOM2008	Integrative Physiology (SBMS)	NEUR3001	Molecular and Cellular Neuroscience (SBMS SIB SMMS)	1	
			BIOM2041	Introductory Pharmacology (SBMS)	DEVB3002	Molecular Mechanisms of Development (SBMS SIB SMMS)		
			BIOL2XX2	Cell Structure and Function (SBMS, SMMS, SIB)	BIOM3002	Integrated Biomedical Anatomy (SBMS)		
			BIOL2008	Cell Differentiation and Development (SBMS, SMMS, SIB)	BIOM3XXX	Systems Pharmacology (SBMS)		
			5		BIOL3XXX	Endocrinology and Metabolism (SBMS SMMS SIB)		
					BIOM3005	Cardiovascular Science (SBMS)		
					NEUR3002	Integrated Brain (SBMS SMMS)		
					DEVB3001	Developmental Neurobiology (SBMS SIB)		
					BIOM3003	Functional Anatomy and Biomechanics (SBMS)		
					BIOM3XXX	Advanced Pharmacology and Toxicology (SBMS SMMS)		
					BIOM3XXX	Biomedical Experimentation (SBMS)		
					12			

Molecular and Microbial Sciences		1st year courses		2nd year courses		3rd year courses		Chemistry 3rd year
			BIOC2XX1	Biochemistry and Molecular Biology (SMMS)	MICR3002	Virology (SMMS SIB)	CHEM3XX1	Advanced Analytical Methods in Chemical and Biological Sciences (SMMS)
			BIOL2XX7	Microbiology (SMMS)	MICR3XX3	Molecular Microbiology (SMMS)	CHEM3XX2	Inorganic Chemistry (SMMS)
			CHEM2XX1	Concepts in Organic and Biological Chemistry (SMMS)	MICR3004	Microbial Diversity and Biotechnology (SMMS SIB)	CHEM3XX3	Synthesis and Mechanisms in Organic Chemistry (SMMS)
			CHEM2XX2	Concepts in Inorganicand Bioinorganic Chemistry (SMMS)	BIOL3003	Immunology (SMMS SBMS)	CHEM3XX4	Physical and Computational Chemistry (SMMS)
			CHEM2XX3	Quantitative Biomolecular Science (SMMS)	MICR3001	Microbes and Human Health (SMMS)	CHEM3XX5	Determination of Molecular Structure (SMMS)
			CHEM2XX4	Physical and Surface Chemistry (SMMS)	PARA3002	Molecular and Applied Parasitology (SMMS)	CHEM3XX6	Medicinal Chemistry (SMMS SBMS)
			6		BIOC3XXX	Genetic Engineering (SMMS SBMS)	CHEM3XX7	Materials Chemistry and Nanotechnology (SMMS)
					BIOL3XXX	Human Molecular Genetics and Disease (SMMS SBMS)	7	
					BIOL3XXX	Genomics and Bioinformatics (SMMS)		
					BIOC3XXX	Molecular Cell Biology (SMMS SBMS)		
					BIOC3XXX	Protein Structure and Function (SMMS)		
					11			

Integrative Biology		1st year courses		2nd year courses		3rd year course
			BIOL2XX3	Ecology (SIB)	BIOL3XXX	Plant Diseases (SIB SMMS)
			BIOL2XX4	Evolution (SIB)	BIOL3XXX	Plant Development and Cell Biology (SIB SMMS)
			BIOL2XX6	Genetics (SIB, SMMS)	BIOL3XXX	Plant Molecular Biology and Biotechnology (SIB SMMS)
			BIOL2XX8	Plant Biology (SIB)	BIOL3XXX	Ecophysiology of Australian Plants (SIB)
		Programmed Courses	BIOL2XX9	Zoology (SIB, SBMS)	BIOL3XXX	Animal Ecophysiology (SIB)
			BIOL2X12	Biostatistics and Experimental Design (SIB, SPS)	BIOL3XXX	Marine Vertebrate Biology (SIB SBMS SMMS)
Key:	SCIE1XX1	Foundations of Science	BIOL2X13	Ecology Field Studies (SIB)	BIOL3XXX	Animal Behaviour (SIB CMM)
ASP - Advanced Studies Program	SCIE1XX2	Analysis of Scientific Data and Experiments	7		BIOL3XXX	Applied Insect Biology (SIB SMMS)
SBMS - School of Biomedical Sciences					BIOL3XXX	Identification and Diversity of Insects (SIB)
SIB - School of Integrative Biology		Introductory Courses			BIOL3XXX	Arthropods and Human Health (SIB SMMS)
SMMS- School of Molecular & Microbial Sciences					BIOL3XXX	Marine Invertebrates (SIB SMMS)
SPS - School of Physical Sciences	CHEM1XXX	Introductory Chemistry			BIOL3XXX	Advanced Evolutionary Biology (SIB)
	BIOL1XXX	Introductory Biology			BIOL3010	Ecological and Evolutionary Genetics (SIB)
	PHYS1090	Introductory Physics			BIOL3XXX	Ecology Theory and Methodology (SIB)
	2				MARS3XXX	Marine Ecology (SIB)
Note: The proposed first level courses shown adjacent have not been allocated to specific schools.		Core Courses			ZOOL3XXX	Molecular Ecology (SIB)
					BIOL3XXX	Conservation and Wildlife Biology (SIB)
	BIOL1XX1	Genes Cells and Evolution			BIOL3XXX	Rainforest Ecology Field Studies (SIB)
	BIOL1XX2	Biodiversity and Ecology			BIOL3XXX	Coral Reef Ecology Field Studies (SIB)
Note: For a complete view of the proposed first level program all courses are shown. Those that will be shared between the faculties are highlighted. These courses have not been included in the count.	BIOL1XX3	Biological Form and Function:Cells to Organisms			BIOL3XXX	Outback Ecology Field Studies (SIB)
	CHEM1XX1	Chemistry: Energetics and Reactivity			20	
	CHEM1XX2	Chemistry: Structure and Reactions				
	5					
Year 1	8	Year 2	20	Year 3	53	Summer 2
					TOTAL	81

Figure 11.5 Complete list of courses for the Psychology major.

Faculty of Social and Behavioural Sciences - 1st, 2nd, 3rd Year Courses

PSYCHOLOGY MAJOR	1st year courses		2nd year courses		3rd year course	
	PSYC1020	Introduction to Psychology: Physiological and Cognitive Psychology	PSYC2010	Psychological Research Methodology II	PSYC3000	Advanced Sport and Exercise Psychology
	PSYC1030	Introduction to Psychology: Developmental, Social, and Clinical Psychology	PSYC2020	Neuroscience for Psychologists	PSYC3010	Psychological Research Methodology III
	PSYC1040	Psychological Research Methodology I	PSYC2030	Developmental Psychology	PSYC3020	Principles of Psychological Assessment
			PSYC2040	Social and Organisational Psychology	PSYC3042	Psychological Research: Interpretation and Evaluation
			PSYC2050	Learning and Cognition	PSYC3052	Judgment and Decision-Making
			PSYC2311	Developmental Disorders of Childhood	PSYC3062	Skills and Human Factors
			PSYC2321	Family Roles and Relationships	PSYC3071	Psychology of Disability
			PSYC2341	Psychological Problems of Adolescence	PSYC3082	Psychotherapies and Counselling
			PSYC2351	Psychology and Human Sexuality	PSYC3092	Language Development
			PSYC2361	Psychology of Law and Justice	PSYC3102	Psychopathology
					PSYC3112	The Social Psychology of Human Communication
					PSYC3122	Attitudes and Social Cognition
					PSYC3132	Health Psychology
					PSYC3142	Intergroup Relations and Group Processes
					PSYC3152	Applied Topics in Lifespan Development
					PSYC3172	Basic Processes in Cognition
					PSYC3192	Perception and Attention
					PSYC3202	Industrial and Organisational Psychology
					PSYC3212	Personal Relationships
					PSYC3232	Behavioural Neuroscience: Learning and Emotion
					PSYC3252	Forensic Psychology
					PSYC3262	Evolutionary Approaches to Human Behaviour
					PSYC3272	The Neuroscience of Social Behaviour
					PSYC3282	Perspectives on Social and Observational Learning

Table 11.6 Summary of proposed course changes in the Faculty of Biological & Chemical Sciences

	Faculty of Biological & Chemical Sciences							
	1st Year		2nd Year		3rd Year		Total Courses	
	Old	New	Old	New	Old	New	Old	New
Faculty	3	8	1	1	6	3	10	12
Biomedical Sciences	1		7	6	14	12	22	18
Molecular & Microbial Sciences	4		10	6	24	18	38	24
Integrative Biology	4		14	7	30	20	48	27
Existing Courses	12		32		74		Total Existing	118
Proposed Courses		8		20		53	Total Proposed	81
							31.4	% reduction

Note: The above numbers count each course once and therefore do not count courses that are offered in both semesters.

11.9.1 Management of Majors

A Convener will be appointed for each major and that person will lead a "Majors Team" which will have broad representation. This team will oversee the management and implementation of both content and delivery of courses within the Major across second and third Levels. In doing so, the Majors Team will take into consideration the strategic issues outlined in the Carrick Leadership Development Project prepared by Dr Fred D'Agostino and Dr Mia O'Brien at UQ. These include:

1. How the number of courses offered in the major can be optimized against three criteria: (a) ensure viable class sizes at all levels; (b) facilitate the strategic allocation of teaching, curriculum, and flexible delivery resources; and (c) balance student choice against staff and workload management issues;
2. How each major can be managed to ensure (a) that it becomes an appropriate site for the delivery of Graduate Attribute skills sets; (b) the career prospects for graduates are identified and made visible; (c) staff are deployed into introductory and any capstone courses in appropriate ways (e.g. to ensure that students are given an exciting and well organised introduction to the discipline, at one end, and to give students, at the other, later end, an appropriate introduction to the research culture in the discipline).

Furthermore, it should be implicit that the Major Course Convenors and Team members would receive workload and career progression recognition in accordance with the time commitment, as well as the organizational and intellectual input they make to the position, in line with suggestions of the Pedagogy and Student Experience Working Party (see later).

