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Appendix A: Data Collection Formats & Methodology

A.1 Overview

There are 34 Australian universities with a group of academics teaching physics. For convenience we refer to such a group as a 'department' even though several groups do not carry this title. All such groups in the 34 universities have agreed to participate in the project and each has nominated a contact person. Privacy arrangements require that institutions and individuals are not identified except when a department agrees to have a good practice example showcased.

In Stage 1 of the project, the data collection process took place in two distinct sections (in the following chronological order):

- all 34 departments were asked to complete a questionnaire
- nine chosen departments were asked to participate in an in-depth study

The questionnaire covered all areas specified in the project brief and provided an overview of the diversity of approaches and issues in the teaching and learning of physics. Based on the results of the questionnaire, nine institutions were selected, as representative of the range and geographical spread of departments, for an in-depth study to draw out how, in practice, departments decide, develop, and resource their academic programme. This in-depth study comprised an interview with the Head of Department, an interview with the chair of academic programs, and focus groups with students.

A.2 Description of Data Collection

Questionnaire

The questionnaire was distributed to each of the 34 departments, requesting responses by the HOD or a designated representative. It was stipulated that the responses should provide a representative view of the whole department and not reflect individual opinions. The questionnaire design was based on the recognition that each department has a unique teaching and learning situation, including its institutional structure, degree programs, and student cohorts, so that the local context will often affect how a question is interpreted. For this reason the questionnaire questions were almost entirely free-form. It focused on the current situation and those changes in the past 5 years which have impacted on the present, with opportunity to comment on future directions. The sections covered included:

- physics majors
- service and multidisciplinary teaching
- good practices
- employment / industry involvement

- staff development and support
- school teacher training

The data from the questionnaire was used to provide an overview of the teaching and learning across all Australian universities, and to identify trends, themes, and successful practices. Data analysis and interpretation occurred as data was gathered, at times influencing further research questions.

All 34 institutions completed the questionnaire.

Interview with Head of Department

The Head of Department interview was designed to gain insight into the priorities and strategies of each of the chosen nine departments. It explored issues in greater depth than the written questionnaire allowed and provided a glimpse into the department's broad vision or "philosophy". The majority of the questions were themed around three important areas relating to teaching and learning:

- the teaching profile
- infrastructure/resources
- the staff profile

Both the near past-to-present situation and future directions in these areas were explored. The issues involved in developing and maintaining good teaching practices were also sought.

Interviews were conducted with the Head of Department of all nine chosen institutions.

Interview with the chair of academic programs

The interview with the chair of academic programs was designed to complement the Head of Department interview by seeking more specific departmental information about:

- the processes involved in curriculum development
- achieving the learning outcomes
- other areas needing clarification (after the questionnaire)

Interviews were conducted with the chair of academic programs of all nine chosen institutions.

Focus groups of students

Focus groups of students were run in all but one of the nine chosen institutions, to gauge opinions on their physics education and thus provide the learning perspective. Students at four stages of their physics education were surveyed – first year mainstream, first year service, third year and postgraduate. They were asked:

- what has most helped them learn in physics
- what skills they have gained in physics
- physics-based employment opportunities

Focus groups of students were conducted at eight of the nine chosen institutions.

External data sources

Two external sources of data were acquired but do not feature in the main analysis.

The Department of Science Education and Training (DEST) in Australia maintains enrolment statistics for Australian universities, and it was hoped that these may be used to show trends in student numbers. However there are recognised difficulties in using such data, as reported by the Australian Council of Deans of Science (Dobson 2003). Difficulties in isolating physics subjects due to the coding used and the apparent omission of certain data introduced an amount of subjectivity into any synthesising of the data. This made the process irreconcilable with obtaining accurate student number trends. A number of institutions were asked to verify the DEST numbers and their inability to do so provided further confirmation of their unsuitability for use in the project.

The Course Experience Questionnaire (CEQ) is administered to university graduates within six months of their graduation, and can be used to study trends and comparisons for student satisfaction and attitudes. Concerns about CEQ's relatively low return rate and the inclusion of astronomy and materials science with physics in the 'Physical Sciences' category, has also made using these data impractical.

Appendix B: Data Collection Instruments

B.1 Questionnaire

AUTC Physics Project
Questionnaire on Physics Teaching and Learning

Introduction

The Australian Universities Teaching Commission (AUTC) has funded a study to obtain an accurate and representative picture of the teaching and learning of physics in Australian universities. As physics in Australia has experienced major changes, this study is timely and it aims to assist in revitalising tertiary physics education to the benefit of all stakeholders.

This is an extensive survey. We believe the data will be valuable for the physics community, for instance by identifying and sharing successful approaches in a variety of situations. As the main findings emerge we hope to be able to meet with you and interested members of your and other departments to examine them before finalising the report.

We appreciate your time and commitment in completing this survey.

Thank you,
The AUTC Physics Project Team - *www.physics.usyd.edu.au/super/AUTC/autc*

Advice on completing the questionnaire

The questions refer to **undergraduate teaching**, i.e. year 1, year 2, year 3 and honours, and the employment possibilities of physics majors and honours students. The final questions are about the support provided for staff teaching undergraduate subjects and the training of school teachers.

You can either complete the questionnaire electronically or on hardcopy. Email completed survey as an attachment to **a.mendez@physics.usyd.edu.au** or post to:

AUTC Physics Project Officer
Alberto Mendez
School of Physics
University of Sydney
NSW 2006, Australia

When completing the hard copy version please feel free to use the reverse sides of the pages or add extra sheets.

In answering the questions please provide a collective/representative view of the department rather than your own personal view. Please consult colleagues.

Please feel free to include more information than the question asks for.

In some cases the sub-questions indicate the sort of data we are interested in.

An Explanatory Statement for this project, as required by the Ethics approval granted by Monash University is attached. It is the same as one previously sent to your department's head and other participants.

Privacy of data pertaining to institutions and individuals will be respected. We will seek your department's permission for the disclosure of any information that identifies your department, for example, in highlighting the use of a successful teaching and learning approach.

Terminology used in the questionnaire
Different terms are in use at different institutions. To avoid ambiguity, terms used in the questionnaire have the following meanings:

Physics department: is a team of academics that teach physics in Australian universities. This may in fact be a small group within a department or faculty, rather than actually being called a department.

Subject: is a study of a particular set of topics usually over a period of about 12 or 14 weeks and being assessed as an individual element within a degree program.

Physics service subject: is one delivered, maintained and assessed largely by the department of physics, specifically designed for non-physics majors (including interest courses such as Physics for Life Sciences and Astronomy).

Multidisciplinary subject: is where the teaching of a subject is substantially shared between physics and other departments, schools or faculties.

Mainstream subject: is one that physics majors or potential physics majors take. A mainstream subject can also be taken by non-physics majors.

Program: is the complete 3 or 4 year degree study schedule.

Physics Major: is the 'physics degree' with which we are familiar, often comprising mostly Physics and Mathematics subjects with electives in earlier years and increasing physics content in higher years.

Multidisciplinary Program: one of the newer types of 3 or 4 year specialised degree programs, for example Nanotechnology, Biotechnology, Environmental Science, Medical Physics and Computational Science. Physics may make a significant contribution to such a program.

Joint or Double or Combined Degree Program (with Physics majors): a degree program which fulfils the requirements for two degree programs, for example, Science/Arts, Science/Law, Physics and Computing, Engineering and Physics (often electrical or mechanical engineering).

Section A: Local information

In this section we seek to document statistical data from your department.

We have collected the following data regarding physics subjects taught at your institution from the web and DEST. Could you please verify the data in the tables provided? Please tick those subjects usually offered by your department [column 2] and also tick those subjects that your potential physics majors would typically study (i.e. mainstream subjects) [column 3]. Any subjects omitted can be added in the empty cells at the bottom of the table.