11.10 Overview from the Groups that Contribute to the BSc

11.10.1 Biological and Chemical Sciences in the BSc

Currently six biology courses are offered at level 1. It is proposed to reduce this number to three courses in an effort to increase the breadth of science studied at this level and to lay the foundation for a greater number of level 2 and 3 courses (and therefore, majors).

Three new biology courses and two new chemistry courses will be developed and managed by a First Year Biology and Chemistry Team which will be comprised of the co-ordinators of each of the first year courses. The courses will be interdisciplinary and developed in consultation with other Faculties that currently utilise the Level 1 BSc course offerings in their programs such as the Dental Science, Human Movement Science, Biotechnnology, Food and Nutrition, Engineering, and Environmental Science and Environmental Management degree programs. The first year biology and chemistry courses will also be included in the proposed BBiomedSci degree (Appendix 17).

This team will meet on a regular basis and oversee the content and delivery of the courses, taking into account the recommendations of the PASE WP in terms of best practice teaching and learning methods. It is also expected that the reduction in the number of courses will lead to an increase in staff time and financial resources to develop new approaches to teaching and learning, including more small group interactions, better assessment methods, and increased feedback for students. It is also expected that staff who comprise the First Year Biology and Chemistry Team will be divested of some other School responsibilities to account for the increased responsibilities they will be taking on managing the First Year courses in line with recommendations of the Pedagogy and Student Experience Working Party (see later) which emphasise the need to form student cohorts to assist with the transition to university and enable students to become part of the community of scientists.

A consequence of the increased breadth of study required at Level 1 will be the displacement of some "content", especially in biology and chemistry from level 1 to level 2 and level 2 to 3. The Structure WP agreed that this could be ameliorated, especially in biology, by focusing at all levels on concepts rather than content. There is also currently considerable overlap in the first level biology courses which would be eliminated by the strong co-ordination of the first year biology team. Nevertheless, it is likely that the degree of specialization possible at levels 2 and 3 will decrease.

The proposed list of Level 2 biology and chemistry courses shows a substantial reduction in the numbers of courses (from 32 to 20) which is again aimed at providing for greater breadth of study and better scope for students to prepare for a range of specializations in later years.

The principles used in developing the proposed list of Level 3 BACS courses were as follows:

1. Several factors, including duplication, crowding out of core material for a major, financial and workload pressures and timetabling difficulties suggested that a significant reduction should be made in the number of courses offered by BACS Schools.
2. The coming together of the biological and chemical disciplines suggested that there are increasing opportunities for collaborative teaching involving two or more of the BACS Schools.
3. It is necessary to ensure that sufficient courses are made available to service each of the agreed Majors in Biological and Chemical Sciences.
4. The need to incorporate financial management on a course by course basis will also dictate a reduction in the number of courses.

11.10.2 Overview of Physics in the BSc

The field of physics in the BSc provides excellent undergraduate training for the professional physicist as well as training for those students wishing to proceed to postgraduate studies. In addition to teaching that is aimed at the physics professionals, physics does a very significant amount of "service" teaching to biology, biomedical, engineering, dentistry, physiotherapy, and human movement students.

Accreditation of the physics program and courses was undertaken by the Australian Institute of Physics in 2004. The panel found "that physics courses have considerable breadth in their content, are relevant and challenging and are of high quality". Those courses for the professional physicist (two at first, five at second and six at third level) covered relevant theoretical and experimental topics and were of an excellent standard, historically being driven by research strengths in the discipline.

Since 2001 physics has progressively undertaken a review of its program and curriculum, fine tuning its offering of courses to ensure a coherent well-structured program from first year to Honours year that was achievable with the existing teaching resources.

In first year the number of courses has remained constant; 2 core courses plus one course for biology and human movement studies students and an introductory physics course for students who have not completed year 12 secondary school physics and are interested in further progress in physics. Core physics courses in second year have been reduced from 6 to 5 with additional courses for students interested in astronomy and biophysics and courses for engineering students. The biggest reduction has occurred at third year with 8 core courses being reduced to 6. At this level there are three other courses for astronomy and biophysics and engineering students.

Appropriate curriculum content, diversity of topics and available teaching resources have been the overarching issues for implementing significant changes to the honours program since 2001. The program has always consisted of an Honours project (~ 50%) and coursework (~ 50%). From 2001 where the program had 13 half coursework courses from which 8 were chosen it has been reorganised to now have 2 core courses and 2 elective courses from 4 different odd and even year offered courses.

Additional comments on first year physics courses:

PHYS1090 Introductory General Physics is proposed to be a #2 semester 1 course (currently PHYS1000 Introductory General Physics #1 semester 1 course). This course, for students who have not completed secondary school years 11 and 12 physics. It will illustrate the role of physics in modern technological society, covering topics ranging from atoms to the cosmos. It will cover important basic principles of physics and their application. Its content and mode of delivery are designed to inform and enthuse students about physics by focusing on some of the big issues and challenges of physics in today's world.

PHYS1171 Physical Basis of Biological Systems (#2 - Semester 1 and 2). This course is designed for biological students, offering an understanding and application of physical principles and concepts in a biological context. It is a non-calculus based course not requiring the first year mathematics necessary in PHYS1001 and PHYS1002. This course meets a diversity of interests including: biological, biophysics (possible pathway to higher-level study), dentistry (compulsory course), medicine (GAMSAT preparation), human movement studies (compulsory course) and biomedical sciences (recommended course).

PHYS1001 (Mechanics & Thermal Physics) is a #2 first semester course covering topics from mechanics to thermodynamics. This course, which has a laboratory component, is one of the first year core courses for a physics major. It feeds into the second semester course PHYS1002. A satisfactory achievement of year 12 secondary school physics and competency in calculus (equivalent to Maths C at Year 12) is an advantage in order to achieve a higher level of performance in this course.

PHYS1002 (Electromagnetism, Optics & Modern Physics) is a #2 course offered in first and second semester with a laboratory component covering electromagnetism to modern physics. This is the second first year core course for students interested in a physics major. Both courses are important preparation for students entering second year physics and biophysics. This course requires a level of application of calculus and differential equations that are covered in mathematics courses MATH1051 and MATH1052 in first year. The course is taken by engineering students (only) in Semester 1 and science and engineering students (combined) in Semester 2. Although previous study of senior school physics is not assumed, students who have this background find the course significantly easier and tend to perform better. The course is taken by human movement studies students in Semester 2.

11.10.3 Overview of Geographical Sciences in the BSc

Foundation courses for a Geographical Sciences major are "Environment & Society" and "Geographical Information & Analysis". The former provides an introduction to physical geography and human-environment interactions, and the latter an introduction to spatial sciences (eg. cartography, GIS, remote sensing). Second and third level courses are organised into four broad areas, viz. physical geography (climatology, hydrology, geomorphology, biogeography, landscape ecology), human geography/demography, spatial sciences (GIS, remote sensing) and advanced level courses investigating selected environmental systems and their management (eg. catchments, coasts, coral reefs). Honours in Geographical Sciences consists of a major research project and thesis (75%), a course in Research Design & Implementation (25%) and an elective (25%).

Over the last decade, Geographical Sciences has maintained a strong commitment to fieldwork as core component of the discipline, with one-day, weekend or week-long field trips an intrinsic part of the curriculum in most undergraduate courses. This commitment has been maintained despite budgetary, workload and OH&S pressures. Geographical Sciences has markedly improved its laboratory facilities in recent years and maintains a commitment to enhancement of learning spaces within its control. A strength of Geographical Sciences is its focus on some of the important, global-scale issues facing the planet and its inhabitants; a weakness is the decline in commitment to geographical knowledge and inquiry in school systems.

11.10.4 Overview of Psychology in the BSc

Psychology is a profession as well as an academic discipline. To practise as psychologists, graduates are required to undertake programs which are accredited by the Australian Psychological Society and relevant Colleges, and which are also accredited for registration in Queensland and other states. At UQ, Psychology is offered through the Bachelor of Psychological Science (BPsySc) and the BA as well as the BSc. The single major is not an accredited sequence, but the double major is, and thus it must reflect the accredited sequence of courses. The curriculum is re-accredited every five years (the most recent accreditation has taken place in 2006). Thus, the Psychology major reflects the new structure of the BSc but the double major is also consistent with accreditation requirements.

The double major is designed to prepare students for professional training or a research career in Psychology. The single major does not lead to professional recognition but aims to provide a broad-based overview of Psychology that will complement other scientific fields. The philosophy behind the curriculum is to provide a comprehensive coverage of the whole field of Psychology, from brain function and neuroscience through to social behaviour and communication, with appropriate grounding to prepare students for postgraduate research or advanced professional preparation in clinical, organisational, and applied psychology. In addition, research methods and quantitative data analysis are core features of the single and double majors, with compulsory methods/analysis courses in each year of the program. There is an emphasis on practical experience, with laboratories in most courses at all level.

The first-level courses provide a comprehensive introduction to the whole field of psychology; very few or no students have studied this subject at school. PSYC1020 and PSYC1030 cover basic biological and cognitive processes underlying behaviour, and social and developmental aspects of human behaviour, respectively. PSYC1040 (required for accreditation) overlaps significantly in content with the proposed compulsory course Foundations of Science B with respect to statistics, so Psychology students in the BSc will substitute PSYC1040 for this course; they will also be required to take Foundations of Science as well as to meet the graduation requirement of study in physics, chemistry, and biology equivalent to Year 12.

Second-level psychology continues the broad-based curriculum, with students in the double major required to undertake courses in all areas. In the single major, students must undertake methodology, and can choose a specialist content area. At third level, all students must continue with methodology, and those in the double major may choose three areas of specialization; students in the single major may choose areas in which to specialize (with appropriate pre-requisites). Many students continue to level 4, which is available through selection into Honours (or through the BPsySci, a specialist four-year degree offered through the Faculty of SBS – second-year entry to this degree is possible). Level 4 provides advanced study in psychological research, as well as early professional preparation for students who choose this path.