A1. Name of Institution:
A2. Head of physics department/group:
A3. Liaising physicist for AUTC Physics Project:

A4. Names and codes of **all first year subjects** that your department is involved in teaching, including mainstream, service and multidisciplinary subjects, in both semesters:

subjects	offered	mainstream

A5. Names and codes of all subjects taught in second year in both semesters:

subjects	offered	mainstream

A6. Names and codes of all subjects taught in third year in both semesters:

subjects	offered	mainstream

A7. Names and codes of all subjects taught in honours year in both semesters:

subjects	offered	mainstream

Statistics: We are in the process of tabulating data for students enrolled in physics subjects from year 1 to honours (for the years 1998 to 2003), as well as staff numbers at your institution. We have requested these data from DEST and when available they will be sent to you for verification.

Section B: Overview of teaching and learning at a departmental level

In this section we seek to:

- understand how and why the teaching and learning of physics is evolving,
- identify strengths and resources which can be shared.

B1. What challenges has your department faced in the teaching and learning of physics in the last 3 to 5 years?

B2. How has your department responded to the challenges mentioned above?

B3. What directions will the teaching and learning in your department take in the near future? Why? Please note any specific changes that are planned.

B4. What are the strengths of the teaching and learning in your department?

B5. Aside from traditional lectures, labs and tutorials, have you introduced new modes of teaching and learning (e.g. web based or e-learning, active learning labs, undergraduate research activities, field trips)? Please describe. It would help if you could explain why you have chosen to explore alternative modes of teaching.

B6. Can you identify resources that could be developed cooperatively by the physics education community that could support the teaching and learning of physics in your department? Please provide a brief description.

B7. Please make any general comments regarding student backgrounds entering physics, including effect of changes to high school physics or mathematics. How has your own department adapted to these changes?

Section C: Physics majors

In this section we seek to understand the:

- characteristics of students who major in physics,
- experiences of students who major in physics (teaching environments, school physics, etc).

C1. What is the focus of your undergraduate physics majors program? How would you describe or characterise a graduate from that program? (Please indicate if there are special skills that are particular to your graduates.)

C2. Physics departments have particular strengths within certain research areas. How is this reflected in your undergraduate curriculum? Are undergraduate students exposed to these research areas within the department?

C3. For each of the years (1 to 3), approximately what fraction of the students' contact time in physics is spent in experimental laboratories? Please describe the strengths of the teaching in your experimental laboratories as well as any issues regarding maintaining a laboratory program.

C4. The following is a list of possible ways in which industry partners can be involved in the teaching of physics majors. Please tick those being currently used by your department.

curriculum design	
required industry experience	
financial support	
assessment	
field trips and site visits	
advisory committee	
guest lecturers	
'in kind' support	
case study material	
career advice	
optional industry project	

Others (please specify)

C5. Does your physics majors program involve a component that is multidisciplinary? Please describe.

C6. Please describe the balance between applied and theoretical physics in your physics majors program.

C7. Are your physics majors informed of jobs in physics? If so, how? Does this include multidisciplinary areas?

C8. For each of the following areas, within the entire physics major degree program (excluding honours), please provide an approximate percentage denoting the student time (both contact and non-contact) spent on and the assessment weighting of each area. Any areas not included can be added in the blank cells at the bottom of the table. In this table, *generic skills* refers to a range of general skills, such as listed in table F3 below (F3 refers to a broad range of graduate outcomes).

areas	student time spent	assessment weighting
classical mechanics		
computational physics		
electromagnetism		
electronics/instrumentation		
fluids		
nuclear & particle physics		

photonics		
plasma physics		
quantum mechanics		
solid state physics		
special & general relativity		
statistical mechanics		
thermodynamics		
waves		
experimental skills		
generic skills		
total	100 %	100 %

Section D: Service and multidisciplinary teaching

In this section we are seek to understand:

- the role of service and multidisciplinary teaching in your department,
- how changes in service and multidisciplinary teaching are affecting your department.

D1. Traditionally physics has been involved in teaching engineering, life science and medical science students. Please describe the changes in the past 3 to 5 years in such service and multidisciplinary subjects and the impact of these changes on your department.

D2. Please name the newer multidisciplinary degree programs that your department has been involved in developing and delivering. Have such programs been successful? If so, how?

D3. More institutions are offering double/combined/joint degrees. Have these programs been successful in your department? If so, how?