11.10.5 Overview of Geology and Earth Sciences in the BSc

The field of geology and earth sciences in the BSc provides excellent undergraduate training for the professional geologist and geophysicists in the exploration and mining industries, and for students who wish to pursue further postgraduate education. The minimum recommended qualification for professional geologists and exploration geophysicists is 4 years, and the BSc Honours programs in geology and exploration geophysics are a professionally recognized qualification. The field also provides a broader training for students who do not wish to work in the mining industry, and are more interested in aspects of "earth systems science" such as environmental geosciences, marine geology, hydrogeology, and geochemistry. A significant proportion of students taking earth sciences courses is enrolled in the BE (mainly mining engineering), BEnvSci, BEnvMan, and BMarSt programs.

The earth sciences curriculum has been reviewed several times since 1999, with the aim of providing a coherent program for professional geologists and at the same time a broader earth sciences education to other science and non-science students.

This process has seen the reduction of courses offered at all levels, and particularly at level 3, close cooperation with other units in EPSA and BACS for the design and delivery of key courses in the BE, BEnvSci, BEnvMan, and BMarSt programs, and the deletion of the BScAppl program in exploration geophysics. The offering of courses in geophysics is currently being reviewed as part of the School of Physical Sciences review process initiated in 2005. Early in 2006 Earth Sciences suggested the creation of a new "earth systems science" course to be developed jointly with the School of Geography, Planning, and Architecture, and this initiative is currently being considered by the BSc Review Committee.

Since 2001 the School of Physical Sciences has developed and implemented significant changes to the Honours program, which currently comprises 4 units of core courses, 4 units of elective courses (most of which are offered in different odd and even years), and 8 units of research project.

11.10.6 Overview of Mathematics and Statistics in the BSc

There is a variety of mathematics and statistics courses available to students in the BSc, ranging from general introductory courses that cover mathematical material of broad interest and relevance, to specific advanced-level courses directed at students who are seeking to engage in postgraduate mathematics study. All students will be required to complete introductory statistics as part of their BSc studies.

As recognition of the importance of mathematics to the sciences, all students entering the BSc must have completed mathematics to at least the level of Senior Maths B. (Any intending science student who has not done so can take the course MATH1040, which does not count as credit towards the BSc but satisfies the mathematics entry requirements). Students who did not study Maths C at secondary school can complete the course MATH1050, which may be counted as credit towards the BSc.

In their first year, students wishing to extend their mathematical knowledge for use in other disciplines or continue studies in mathematics should complete the two core courses MATH1051 and MATH1052. In addition, the course MATH1061 (Discrete Mathematics) is of particular benefit to students interested in computer science/information technology, bioinformatics and various other applications. MATH1061 is compulsory for BInf Tech and some BE students.

Over recent years there has been a progressive rationalisation of the mathematics/statistics courses available in later years of the BSc. The current level of offerings is appropriate to allow students to study a range of mathematical fields early on, but to specialize more in their later years. This is the correct approach for training professional mathematicians.

In terms of program flexibility, in first year all the sequences outlined below are built on the study of two level 1 mathematics courses. As the core mathematics courses MATH1051, MATH1052, and MATH2000 are currently taught both semesters, students will usually be able to rearrange these sequences to major in mathematics if they have only taken MATH1051 in first year.

Students who are possibly interested in Statistics will usually take a sequence of mathematics courses including STAT2003 and STAT2004 in second year. This gives the choice of a mathematics and/or statistics major, with freedom to pursue other interests in 4 level 2 courses.

Students who wish to major in physics and/or mathematics will usually choose to take MATH2000 and MATH2100 in second year. By taking 4# level 2 physics courses they will be able to complete a physics or mathematics major. Other disciplines can be studied in two further level 2 courses.

Students who wish to have the option of majoring in any of three disciplines after year 2 can easily modify any of the mathematics sequences to take three level 2 mathematics courses in 2nd year. If they then choose mathematics, the major can be completed by taking 5 mathematics courses in their third year.

11.10.7 Overview of Computer Science in the BSc

The field of computer science in the BSc provides excellent undergraduate training for the professional computer scientist as well as training for those students wishing to proceed to postgraduate studies. In addition to teaching that is aimed at the computer professional, computer science courses are used in a number of scientific fields including bioinformatics and computational science.

The computer science program was accredited by the Australian Computer Society in 2003, at the professional level. It may be necessary to request reaccreditation since the proposed new major structure reduces the total number of courses compared with the existing field of study.

11.11 Named Degrees

For completeness, the Boards of Studies of the existing named science-based degrees were requested to summarise pros and cons for their respective degrees**.** The details for the following degrees can be found in Appendix 16:

- Bachelor of Marine Studies
- Bachelor of Biotechnology
- Bachelor of Information Technology
- Bachelor of Environmental Management
- Bachelor of Environmental Science

In addition, an indication to develop a Bachelor of Biomedical Science degree was raised in the Review process. Preliminary details for this proposal are outlined below and a more detailed outline is provided in Appendix 17. The full proposal for the Bachelor of Biomedical Science will be submitted to Academic Board through the normal processes.

11.11.1 Proposal For Bachelor of Biomedical Science Degree At UQ

Biomedical Science is a broadly multidisciplinary science that encompasses fields of study including biochemistry, cell biology, genetics, bioinformatics, physiology, anatomy, developmental biology, neuroscience, immunology, microbiology and pharmacology that forms the basis of our understanding of how the human body functions and responds to disease and the environment. The proposed Biomedical Science Program It is NOT a pre-medical course. It will:

- Provide distinct, focussed education complementary to the BSc and orientated to a research outcome
- Be INCLUSIVE: biochemistry & molecular biology, biophysics, genetics, microbiology, immunology, neuroscience, pharmacology & toxicology, physiology and developmental biology are key components of the proposed program
- Addresses the demand and needs of the students, as shown by the large numbers of students and prospective students interested in biomedical research
- Provide distinct high quality targeted research experience appropriate for postgraduate outcomes
- Takes advantage of our UNIQUE position relative to the research institutes on the St. Lucia campus
- Target the top students (OP1-OP4)

Key Features of Bachelor of Biomedical Science Degree include:

- Four year degree (on course Honours)
- OP predicted cutoff ~4
- Entry quota of 100 domestic places
- Predict >50 full fee paying students
- Common first year with BSc
- Common second and third level courses with the BSc except for capstone courses
- Need to maintain GPA 5.0 or above to progress
- Potential exit to BSc at end of 3rd Year
- Provides a clear cohort experience (capstone courses)
- Cutting-edge practicals - Biomedical Laboratory Techniques

11.12 Pedagogy and the Student Experience

The University of Queensland is proud of its human and physical resources, which underpin the undergraduate experience. The academic staff are active researchers and share their enthusiasm for science, contemporary knowledge, insights and skills with students to facilitate teaching and learning. The University campus is host to extensive first-class research facilities and science students need to be provided with opportunities to undertake research project immersions to experience the excitement of discovery for themselves.

The vision for the new BSc which has emerged from the deliberations of the combined Student Experience and Pedagogy Working Party is centred around the following approaches:

1. Providing the opportunities for students to form cohorts from among their peers;
2. Engendering connections with academic staff;
3. Adopting practices that are conducive to modern ways of teaching and learning and are grounded in established pedagogical theory

Central to this vision is that all students will become members of the community of scientists. Student Experience Surveys indicate that current students, especially in levels 1-3, do not have this sense of belonging[1]. The modern Australian university represents an unfamiliar culture for many students, and the recommendations of the PASE WP are especially aimed at inducting students into the culture and engaging them with their learning experiences[2].

Pedagogy, and particularly defining and evaluating good pedagogical practices, is a complex issue. It is dependent on many factors, including the specific discipline areas being taught, the skills and enthusiasm of individual staff members, the research and teaching culture, and students' backgrounds and expectations. There is no "one size fits all", or set of "right and wrong" answers. Every educational institution will include pockets of effective pedagogical approaches, and also of less effective (or even ineffective) approaches. Furthermore, an approach that works well under one set of conditions may not work well under different conditions.

Taking these challenges into consideration, it is essential that recommendations for improving Science pedagogy at UQ are strongly informed by the specific UQ environment. Much of what is currently done, and what is hoped to be achieved in the future, will be driven by (i) the current staff members; (ii) the requirements of the study body; (iii) the inherent strengths of UQ Science; and (iv) the attitude of Schools and Faculties towards resourcing and valuing teaching activities.

Educational research in science education and pedagogical practices highlights a number of pedagogical factors consistent with improved learning outcomes and enhanced student engagement. These factors include: (i) the importance of inquiry-based processes for higher-order learning; (ii) the need to value, train and adequately resource staff; and (iii) the need for carefully designed assessment to enhance student learning. The research literature shows these factors to be both ubiquitous and uncontroversial.

Science is constantly changing as new information is acquired and new technologies evolve. Consequently, effective science education must be dynamic, flexible and content-rich. Throughout this Review process, the Working Parties have been cognisant of the need to address the process of science teaching and learning. Worldwide, higher education is making the transition from traditional theory-practice models to objectives models and more recently, to process models involving action learning in attempts to (i) teach science as it is practiced; (ii) cultivate inquisitive habits of mind; (iii) induct students into professional practice; and (iv) foster social competencies (for examples see the Boyer Report, and BIO2010). This Review has provided the opportunity to focus on similar progressive ways to teach and learn science and to provide pathways for this to be implemented at UQ.

A major component of this approach is to encourage extensive interdisciplinary collaboration among staff to develop integrated programs which build knowledge and skills in a broad range of areas. No longer can disciplines work in isolation and technology provides the tools to facilitate this interdisciplinarity. A new level of shared resources and technical support and a primary focus on personalised student engagement in learning is also required. The goal of UQ will be achieved by innovative pedagogical practices, a commitment to enhancing the student experience and the recognition that we are forming lifelong partnerships. Studying science at UQ should be an interesting, challenging, inspiring and rewarding experience.

Characteristics of students are continually changing and as previously mentioned, it is incumbent on the university to modify its practices to accommodate diverse backgrounds, learning styles, aspirations and competencies in its students. In the last two decades there has been a large increase in the numbers of students accessing tertiary education, resulting in a shift from elite, to mass, higher education[3]. The resultant increase in student numbers and diversity has many implications for teaching and learning. These issues have been further exacerbated by the growing percentage of full time students working in paid employment, and the increasing number of hours they work each week, so that students spend less time on campus. Students are less likely to engage in support activities scheduled out of class times. Furthermore, students have become less engaged with their university experience, and their attitudes towards academia have changed. Study is expected to fit in with their lifestyle rather than the other way round.

The following is a summary of the deliberations and outcomes of the PASE. Additional detail on all the objectives can be found in Appendix 18.

11.12.1 The Student Experience

The UQ BSc experience will engage all students as active participants in a diverse, supportive community of scientists.

Specific initiatives that will facilitate this include:

- Using Orientation Week to provide a well-structured start to the academic year for undergraduate students at all levels, with activities at first year facilitating the transition into tertiary education, and activities at later years focusing on topics such as career information and options for research higher degrees.
- Providing a supportive learning environment by establishing student cohorts, and adopting a continuing mentoring program in which academic staff members interact with undergraduate students in small groups for the duration of their degree.
- Providing a high quality, undergraduate research experience for all BSc students, to complement interdisciplinary courses and to be identifiable as part of the unique UQ science research experience.
- Involving all students with small group learning activities, in the form of collaborative learning opportunities such as PASS (Peer Assisted Study Sessions), PEGS (Peer Embedded Group Study), tutorials and laboratories, during which students interact with more experienced science students.
- Giving students more information on possible career opportunities and the roles of academics and scientists, with presentations at all year levels by inspirational UQ-based and external guest lecturers (see Section 8 for UQ graduate destinations).
- Creating an identifiable space for BSc students in the form of a “Science Zone” in which most science teaching and learning activities are undertaken and where science students can meet and socialise.

11.12.2 Pedagogical Practices

The UQ BSc will provide a positive student experience, through a combination of effective pedagogy by UQ staff and high quality courses designed for a diverse student body with different backgrounds, expectations, and learning skills. UQ will further promote and reward excellence in course design and delivery in order to provide a high quality learning experience.

Specific initiatives which will facilitate this include:

- Students participating in inquiry-based learning in all science courses, progressing from guided-inquiry in 1st year towards open-ended inquiry at 4th year. There are already examples of the successful development and implementation of this approach in other UQ programs such as engineering.
- All students receiving hands-on experience with state-of-the-art technologies appropriate to their discipline, with increased opportunities for students to be involved in project work.
- UQ encouraging course design that provides high quality learning experiences and outcomes, catering for diverse student cohorts and scientific fields of study.

- Using an appropriate balance of diverse modes of assessment throughout each course to provide diagnostic, formative and summative assessment, clearly linked to learning objectives, and including the provision of timely, detailed feedback to students.
- Monitoring and overview of assessment, at the program level, in order to ensure that overall program objectives are attained.

11.12.3 Outreach

UQ will maintain and improve the interaction of UQ scientists with the wider community, including primary and secondary schools, alumni and the general population.

Specific initiatives that will facilitate this include:

- Instituting central co-ordination of science outreach activities to improve quality of organisation and effectiveness of communication.
- Reviewing current outreach activities in order to identify and support effective models and to rectify any overlaps or omissions.
- Encouraging prospective students, school teachers, parents and community members to engage with science at UQ.
- Encouraging UQ staff to become involved in outreach activities in the community.
- Facilitating the continuing association of UQ science graduates with UQ (see Section 8 for further details).

11.12.4 Staff Support

UQ will enhance student engagement by providing a high quality, personalised undergraduate experience facilitated by enthusiastic staff and sustained institutional support.

Specific initiatives that will facilitate this include:

- Strongly encouraging, supporting and rewarding continuing professional development of science teaching staff.
- Valuing, rewarding and directly supporting teaching excellence as part of the development of an academic career.
- Developing and embedding an active culture of continuous improvement of teaching quality through a clearly defined process of quality assurance and enhancement.
- Remodelling and resourcing infrastructural support to align with contemporary best practice in tertiary education, including:
  - a programmed reduction of the student-staff ratios so that all students experience significant small group teaching in their undergraduate years;
  - the development and expansion of appropriate, flexible teaching space;
  - increased resourcing for large classes;
  - access to a larger pool of skilled technical staff; and
  - equity of student access to advanced learning technologies.

11.12.5 Science Education Research Network (SERN)

UQ will establish a BSc-based Science Education Research Network (SERN) to provide leadership in enabling, encouraging and rewarding best practice in science teaching and

learning.

Specific SERN initiatives that will facilitate this include:

- Focusing on the development of the scholarship of teaching and learning within science education, and encouraging educational expertise of scientists who teach within the BSc.
- Facilitating a network of academics in each discipline whose research interests include the teaching and learning of science.
- SERN members, with a special interest in the study of education methods, providing advice, assistance and guidance to other staff about their teaching and the development of innovative teaching practices in a collaborative and collegial environment.
- Encouraging dissemination of teaching innovations in discipline specific teaching and learning environments, and promoting excellence in teaching within the science community at UQ by:
  - embedding a culture of educational research into a disciplinary context, and appropriately rewarding staff who engage in pedagogical research;
  - disseminating and exchanging ideas and resources across disciplines to develop effective teaching and learning processes within the teaching of the BSc;
  - developing innovative assessment methods, and helping to ensure that assessment in large classes is adequately resourced; and
  - developing systematic validation and evaluation of new teaching technologies, including monitoring current educational literature.

11.13 UQ e-learning Directions

11.13.1 Learning Management Systems (LMS)

In the last two years the university has made some major decisions and invested heavily, in a number of enterprise scale e-Learning tools including the learning management system, Blackboard.[13] This system provides a portal for students to access course related content, a number of communication tools and a quiz system that can be used for formative learning or summative assessment. A grading module is also available that can hold student results and this module can be used as a publishing tool to enable staff and the individual student to track progress.

"Adaptive" release is a feature of this LMS that has the potential to enable focussed learning programs for the individual student. Coordinators have the ability to release content to certain students for a set time, or only after students reach or fail to reach predetermined requirements. Extrapolating this to a big class means advanced students could in theory be exposed to material that is more challenging and therefore more satisfying while at the same time catering for a range of abilities dynamically determined by progressive student assessment.

This student centered learning is a major aim of some of the new generation of learning management tools being developed, typified by the European CommunityiClass project[14] due to come online in 2010.

This project is attempting to develop "an intelligent cognitive-based open learning system and environment, adapted to individual learners' needs" by way of:

- "new pedagogical approach capable of adapting teaching and learning processes to the profile of individual learners;

[13] *http://www.blackboard.com/us/*

[14] *http://www.iclass.info/iclass01.asp*

- Personalization according to different cultural characteristics and learning styles;
- A prescriptive-diagnostic system, where the system not only presents personalized content to learners but also identifies the problem areas encountered during the learning process and reports on these areas to the relevant parties.
- A more generalised and widespread access to learning resources;

11.13.2 Learning Content Management Systems (LCMS)

In its current build Blackboard is course centric. That is, a self contained site that is not accessible unless student and staff are specifically enrolled. All content is contained within the course and is not readily accessible to other staff or students not directly enrolled in the course. The university is currently investigating a number of commercial learning content management systems that attempt to address these limitations while at the same time addressing the challenges faced by issues of copyright and versioning. These systems act as a central repository for "learning objects" that can be easily accessed by other staff members for use across several courses. Types of material that can be stored in a LCMS range from simple text to interactive multimedia applications.

This sharing of resources between staff can be a powerful driver for enhancing the student e-Learning environment.

11.13.3 Blackboard Community System

Introduced late 2005, the Community System[15] is a module of Blackboard that has the potential to enhance the sense of community for students, faculty and administrators by channeling and personalising the flow of information. Of particular relevance is the idea of "roles" where a student or a staff member gains access to information according to a role. For example, a course tutor would have access to specific supporting information in preparation for classes or a student could have access to more advanced material within the same class group. The Community System is still in the early stages of implementation and will evolve with experience but this system has the potential to act a potent tool to facilitate an enhanced sense of community, albeit elctronic.

11.13.4 Plagiarism detection systems

Based on international research it is estimated that up to 30% of written assignments submitted in the tertiary sector contain material that has not been referenced or paraphrased appropriately. The ease of access to online information has exacerbated the problem and as a consequence it is expected that students at the University of Queensland would be not be significantly different to their international counterparts. In a recent trial of 30,000 papers tested by Turnitin (a text matching tool) over a 3 months period – 13% of these papers had more than 75% similar text.[16]

The University of Queensland has defined plagiarism as:

> *"The act of misrepresenting as one's own original work the ideas, interpretations, words or creative works of another. These include published and unpublished documents, designs, music, sounds, images, photographs, computer codes and ideas gained through working in a group. These ideas, interpretations, words or works may be found in print and/or electronic media."* [17]

[15] *http://www.blackboard.com/products/as/communitysys/*

[16] *Jude Carroll - Plagiarism Workshop - November 2005. The University of Queensland*

[17] *http://www.library.uq.edu.au/training/plagiarism.html*

To assist academic staff manage student plagiarism, the university has subscribed to Turnitin[18] which is a web-based application that compares a submitted student's work to online web content as well as previously submitted papers. A report is then generated which presents a "similarity index" expressed as a percentage of the work submitted that matches outside sources.

The challenge is to think about using plagiarism detection software as a formative rather than punitive tool and working with students to produce written work that complies with accepted referencing styles.

Access to Turnitin is via the learning management system, Blackboard and both staff and students can submit assignments for checking. Turnitin can also be used in the marking of submitted assignments using specific rubrics that can be built by the teaching staff. Some examples of the rubrics available within Turnitin are seen in Figure 11.6 and a description of a rubric in Figure 11.7.