D4. Approximately what fraction of your departmental income from teaching is from service and multidisciplinary teaching (not joint degrees)?

D5. How well supported is your service and multidisciplinary teaching? Please describe.

Section E: Teaching and learning practices that are effective in particular situations

In this section we seek to:

- understand how the effectiveness of teaching and learning of physics is determined,
- identify good practice in teaching and learning of physics for particular situations.

E1. Are there any special features associated with teaching, subject content or assessment of students that are particularly effective/successful in your situation/department? If so, please describe these briefly. How have you measured their effectiveness and what are the outcomes?

Section F: Employment possibilities, employer satisfaction

In this section we are seeking to understand graduate employability and employer/industry satisfaction.

F1. How has your curriculum changed in the past 5 years in response to changing perceptions of employment opportunities? Please provide brief descriptions.

F2. How does your department ascertain the suitability of your graduates for their various employment destinations? Do you obtain feedback from employers? If so, how?

F3. For each of the following areas, within the entire physics major degree program (excluding honours), please provide an approximate percentage denoting the student time (both contact and non-contact) spent on and the assessment weighting of each area. Any areas not included can be added in the blank cells at the bottom of the table.

areas	student time spent	assessment weighting
computational skills		
ethical and social issues		
information retrieval		
oral communication		
problem solving		
project planning		
research methodology		
teamwork		
written communication		
knowledge and understanding of physics concepts, models and theories		
total	100 %	100 %

Section G: School teacher training

In this section we seek to understand the involvement of physics departments in school teacher training.

G1. How does your department contribute to the training of school teachers? Please provide example(s) of both in-service and prospective teacher training.

G2. Is your department concerned about the shortage and training of high school physics teachers? If so, does your department plan to contribute to the training of high school physics teachers or increase its involvement with the Education faculty?

Section H: Academic staff development and support for teaching and learning

In this section we are seeking to determine the level of support for academic staff to seek to identify, create and implement good teaching and learning practice.

H1. Are there any forums for discussion of physics education (teaching innovation) within the department? If so, please provide examples of some of the forums.

H2. How does your department (or faculty) support staff interested in curriculum enhancement and investigating issues related to teaching and learning of physics? Are staff who employ innovations in teaching and learning valued? Please provide example(s).

H3. Is there a mechanism for training new teaching staff (tutors, sessional and academic staff)? If so, please provide a brief description.

Section I: Other comments

In this section we are seeking to find if there are factors that you would like to be noted in this project.

I1. Are there other local factors that we should note when interpreting your departments response to this survey?

I2. Are there any other comments that your department would like noted in this project?

B.2 HOD Interview

AUTC Physics Project
Interview with HOD at selected institutions

Glossary

***Physics service subject*:** is one delivered, maintained and assessed largely by the department of physics, specifically designed for non-physics majors (including interest courses such as Physics for Life Sciences and Astronomy).

***Multidisciplinary subject*:** is where the teaching of a subject is substantially shared between physics and other departments, schools or faculties.

***Mainstream subject*:** is one that physics majors or potential physics majors take. A mainstream subject can also be taken by non-physics majors.

Overview

The project team has been asked to explore how physics teaching is responding to changes such as the increasingly multidisciplinary nature of science and broader employment possibilities, new technologies and approaches to teaching and learning, and the evolving nature of service teaching.

This interview will explore some issues in more depth than was possible in the written questionnaire. It will first cover three areas relating to teaching and learning: the teaching profile, infrastructure and the staff profile. We will then look at how your department develops and maintains good teaching practices.

Section 1 - *Departmental Profile* (25-30 mins)

First, the undergraduate *teaching profile* of your department (i.e. the directions and emphases in your teaching). What influenced the decisions for recent and planned developments in your teaching profile?

Second, in relation to the *infrastructure and resources* for teaching: What influenced the recent decisions and plans for *infrastructure and resources* for teaching?

In relation to the *staff profile* of your department; to what extent does teaching influence the decisions made in this area?

What future directions do you see for the *staff profile* at your department?

How do the research strengths of your department influence the curriculum and the quality of teaching?