Figure 11.6 Screenshot of a set of Turnitin rubrics

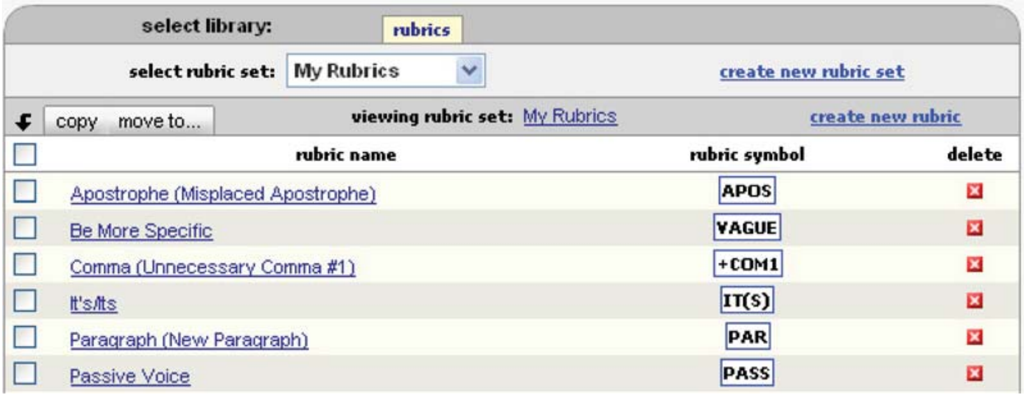
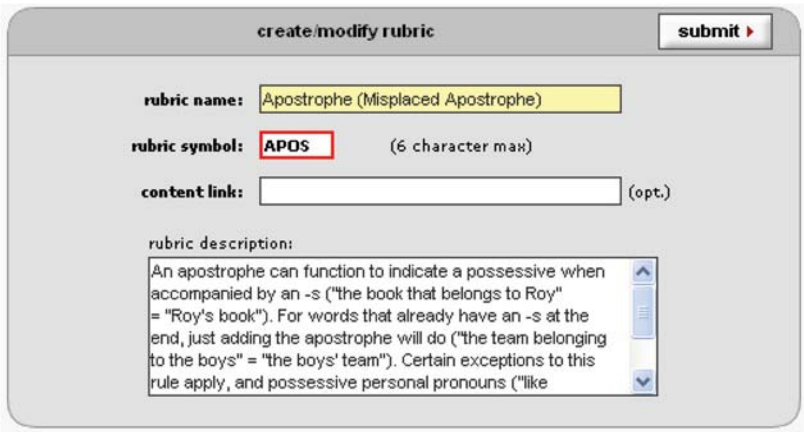


Figure 11.7 Definition of a rubric



In practice this means marking criteria as defined by a set of rubrics specific to the assignment are published for the student before submission. The essay can then be marked online by a single marker or team of markers using the same rubric and a report is generated for the student as valuable feedback.

[18] *http://www.turnitin.com/static/index.html*

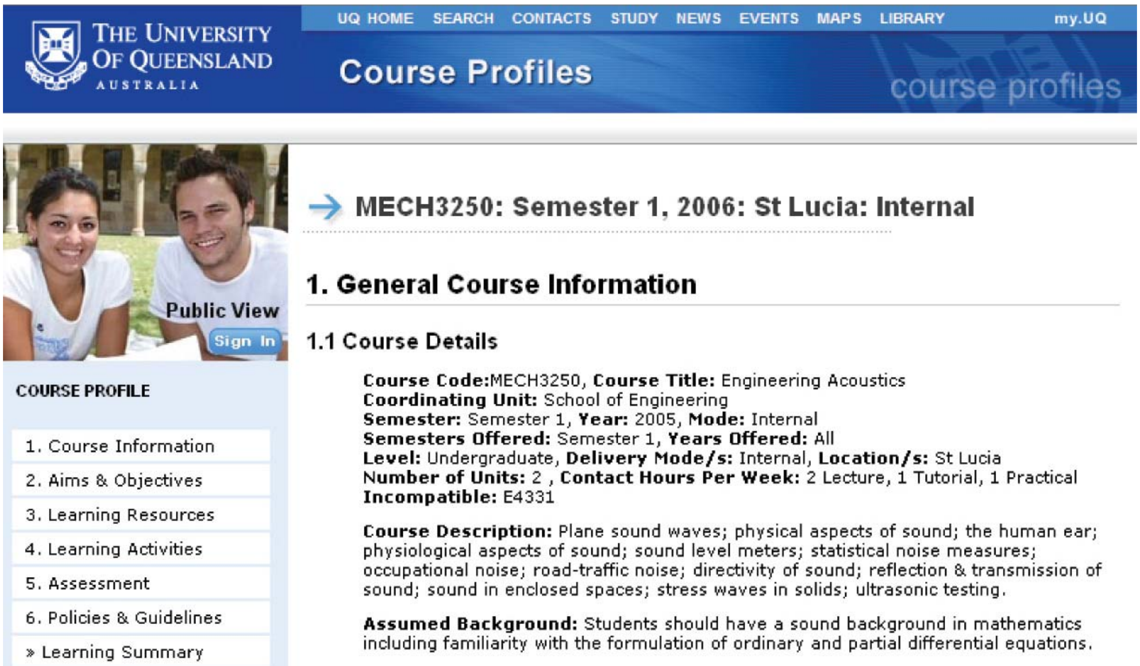
11.13.5 Online course profiles

The UQ Course Profile system was first released in 2005 and was based on a similar facility developed in the School of Engineering and rolled out in 2002 and the systems used by the Faculty of Biological & Chemical Sciences since semester 1, 2000. All relevant course information is stored online and is available for both current and prospective students. The UQ version of a course profile is unique since it has the ability to link learning resources, assessment requirements and graduate attributes in a manner that provides clear and consistent information for both current and prospective students. The UQ Course Profile is a key marketing tool and has been developed outside the Blackboard LMS to facilitate wide distribution. The main objectives of the UQ Course Profile are to:[19]

- Provide students and staff with consistent yet flexible course profiles
- Encourage further adoption of student centred teaching practices
- Enhance the learning experience for students and academics
- Increase collaboration between staff
- Guide academics to meet university policies
- Ensure students have all required course information
- Map graduate attributes for programs
- Provide better quality assurance and reporting
- Integrate with other existing systems
- Simplify existing administrative processes
- Create a point of difference for the University

Further information is available on the UQ Course Profile website.[20] A screenshot of a student view of a course profile can be seen in Figure 11.8.

Figure 11.8 Student view of an online course profile



[19] *http://www.uq.edu.au/teaching-learning/index.html?page=25525&pid=13775*

[20] *http://www.uq.edu.au/teaching-learning/index.html?page=25525&pid=13775*

11.13.6 Expanding the online presence

11.13.6.1 Digital portfolios

Effectively an online resume, digital portfolios[21] are gaining currency across the education sector for the simple reason we can gain a better understanding of a student's abilities by looking at examples of the student's work. When applied to the tertiary sector an online portfolio managed by the student, provides a very powerful mechanism to showcase their level of proficiency at every stage of their program. In particular it provides an opportunity for the student to offer examples of their work to prospective employers.

One particular model that could in the future provide an "end to end" opportunity for the student is a personal portfolio that contains specific examples of work that addresses the range of graduate attributes outlined for their program. These portfolios would in turn be linked to online employment systems that alert a graduating student of potential positions or an employer will be alerted of potential candidates. The employer with appropriate permissions could then see actual, authenticated examples of the students work in their online portfolio.

11.13.6.2 Digital collaboration tools

Digital collaboration is one term for a slew of applications that are facilitating and extending our online social networks. These networks are playing an increasingly important role in student life and are presenting the tertiary sector with some challenging opportunities.[22] In particular they offer access to discipline specific content and provide communication mechanisms that are not necessarily linked to a fixed campus location or time. A range of these tools are currently being trialled across the university and will be available through Blackboard.

Blogs	WeB LOG - a web page of a personal journal available to others can be used as a reflective student tool.
Podcasts	Audio file available from a subscription service which is automatically downloaded to your computer and can be transferred to a portable listening device like an iPod
Vodcasts	Identical to a podcast but contains vision as well as audio.
Digital Whiteboards	Digital equivalent of a whiteboard where writing on a surface is transmitted to other computers via the web.
Digital Drop Box	Online environment where documents or multimedia files can be dropped for access by a wider audience.
Wiki	Web – based page that can be edited by anyone. The most famous is WikiPedia[23] an online encyclopaedia. Wiki's can be used in a class by different groups to develop ePosters, initiate a group discussion or generate a collaborative glossary. Wiki's have been used in courses like BIOL1015 to hold an eConference for 900 students.
Clickers (personal response systems)	Portable handsets that transmit student responses to questions in a class. Used primarily to gauge student understanding.[24] These have been successfully trialled in 1st year physics classes.

[21] *http://www.educause.edu/content.asp?page_id=5524&bhcp=1*

[22] *Krause et al (2005). The first year experience in Australian universities: Findings from a decade of national studies.*

[23] *http://en.wikipedia.org/wiki/Main_Page*

[24] *http://www.educause.edu/ir/library/pdf/ELI7002.pdf*

A number of commercial companies are now combining these tools into one application and including video and audio communications tools to facilitate live interaction between staff and students and student to student. The university is currently investigating these tools for incorporation in the eLearning environment.

Elluminate Live[25]	"Is a real-time virtual classroom environment designed for distance education and collaboration in academic institutions"
Macromedia Breeze[26]	"Based on Macromedia Flash, Breeze provides a rich multimedia conferencing environment for live or on demand presentations and meetings supported by collaborative learning and management tools"
Horizon Wimba[27]	"Online collaboration software for online education, language learning and interactive communication"

11.13.7 Videoconferencing (using the internet - Video over IP)

Although extensively used in the commercial sector the use of broadcast quality vdeo conferencing[28] in the primary and secondary educational sector using the internet has been hampered by the lack of available bandwidth. Videoconferencing in the tertiary sector does not have this limitation in most institutions but it has had a surprisingly slow uptake given the opportunities for national and international collaboration it provides. With the introduction of the Australian high performance research network Grangenet[29] coupled with a substantial reduction in the cost of the equipment, it is expected that more academic staff will take advantage of this medium in the future. Videoconferencing provides unique opportunities to bring experts directly into the classroom or to take the classroom off campus regardless of the location. The communication is bidirectional even in large classes and when supported by learning management systems like Blackboard and online collaborative tools, can significantly enhance the learning environment for students.

Some cross faculty examples of using videoconferencing in the teaching program include a lecture series from the universities of Newcastle and Sydney for class sizes varying from 20 – 400, lectures to and from Nanyang Technological University, Singapore, a series of PhD seminars from Ball State University in the U.S. and live presentations from Australia directly into a major educational conference in the U.S.

Videoconferencing has also been used to facilitate tutorials between the Ipswich and St Lucia campus and the medium has played a key role as part of a schools outreach program where primary school students in Australia are paired with trainee teachers in Indiana, U.S.A as part of the "Moon Project" (managed by Ball State University).

11.13.8 Applications

All faculties make extensive use of computer-based learning tools that range from simple Powerpoint modules to sophisticated interactive models. For example, the interactive Learning Centre within the Faculty of Biological & Chemical Science has over 150 separate applications or computer assisted learning modules that are available within the facility or online. It is expected that as models become more sophisticated and are made available as web-based applications, these learning tools will play a key role in the undergraduate program.

[25] *http://www.elluminate.com/*

[26] *http://www.macromedia.com/software/breeze/*

[27] *http://www.netspot.com.au/horizonwimba.htm*

[28] *http://www.kn.pacbell.com/wired/vidconf/*

[29] *http://www.grangenet.net/*

11.13.8.1 Dedicated e-Learning spaces

It has become increasingly obvious that traditional teaching and learning space within the university does not provide the flexible infrastructure required to facilitate e-Learning in all its guises. As a result the university, as part of its Teaching and Learning Enhancement Plan, is developing dedicated space in a number of recently completed or planned buildings. Examples include the Collaborative Learning Centre in the Sir James Foots Building and a state of the art lecture theatre in the yet to be completed General Purpose North building. The university is also currently conducting a research program funded by the Carrick Institute that is collating information relating to worldwide innovative approaches to learning spaces.

11.13.9 Key readings

Ashwin, P. (ed) (2006) *Changing Higher Education: The Development of Learning and Teaching.* (London, Routledge).

11.13.10 Relevant sites

The **Carrick Institute** for Learning and Teaching in Higher Education (Australia)[30]

Joint Information Systems Committee (JISC UK)[31]

Higher Education Funding Council for England (HEFCE)[32]

The e-Strategy – "Harnessing technology: Transforming Learning and children's services" – Department for Education and Skills (U.K.)[33]

U.S. Department of Education[34]

Electronic Journal of e-Learning[35]

Educause – ("a nonprofit association that aims to advance higher education by promoting the intelligent use of information technology")[36]

7 Principles for using technology to enhance teaching and learning[37]

11.14 Major Initiatives to Come Out of the BSc Review

Two additional initiatives to come out of the Review are major projects which will bring science teaching and learning at UQ into the 21 st Century. The first is a proposal for a new Undergraduate Research Learning Space (URLS). It was initiated in response to the present situation that much of the current teaching and laboratory spaces at the University are "historical treasures" that do not cater for new advances in our sciences or pedagogical approaches to learning. It proposes a new paradigm for undergraduate science education where traditional lectures/laboratory classes are

[30] *http://www.carrickinstitute.edu.au/carrick/go*

[31] *http://www.jisc.ac.uk/*

[32] *http://www.hefce.ac.uk/*

[33] *http://www.dfes.gov.uk/publications/e-strategy/*

[34] *http://www.ed.gov/index.jhtml*

[35] *http://www.ejel.org/issue-current.htm*

[36] *http://www.educause.edu/Browse/645?parent_id=107*

[37] *http://www.tltgroup.org/Seven/Library_TOC.htm*

transformed into engaging enquiry based experiences embedded in a rich information technology environment. Such a facility is critical to attracting and retaining talented students in science. It will also help address the predicted skills shortage in science, engineering and technology within Australia. It is one of the corner stones required to build a knowledge led economy in Queensland. The full description of this proposal can be found in Section 14.1.

The second major initiative to come out of this Review is the proposal for a Science Teacher Centre (STC) which is aimed at addressing the two main factors which have contributed to the downward trend in popularity of science education programs and in science as a career: (i) the failure of education systems to adapt to the rapid growth in new knowledge and change in theories, paradigms and teaching practices; and (ii) the "fright from science" that students develop because of their limited experience of and exposure to science in practice. Another goal of the STC is to ensure that the undergraduate curriculum is evidence based and that new pedagogical advances are embedded ion our courses. The summary details of this proposal can be found in Section 11.14.2 and the full proposal in Appendix 19.

11.14.1 Proposal for an Undergraduate Research Learning Space

11.14.1.1 Introduction

Over the last six years there has been spectacular growth in "Big Science" research institutes at the University of Queensland. For example, during this time the following institutes have been built: (1) Institute for Molecular Bioscience; (2) Sustainable Minerals Institute and; (3) Australian Institute for Bioengineering & Nanotechnology. As we write, the Queensland Brain Institute is well under way and the Clinical Sciences Center is about to commence. This development represents spectacular growth on a global scale and translates into an investment in excess of half a billion dollars. In stark contrast to these developments, most of the space that is currently occupied by undergraduate teaching classrooms and laboratories represent historical treasures that are out of step with recent advances in our sciences, and equally important, are not reflective of new pedagogical approaches to learning.

If the University is to translate its tremendous investment in research institutes into economic outcomes driven by new knowledge, it must not lose site of the human capital that is necessary to drive such developments. This highlights the importance for the University to champion a new paradigm for undergraduate science teaching and learning, whereby traditional lectures are transformed into an engaging enquiry based experiences for students within a community of learners. This requires the interface between the traditional lecture and laboratory session to become blurred whereby students are involved in direct investigation embedded within a rich information technology environment. *To fulfill such a goal a new building dedicated as an Undergraduate Research Learning Space (URLS) is required.*

The quality and flexibility of our teaching & learning space plays a central role in enhancing learning and building communities of scholars. There is now a mounting body of information that questions the utility of traditional lecture/laboratory classes (1, 2, 3). This has led to the emergence of new scientific teaching strategies and recognition by the US National Research Council's Government-University–Industry Research Roundtable, which stated that we must "make use of cognition research to better inform pedagogy at all educational levels. Today's classrooms look much as they did in 1900. Knowledge on how students learn and use information has largely been ignored (1, 4). There has never been a more important time to recognize the wisdom of this advice as we are experiencing a significant reduction in the number of high school students taking science and an approximate 12-15% attrition rate within the undergraduate science cohort during their first three years at the University. Further, the OP cut-off has gone from 7 in 2004 to 10 and 12 in 2005 and 2006, respectively. Add to this the increasing number of international students taking science, and the number of domestic students who have English as a second language, highlights that the mix and ability of the student body is considerable. This mix is already challenging the system as a recent DEST audit of science, engineering and technology skills has highlighted an impending shortage in this area (5). This emphasizes the importance of teaching and communicating with “a student” and not a class and that the best outcomes are obtained when they are engaged in their own learning through what the physics Nobelist Carl Wieman termed “scientific teaching” to produce levels of understanding, knowledge retention and transfer that are greater than those resulting from traditional lecture/laboratory classes (1). Such an approach requires learning to be enquiry based and to involve real world problem solving from day one of the undergraduate experience.

11.14.1.2 Bachelor of Science Review

The BSc Review is a timely opportunity to explore options for an initiative to develop a unique and world-leading facility to connect the teaching with the research culture at UQ. Two key issues that confront us during this review process are the role that undergraduate student research plays in the science curriculum and how we can improve science teaching/delivery. Despite our leading in teaching excellence, there are significant inadequacies in our infrastructure that impede our teaching in science to reach its full potential. Furthermore, many students leave UQ with a BSc without ever having “done” science, however, as the University Planning Committee for Science and Engineering (UPCSE; 3) Preliminary Report from Harvard University acknowledges, “the reality of research is an important learning experience that complements classroom experiences”. We propose a truly innovative and novel approach to undergraduate science education modeled around existing models in the USA and major teaching institutions in the UK and Singapore. *The broad concept is reflected in the title “An Undergraduate Research Learning Space – Learning through Enquiry”.*

In modern science, where discipline barriers change with considerable speed and unpredictability it is imperative to focus on the fundamental core disciplines and skill sets. This is key to providing a solid foundation for the students to embrace this interdisciplinarity with confidence and competence. In addition, success in the new era for science depends of the quality of research, teaching and learning and high level connections to the employer base. This importantly requires that the students be skilled in the requisite competencies demanded by their future professions.

Despite our leading position in both teaching and research, one significant problem (as is already clearly evident from the initial curriculum review discussions) is that a tangible connection between our research and teaching is only made for a small number of talented undergraduate students. In order to maintain this position we need to demonstrate ongoing leadership in renewal of the undergraduate science experience. Therefore we are significantly under tapping the talent resource base of our cohort of students. Secondly, our practical class facilities are traditional and do not allow the flexibility required to present the students with the range of skills and intellectual challenge that reflects the interdisciplinarity of today’s science. At all tertiary institutes, this gap is traditionally bridged by practical classes that endeavor to provide core competencies and skills. However, these classes are frequently poorly resourced and take place in inflexible and outdated environments. As a result such outmoded facilities shoehorn the learning of undergraduate science and prevent UQ from capitalizing on its established strengths. This issue in fact forms one of the major foci of the impending University wide review of the curriculum for the BSc. We have had significant success with our recent innovations in delivery and assessment modes that are designed to enhance the ability of the students to communicate in diverse genres and contexts as well as to enhance deeper learning. These include the use of Keepad audience response units in our large classes, involvement of the Radio National Science Unit in our courses (i.e. Robyn Williams) and journalists in our 3rd year classes and the development of the innovative eConference for large first year classes. We must now push these innovations into the area of skill acquisition. This is at a time when there is an increasing demand for graduates with specific competencies in the workplace. Thus there is an absolute need for a dedicated and centralized learning space for use in the teaching of undergraduate science.