<u>Section 2</u> - Good Teaching Practices (20 mins)

We will now turn to good teaching practices in your department. Questions about good practices will cover up to two instances selected where possible from multidisciplinary, service and mainstream teaching.

In reply to our questionnaire you mentioned _____ and _____ (whatever they DID mention that is relevant; up to two examples, with selection across institutions to ensure coverage of multidisciplinary, service and mainstream)**.**

(In the case of only one case mentioned in the questionnaire, invite a further example, asking particularly for teaching in one area not mentioned above)
Can you describe another development in the last few years in the provision of (one of service/multidisciplinary/mainstream not covered above) **teaching which has been successful in your department?**

Could you give some background to (each) good practice and explain the extent to which it has been successful in your department?

How have you been able to ensure that good practices are sustained?

What type of support and incentives do you (your department or institution) provide for staff development in teaching, and for developing good teaching practices? Are these effective?

<u>Section 3</u> – Future (10 mins)

Three broad questions in conclusion:

Has your department's teaching benefited from interaction with peers in Australia or overseas? If so, how?

Where do you see tertiary physics teaching and learning in Australia heading in the future? (How can we improve our future?)

Is there anything else that you would like to say concerning physics teaching and learning in your department?

B.3 Additional Questions

AUTC Physics Project
Interview In-depth Questions for Selected Institutions

Interviewee is a person nominated by Head of School, ideally the person responsible for physics education matters (e.g. Education chairperson).

Anticipated Length: 75 minutes

A copy of this interview will be provided in advance of the interview.

A copy of the Explanatory Statement to Head of School and their nominated representatives will be provided in advance to the interviewee.

Permission to tape this interview is requested, to ensure accuracy of the summary used for the project.

GLOSSARY

Physics service subject: is one delivered, maintained and assessed largely by the department of physics, specifically designed for non-physics majors (including interest courses such as Physics for Life Sciences and Astronomy).

Multidisciplinary subject: is where the teaching of a subject is substantially shared between physics and other departments, schools or faculties.

Mainstream subject: is one that physics majors or potential physics majors take. A mainstream subject can also be taken by non-physics majors.

Overview:

The project team has been asked to explore how physics teaching is responding to changes such as the increasingly multidisciplinary nature of science and broader employment possibilities, new technologies and approaches to teaching and learning. This interview will explore some issues in more depth than was possible in the written questionnaire.

Curriculum development:

We will focus on subjects primarily offered as (*to be selected by the project team for each institution, max of two*)
[ ] service teaching for engineering or related technologies
[ ] service teaching for biomedical
[ ] multidisciplinary course with substantial physics component
[ ] mainstream physics

Representative subject(s) would be _ _ _ _ _ _ _ _ _ _ and _ _ _ _ _ _ _ _ _ _ _ _

For your [*selected*] subjects, who decides the subject content?

(a) one person from physics
(b) one person from client faculty
(c) a team (including academics from client faculty for service subjects)
(d) other (please describe)

For your [*selected*] subjects, who decides the subject content?

(a) one person from physics
(b) one person from client faculty
(c) a team (including academics from client faculty for service subjects)
(d) other (please describe)

How often is subject content reviewed and revised?
(a) four to five years
(b) when client faculty thinks it's necessary
(c) depends on circumstances (explain)
(d) other (please describe)

Learning outcomes:

Do published objectives/ learning outcomes exist for your [*selected*] and [*selected*] subjects?
(a) yes
(b) no
(c) other (please describe)

How are students informed of these outcomes?
(a) handouts
(b) verbal notices
(c) web notices
(d) other (please describe)

Could you please provide one of your best example of learning outcome statements. This will be useful as we seek a range of good practices in various areas.

What methods are used to establish whether objectives/learning outcomes are achieved?

(a) exams
(b) assignments, reports and essays
(c) oral student presentations
(d) assessment of skills eg laboratory skills
(e) class surveys
(f) student focus groups
(g) outside reviewer
(h) other (please describe)

Do you align learning outcomes with graduate attributes and competencies? For your [*selected*] subjects, and for your [*selected*] subjects? If so, how?

Are students informed and/or aware of this alignment?

How are learning outcomes and objectives balanced with content in subject reviews and curriculum planning?

Do you use any external benchmarks to evaluate teaching and learning outcomes? (e.g. standard Course Experience Questionnaire, diagnostic tests for particular content areas, comparison with other institutions)

What processes do you have for reviewing subjects/curriculum/teaching?

Do you have outside/industry involvement in your review process? If so, how has this been helpful?

If you have made major changes in your teaching methods or curriculum recently, has this come from initiatives from within the department or from outside factors? Please comment.

If you have an effective process for review, could you please provide a copy of the relevant description of the process (for the purpose of establishing a range of good practices)

Student expectations and feedback:

Do you have ways of gauging the expectations of students entering the course in which you teach these subjects? If so, please describe.

How do you sample student feedback and how do you respond to it?

Web-based (on-line) teaching and learning:

To what extent is the Web used for teaching and learning?

The following four categories may be useful.

1. Information about a subject is online for students to access (optional).
2. Learning strategies and resources are available online (supplementary).
3. Completion of a subject requires on-line work or access.
4. Students study and complete subject online with no face-to-face teaching.

Why has it been introduced? How has this resulted in improved learning? Have there been disadvantages?

Projects:

To what extent do projects form part of your undergraduate physics (or multidisciplinary) curriculum. If applicable, please describe the main reasons for having projects.

Staff development and support:

What training and support do you provide for sessional or casual teaching staff (including postgraduate students)? Please provide brief details.

(a) Tutor/demonstrator training
(b) Evaluation and feedback
(c) Mentoring by experienced tutor/demonstrator
(d) Regular meeting with subject leader/coordinator or laboratory supervisor
(e) Regular meetings with demonstrator/tutor group
(f) Other (please describe).

If applicable, what approaches are used to deal with staff shortages? Are any particularly successful? What are the advantages, disadvantages and consequences of these approaches?

Employment, industry involvement:

What mechanisms are used to inform students of career prospects and the usefulness of further studies in physics?

What types of information do you gather from employers about graduate attributes, skills and overall employer satisfaction? How do you use this information?

Role of Professional organisations, networks, peers:

Has your department's teaching benefited from interaction with peers in Australia or overseas? If so, how? (e.g. from Australian Institute of Physics events, the AIP Accreditation process, other conferences and workshops, individual contacts?)

B.4 Focus Group Questions

AUTC Physics Project
Nominal Group Technique protocol

- Welcome by facilitator.
- Facilitator hands each student the following sheets:
  - B. Consent Form – Student Focus Groups,
  - C. Student Focus Group Questions, according to which group/subject-type,
  - D. Graduate Skills,
  - A. Explanation to Student Participants in Focus Groups if not already received.
- Participants fill in sheet B. Consent Forms and return it. Consent forms should be placed in a separate envelope within the main envelope.
- Participates spend 10 minutes answering the questions individually on form C.
- After the participants have filled in form C, they are asked, one by one, for their responses to the first question. The responses are written on butcher's paper by the facilitator and a discussion on those responses follows. Use a separate sheet of paper for each question. Please draw a column on the left hand side for students to later write their ranking of the items.
- With 4 questions × 7.5 minutes discussion per question, the total time spent to here should be ~40 minutes. All questions are important – IF there is a risk of running out of time, you may do question 4 in a shorter time (however note that Question 4 is important for service subjects).
- The facilitator provides students each with a marker pen. Participants are asked to look at the responses to each of the 4 questions, and then as individuals to rank the top 3 responses; the participants then marks 1, 2, and 3 against the chosen items on the butchers paper, for each question. (~5 minutes for ranking exercise)
- Finally the participants complete the sheet titled D. Graduate Skills, taking ~5 minutes, ticking the skills that they believe were present and/or were developed in their physics studies.
- The facilitator collects sheets C and D from every participant before leaving.
- Facilitator extends thanks to the participants.

AUTC Physics Project
Student Focus Group Questions – 1st Year Mainstream Physics

This is a focus group of 1st year Physics mainstream students to gauge your opinions about teaching and learning in Physics.

Please fill in the following table. Do NOT write your name on this sheet.