The initial working party reports for the curriculum review have highlighted a number of key issues. The Structure Working Party has stated the need for an integrated approach to the first year courses to reflect interdisciplinarity and establish a broad and solid foundation from which to progress to a range of more specialized studies in later years; the Honours and Careers working party has highlighted the need for clearly defined career trajectories and industry involvement and the Pedagogy and Student Experience have highlighted the need to engage the students more in the research culture of the university and to support pedagogy via a Science Education Research Network. Further proposals include a Science Teachers Centre and an Undergraduate Research Experience. Other relevant issues include increasing the involvement of the research institutes in the teaching and learning experience of our students and ongoing professional development of our post-graduates.

The challenges are encapsulated in the UPCSE Preliminary Report (3). These are: (i) how can we draw together the related but currently disconnected intellectual activities that take part in the different disciplines at UQ? and; (ii) how can we increase the effectiveness of our scholars, particularly in research and teaching that cuts across existing disciplines?

A centralized dedicated research learning space in the form of a new purpose designed building would serve to physically connect the teaching with the research by providing immersion in a situated learning environment to explore the processes of discovery and creation of new knowledge. Science no longer happens just in laboratories, thus the extent to which students can be enculturated into a professional scientific learning community depends heavily on the skills and experiences of the mentors. Such a learning space that is populated by top level researchers will provide immersion in an authentic environment and consolidate the credibility of the experience for the students. It would also combine physical and virtual eLearning facilities in an integrated architecture that would support collaborative and multimodal learning and reflect the research themes and culture of UQ. This would enable the synergy of innovation resulting from a unique combination of scientific research, teaching and learning. It will also act as a repository for the latest scientific research and learning technologies informed by our scholarship of discovery and teaching that would be shared at both the national and international levels.

11.14.1.3 Proposal

The proposal is to establish a central new multi-story building that will provide the physical space to create a research rich environment that supports a investigation-based curriculum, allows researchers and students to work in partnership and takes advantage of the “logic of interdisciplinary science”. Researchers from diverse disciplines often use common platforms and instrumentation. The space would provide access to these common resources and reduce duplication across the campus in these costly items of infrastructure.

It is envisaged that *URLS* will:

- Integrate practical and research activities for all science students including those in degree programs other than the BSc such as engineering, IT, biomedical science and psychology and professional courses
- Allow science teachers and teachers in training (including BEd and GradDipEd) to integrate their learning of science with the students from the other disciplines
- Include laboratories and major teaching infrastructure as well as lecture theatres, break-out rooms, tutorial and collaborative learning rooms as well as a mini library with key journals/ resources
- Provide opportunities for postgraduate and HRD students to conduct research and provide research experience to UG students
- Provide a postgraduate training area and bioinformatics suites

- Be flexible in structure and function to take advantage of semester down times for short courses and research activities (especially by postgraduate and HDR students)
- Will provide opportunities for interaction with potential employers and for industry-relevant research projects
- Provide communal spaces for the students such as rooftop BBQ area, coffee shop/canteen
- Provide an Education Research Annex (with seminar rooms) to complement the STC and SERN

11.14.1.4 Key activities

- Enhance the relevance of the BSc curriculum in a contextualized "real world" environment
- Form a physical base for the Undergraduate Research Experience
- Reflect the broad interdisciplinarity of science in a collaborative learning environment
- Integrate research led teaching initiatives and the development of core/generic skills
- Provide a space for pedagogies proposed by SERN
- Provide a drop-in zone for support for initiatives such as an "undergraduate writing center" www.ulc.psd/edu/uwc/php
- Feature an "employer interaction room" where students can meet with potential employers and other stakeholders
- Allow teachers involved with Science Teachers Center (STC) initiative to practice science and teaching science in a real environment
- Provide a base for induction and ongoing professional development of our post-graduates
- Capital investment in "big science" that caters for the needs of advanced graduates
- Feature display areas on all levels that highlight the careers in science and the diversity of research options
- Vertically and horizontally integrated architecture that is flexible, adaptable and sustainable to new teaching demands and allows peer-peer interactions across the years
- Interaction zones to facilitate and engage students in the research community
- Provide industry with specific areas in which they can support "training areas" in relevant specialized areas

In the context of conceptualizing the URLS it is useful to consider the "cutting edge" approach of the Cranbrook Roundtable (6):

C = collaborative: collaborative: science will be learned best in a collaborative setting that more closely reflects the working world of research institutions, industrial and corporate environments

U = unpredictable: the world of science will continue to evolve in unpredictable ways, thus requiring facilities/infrastructure that is truly flexible and adaptable

T = transparent: the lines between disciplines and departments will not only blur, but become virtually transparent, with open labs and increased use of "science on display"

T = technology-rich: research and learning in the sciences will rely increasingly on all forms of technology to enhance the entire process and to deal with the massive amount of available data

I = inclusive: science programs (and thus spaces) will recognize the importance of "science for all"

N = nurturing: science programs (and thus spaces) will recognize that people learn in different ways

G = genuine: students will be drawn to the study/practice of science as they understand the relevance to real world situations and learn how to use their knowledge in the future

EDGE = science education will capture **E**merging fields, be **D**iscovery-based, **G**roup-oriented and **E**xciting

11.14.1.5 Outcomes

Rather than a simple organization change/rearrangement, the *URLS* will provide a systematic and integrated approach to spearheading novel improvements/innovations in undergraduate teaching and learning. As a result we expect the following outcomes:

- Coordinated and coherent/cohesive approach to undergraduate teaching and learning underpinned a common focus on research led learning
- Provide a model in the Australian context for the undergraduate research experience
- Increase social and cultural interactions of the broader research community
- Consolidates and builds on UQ's growing reputation as a center of excellence in undergraduate teaching and learning
- More efficient use of infrastructure and resources by limiting duplication in equipment, course content and staff
- Increased and sustained student engagement and participation in science
- Better educated students to enter our Honours/Post-graduate programs

The need for the university to provide a world-class Undergraduate Research Learning Space (URLS) is critical for us to capitalize on our tremendous investment in "Big Science" research infrastructure. Providing students with such a learning environment is vital to underpin the human capital required to drive a knowledge based economy. Indeed, a recent audit by the Department of Education, Science and Training of Australia's science engineering and technology skills, highlights that significant challenges lie ahead for us to meet emerging demands. In the words of Julie Bishop, the Minister for Science, "the Audit forecast that Australia's supply in key science engineering technology areas may not be sufficient to meet future demand. Now, projected demand for science skills suggests that we'll need an additional 55,000 professionals by 2013, with supply likely to fall short by some thirty-five percent. Now some will challenge those predictions but our booming economy, particularly in mining and resources is highlighting the need for skills in these areas. But the Audit's findings of static or declining participation rates in science, engineering, technology studies, coupled with concerns about the quality of science engineering and technology education and career path is a worry (7)." These data highlight more than ever the need to give students a quality undergraduate experience so we retain the best and brightest in science. The *URLS* is central to this mission and it is similar to the Integrated Science Building at the University of Massachusetts (8) and the Undergraduate Science Instruction Center at the University of Michigan (9).

11.14.1.6 References

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11.14.2 Proposal for a Science Teachers Centre (STC)

Australia, like many other western countries, has been suffering from the global "flight from science" that is occurring at all levels of education and professional activity. This has impacted on its ability to continue to produce an educated, innovative, flexible and motivated workforce that can add to Australia's reputation of excellence in scientific research and on its ability to participate in the global knowledge economy. Both the Australian Federal and State Governments have recognised the problem and have dedicated significant resources to reverse the flight trend: at the Federal level, through such initiatives as *Backing Australia's Ability - Building Our Future Through Science and Innovatio*n (http://backingaus.innovation.gov.au/), a package totalling $5.3 billion over seven years from 2004-05; and, at the Queensland State Government level, through its diverse and phased *Smart State Strategy*, with the underlying message "continue to innovate or stagnate".

The need to provide a focus for high-quality science teacher education is recognised as a critical factor in stemming the "flight from science" in the secondary school sector and embedding science as a career. A second critical factor is to promote a career in science as an attractive and exciting option. In the US and the UK, universities, industry/business and government variously have combined to develop, for example, the Penn Science Teacher Institute and the National Science Learning Centre/Science Learning Centres network respectively, which provide rigorous professional training and development in content and pedagogy for school science teachers. In Australia at present, there are very few mechanisms for providing school science teachers with authentic and sustained experiences of science in action. A recent report by the Australian Council of Deans of Science highlighted significant gaps in science teacher training, particularly for those teaching at the critical secondary level. There is also considerable concern at the tertiary level about the disconnect between science teachers and the frontiers of science.

The University of Queensland (UQ) has identified the opportunity to build on the US and UK science teacher institute/centre models and to fill the Australian gap by establishing a unique *Science Teachers Centre (STC)* based at its St Lucia Campus. Significantly, the STC will represent the University of Queensland's response to the Queensland State Government's $46 million-over-four-years investment in two Smart Academies for high-performing senior school students. The Science, Maths and Technology Academy, now being established at Toowong in the neighbourhood of UQ's St Lucia campus and in close collaboration with UQ, will, from 2007, provide a specialised educational program to cater for students that have the potential to excel in the related fields of science, mathematics and technology. UQ is presently in discussion with the

Academy team concerning the provision of science teacher professional development, assistance with curriculum development, and the provision of laboratory experience for Academy students as part of their independent study options.

The over-arching goal of the STC is to provide an environment that fosters strong partnerships between university scientists (science academics) and school teachers in order to promote sustained generational engagement. The Centre will draw on the state-of-the-art facilities and resources available in UQ's research institutes, four of which were developed with support from The Atlantic Philanthropies, and forge links with industry/government. These crucial linkages will underpin the relevance of science to the global economy and the credibility of science within the community at large.

11.14.2.1 The specific objectives of UQ's STC

- To actively engage students in science at school and at university and to foster their interest in science as a career
- To this end, enhance the UQ science curriculum by incorporating advances in scientific and pedagogical knowledge
- Provide rigorous undergraduate training and professional life-long learning for school teachers, enabling them to apply current practices in science and education
- Drive collaborative educational research programs involving the science and education fields
- Provide a "think-tank" whereby industry and government have direct input into science education policy and practices
- Generate the human capital necessary to fuel the Queensland *Smart State* and the Federal Government's *Backing Australia's Ability - Building Our Future through Science and Innovation* initiatives.

11.14.2.2 The Key Features of UQ's STC

- The Centre will focus its activities on four cohorts:
    1. students: providing them with sustained and stimulating exposure to the latest scientific advancements and opportunities for progressive knowledge and skills development
    2. school science teachers: providing them with opportunities for effective training and sustained professional development
    3. university scientists and educators: incorporating advances in science education research into teaching practice and encouraging scientists to undertake ongoing professional development in teaching practice
    4. industry and government: encouraging their active involvement in curriculum design and educational requirements for a changing workforce.
- The STC will build on the *Bright Minds* initiative funded by The Atlantic Philanthropies to attract bright students to science; raise student awareness of career options in science; and provide teachers with the knowledge and resources to excite students and encourage them to study science. In particular, the Centre will enable UQ to support and strengthen the goals of the Toowong "Smart Academy" and to expand significantly its outreach to primary and secondary schools, in some cases through partnership arrangements.
- The STC will draw on the world-class research infrastructure at UQ including the Institute for Molecular Bioscience, the Queensland Brain Institute, the Australian Institute for Bioengineering and Nanotechnology and the UQ Clinical Research Centre at the Royal Brisbane Hospital when completed**.** The close association between leading-edge science and education will expose students to vibrant and innovative curricula that will provide an insight into and foster a strong interest in science as a career.

- A unique aspect is that science teachers-in-training will participate actively in tutoring, lecturing and assessing UQ Bachelor of Science students. In this environment, science academics will learn from the pedagogical expertise of the science teachers who, in turn, will benefit from the technological and academic expertise of the scientists.
- The STC will also establish itself as the conduit between UQ research institutes and (science) teaching practice, offering school science teachers opportunities for experiential learning.

Outcomes for this initiative in the short to long term include: an increase in student participation and retention in science and science-education programs based around innovative curricula; high-quality science teacher professional training; increased stakeholder involvement in science education policy and research; excellence in science education research, with funding from national and international bodies; enhanced community recognition of the value and contribution of science to the global economy; well-prepared science graduates who aspire to long-term careers in science; enthusiastic science teachers who can inspire the next generation's workforce.

It is envisaged that the STC will become a focal point at which scientists and science educators at all levels, as well as industry and government, can collaborate, engage and participate in intensive professional interactions about science education. The activities of the STC will be disseminated to relevant national and international education and research bodies in line with the vision of the STC becoming an international leader with a reputation for excellence in science education and research. This has the real potential of transforming science teaching and learning across all levels of education in Queensland and in Australia.

The University of Queensland has agreed to contribute $5 million from Strategic Initiative Funding to establish an endowed Chair (professorial-level appointment) to lead the STC and to fund other staff positions. Funding of $17 million is being sought from The Atlantic Philanthropies for infrastructure development, to support undergraduate and postgraduate scholarships, and to undertake an expanded science outreach program to schools. This initiative complements and adds strength to the Queensland State Government's investment in the Science, Mathematics and Technology Academy as part of phase 2 of the *Smart State Strategy,* so matching funds will not be sought from the State Government in this instance.

The establishment of the STC is a unique opportunity for The University of Queensland to take the lead in science education in Australia. The STC will play a critical role in advancing new pedagogies in science education to school teachers. The STC will take advantage of the significant investment in the biological, physical and clinical sciences at UQ. The STC will provide a unique opportunity to build partnerships between critical components of the science education system in a way that has not been achieved in the Australian system to date.

11.15 Concluding Comments on the Future Directions of the UQ BSc

The period since the BSc Review process commenced has been exciting and challenging, and at times even confronting. Many positive outcomes have already occurred, and the ground is set for many more to arise. We have certainly not yet reached a final destination in the review process, but we are well-advanced on a journey with the real potential to produce a forward-looking, world-leading BSc program that will provide excellent outcomes for graduates, staff, the University and the broader community in the years to come.

The review has identified an extraordinarily rich variety of high-quality, innovative academic activities that currently occur within the three faculties. We are rightly proud of our strong reputation for teaching excellence, and of the numerous examples of world-leading research undertaken by staff members who are actively involved with the BSc. The close links between teaching and research represent one of the greatest strengths of science at UQ.

The positive aspects of the current BSc experience are clearly recognised and appreciated by our students, evidenced by the pre-eminent place the UQ BSc holds within science education in Queensland, and by the broad level of student satisfaction identified in the comprehensive surveys that have been undertaken.

It became clear very early in the review process that a crucial activity was to critically examine and evaluate what we currently do, identifying those aspects of the UQ BSc that should be retained, and only introducing changes where appropriate. The respective committees have worked very hard at this, also addressing how best to support staff in continuing and expanding current excellence.

By their nature, science and science education are incredibly dynamic. It is some time since a comprehensive review of the UQ BSc has been undertaken, so it is natural (indeed, desirable) for this review to identify a large number of important changes, some of which are quite fundamental. To ensure that our graduates are well-prepared for a successful engagement in the international science world in the 21st century, we must involve them in a carefully-crafted, modern BSc experience.

We recognise that UQ does not operate in a vacuum, and many of the questions with which we are grappling have been considered elsewhere. We have made use of a wide range of sources, particularly the Boyer Report (1), Bio2010 (2), Towards 2020 (3) and the recent books by Newman et al (4) and Bok (5). The issues, questions and possible solutions raised in these reports have informed our deliberations, and we believe that we have been able to select those aspects that are most important for our students, whilst still remaining consistent with an identifiable UQ experience.

A feature of modern science is its increasing breadth and interdisciplinary nature. This review represents perhaps the first time in UQ Science that there has been a serious attempt across the three faculties to reflect this breadth in the BSc. Previously, a variety of factors has severely limited the extent of “big-picture, student-focused” discussions between academics from the three faculties involved in teaching the BSc degree. These factors include artificial barriers linked to funding, suspicion between different disciplines, and a lack of time and focus from staff members and management.

The review has provided the opportunity, time and motivation for staff to work together closely, driven by the search for excellence in student outcomes. The extent to which previous barriers have been overcome is very encouraging, and there are already strong indications that this improved level of understanding and goodwill between staff from different Schools and Faculties will lead to new collaborations in teaching and research.

By focusing on the best possible student experience and the graduate outcomes required in the 21st century, we have been able to propose a new BSc structure and content that encourages students to think outside traditional narrow discipline-based boundaries. This is stated explicitly in the new list of BSc graduate attributes. Students will now graduate with a broader skill base, with experience in all of the enabling sciences and more knowledge of the quantitative and information aspects of science. They will also retain more flexibility in their studies, with discipline-specific decision points moved to later years of their degrees. Coupled with these changes, we are proposing a simplified degree structure, with a smaller number of better-defined majors.

Previously, most courses were taught in comparative academic isolation from other disciplines. Under the new structure, there will be a stronger focus on integrating skills and knowledge into a broader context. Courses will be more interdisciplinary, with key concepts reinforced in several places. All students will be required to complete two compulsory courses in the BSc, with a strong focus on learning fundamental scientific techniques and applying them to relevant, practical problems.

Numerous international studies have highlighted the importance involving students as active participants in the education process, rather than simply as passive receivers of information. We recognise that there are many different educational models, and that different student cohorts and discipline areas are most appropriately served by different teaching modes. However, an important feature of the proposed BSc is to increase student access to small-group learning activities and to modern, well-resourced laboratories. Importantly, we also aim to provide all students with the opportunities to engage in appropriate research-based learning activities. This involvement will commence early in their studies, and will be reinforced at later years. We are very fortunate that UQ is the location of excellent Research Institutes, which are in a unique position to make a strong contribution to student research experiences.

Naturally, most of the review recommendations are focused on improving the general student experience and ensuring that graduates are appropriately skilled. In addition to technical knowledge, the proposed BSc will develop qualities such as creativity, curiosity, communication skills and ethical sensitivity. We are also acutely aware of some of the social and personal challenges that many students face on entering university. To address the sometimes daunting and impersonal transition to university, we will further highlight the importance of interactions between students and the creation of student cohorts.

During review discussions, it was repeatedly apparent that there are many examples of teaching excellence within the UQ BSC, including innovative teaching and assessment practices, outstanding individual performance, rigorous pedagogical research and imaginative course design. However, it was also apparent that such examples of excellence were often not widely known, even within the same School. Furthermore, there was a strong view that pedagogical improvement is largely left to the individual, may not be valued by management, and is certainly often under-resourced. Hence we have proposed a number of mechanisms to more systematically encourage, evaluate, disseminate and reward improvements in teaching and course design. In particular, it is proposed to create a cross-faculty *Science Education Research Network,* to provide a particular focus for science-based teaching developments. Related to this submission is a proposal to create a comprehensive *Science Teachers Centre,* which will act as a flagship for science education at UQ, including upgrading the skills of secondary-level science teachers.

Most of the key recommendations have received widespread support from stakeholders. However, it is inevitable in a complex process like this that there will be differences of opinion, some uncertainty as to the best way to proceed, and room for more consultation. In particular, the level to which we have involved industry, alumni, University colleges and the Queensland Studies Authority in the review has been less than optimal. There are also some issues that have been given only limited attention, including, assessment, extra-curricular activities, student advising, and the optimal use of technology in the learning process. We recognise that the onus is on us to continue to work on these and other issues during the remainder of the review process and the roll-out phase.

We are excited by the opportunities that we perceive for the new UQ BSc. A certain amount of preliminary work remains to be completed, and implementation will be both time-consuming and challenging. However, if we have the courage and will to adopt the key far-sighted recommendations that have arisen from the review process, then the UQ BSc will be strongly positioned as a leading player in Australian science education for the next 10-20 years.

"Education is not filling a bucket, but lighting a fire"

W.B. Yates

"I forget what I was taught.
I only remember what I have learnt"

Patrick White