Age	
Gender	
Did you do high school physics?	
Why did you decide to do tertiary Physics?	
Degree enrolled in	
Are you intending to major in Physics?	Yes No Possibly (circle one)
Physics subjects/units taken this year	

Please spend 8-10 minutes answering the following questions. Please write down brief answers (dot points); feel free to provide several points for the one question.

1. What features of your physics studies has most helped your learning?
Focus on approaches, teaching and learning environments, assessment practices, ***not*** topics, individual lecturers, or how difficult physics is.

2. What are the valuable skills and knowledge you have gained from your Physics studies?

3. Has your first year Physics related Physics to other areas of science and technology? If so, how?
Focus on applications, multidisciplinary aspects.

4. Has your first year physics helped you find out about employment opportunities for Physics graduates? If so, how?

AUTC Physics Project
Student Focus Group Questions – 1st Year Service Physics

This is a focus group of 1st year students taking Physics as a service subject to gauge your opinions about teaching and learning in Physics.

Please fill in the following table. Do NOT write your name on this sheet.

Age	
Gender	
Did you do high school physics?	
(If applicable)Why did you decide to do high school Physics?	
Degree enrolled in	
Physics subjects/units done this year	

Please spend 8-10 minutes answering the following questions. Please write down brief answers (dot points); feel free to provide several points for the one question.

1. What features of your first-year physics studies has most helped your learning?
Focus on approaches, teaching and learning environments, assessment practices, ***not*** topics, individual lecturers, or how difficult physics is.

2. What are the valuable skills and knowledge you have gained from your first-year Physics studies?

3. Has your first year Physics related Physics to the needs and directions of your degree? If so, how?
Focus on applications and any multidisciplinary aspects.

4. What is the value or usefulness of your first-year Physics studies to your degree?
Focus on perceived relevance/importance ***not*** the credit points for the studies. Include any long-term perspective if possible.

AUTC Physics Project
Student Focus Group Questions - 3rd Year Physics

This is a focus group of 3rd year Physics students to gauge your opinions about teaching and learning in Physics.

Please fill in the following table. Do NOT write your name on this sheet.

Age	
Gender	
Did you do high school physics?	
Why did you decide to do tertiary Physics?	
Degree enrolled in	
Physics subjects/units done in 3rd year	

Please spend 8-10 minutes answering the following questions. Please write down brief answers (dot points); feel free to provide several points for the one question.

1. What features of your physics studies has most helped your learning?
Focus on approaches, teaching and learning environments, assessment practices, ***not*** topics, individual lecturers, or how difficult physics is.

2. What do you think are the valuable skills and knowledge you have gained from your Physics studies?

3. Have your Physics studies related Physics to other areas of science and technology? If so, how?
Focus on applications, multidisciplinary aspects.

4. Have your physics studies helped you find out about employment opportunities for Physics graduates? If so, how?

AUTC Physics Project
Student Focus Group Questions - Postgraduate

This is a focus group of postgraduate Physics students to gauge your opinions about teaching and learning in Physics. Participants should have done their undergraduate physics at the institution where this focus group is being conducted.

Please fill in the following table. Do NOT write your name on this sheet.

Age	
Gender	
Did you do high school physics?	
Why did you decide to do undergraduate Physics?	
Name of undergraduate degree completed	
How many year of postgraduate study have you done?	
Have you done any teaching, tutoring or demonstrating to undergraduates?	
Has your teaching affected your view of the way your undergraduate Physics studies were taught? If so, how?	

Please spend 8-10 minutes answering the following questions. Please write down brief answers (dot points); feel free to provide several points for the one question.

1. What features of your undergraduate physics studies has most helped your learning?
Focus on approaches, teaching & learning environments, assessment practices, skills ***not*** topics, content or individual lecturers, or how difficult physics or maths is.

2. What do you think are the valuable skills and knowledge you have gained from your undergraduate Physics studies?

3. Did your undergraduate Physics studies relate Physics to other areas of science and technology? If so, how?
Focus on applications, multidisciplinary aspects.

4. Did your undergraduate physics studies help you find out about employment opportunities for Physics graduates? If so, how?

AUTC Physics Project
Graduate Skills

Please fill in the following table by ticking the box that represents the level to which a particular skill or attribute was made use of or developed in your Physics studies.

Skill/Attribute	not at all	a little	some	A lot
computational skills				
consideration of ethical and social issues				
experimental design				
information retrieval (electronic and print)				
laboratory skills				
oral communication				
problem solving				
project planning				
research methodology				
teamwork				
written communication				

Please note any other significant skill which was developed:

B.5 Graduate Interview Questions

AUTC Physics Project
Interview with recent graduates currently in the workforce

This is one in a series of interviews with recent graduates who have completed a 3 or 4 year or Honours level undergraduate degree with a Physics major or a Physics-based multidisciplinary major. We'd value your opinions on your undergraduate Physics and how well it prepared you for the workforce.

Please fill in the following table of personal details:

Age	
Gender	
Did you do high school physics?	
Why did you decide to do Physics?	
Undergraduate degree completed	
When and where did you graduate?	
Have you completed any other degrees?	
Current position	

I'd now like to ask you a series of questions pertaining to your undergraduate Physics studies (Physics below may be read as `multidisciplinary' if appropriate).

1. What features of your undergraduate Physics studies were of most help to your learning?
Prompts: Focus on styles, approaches, teaching & learning environments, assessment practices, skills ***not*** topics, content or individual lecturers.

2. How were you made aware of employment opportunities for Physics graduates in your undergraduate Physics studies?
Prompts: Focus on applications, multidisciplinary aspects.

3. What aspects of your Physics education have helped you most in your career?

4. Is it an advantage having done Physics? Do you think you have an advantage over graduates from other disciplines? How? Are there special knowledge and skills that Physics provides?
Prompts: You may choose to comment on your initial years of employment and later years of employment separately.

Graduate attributes table

Please fill in the following table by ticking the box that represents the level to which a particular attribute was used or developed in your undergraduate Physics subjects.

attribute	not at all	a little	some	a lot
computational skills				
consideration of ethical and social issues				
experimental design				
information retrieval				
laboratory skills				
oral communication				
problem solving				
project planning				
research methodology				
teamwork				
written communication				

Please say if there was another valuable attribute:

B.6 Employer Interview Questions

AUTC Physics Project
Interview with the employers of recent graduates

This is one in a series of interviews with employers that have recently (in the last 5 years) hired staff who have completed a 3 or 4 year or Honours level undergraduate degree with a Physics major or a Physics-based multidisciplinary major. We'd like to gauge your opinions on the value of an undergraduate Physics major as demonstrated by your employee(s).

Could you please provide the following information?

Type of firm	
Jobs done by physics graduates	
Level of education of physics graduates	

We would like you to think about physics graduates who have worked for you in the last few years. Please try to separate physics graduates early in their employment from those who have worked with you for some time. We would also like to concentrate on graduates with a basic (not postgraduate) degree with a Physics major.

Are there special knowledge, skills and approaches that these Physics graduates have?

Please comment on their ability to learn and adapt.

How could Physics graduates be better? Do fresh graduates from other disciplines meet these expectations? Is it reasonable to expect university graduates to come with these attributes or are they better learnt/developed at work?

After a couple of years of employment, are Physics graduates different from those from other disciplines? If yes, in what way?

Would you employ a Physics graduate in preference to those from other disciplines? If so why?

Graduate attributes table

Please fill in the first four columns of the following table by ticking the box that represents the level to which your employee(s) with a Physics education demonstrated a particular attribute, as gauged at the start of their employment with you, *i.e. the attributes they have*.

	Have attribute				Required
	not at all	a little	some	a lot	(greater, less or OK)
computational skills					
consideration of ethical and social issues					
experimental design					
information retrieval					
laboratory skills					
oral communication					
problem solving					
project planning					
research methodology					
teamwork					
written communication					

Please say if there was another valuable attribute:

Could you now please fill in the last column, this time indicating whether a particular attribute should be present to a greater or lesser extent at the start of their employment, or whether it is about what you require (OK)?

Appendix C: Data Analysis & Results

C.1 Questionnaire

The dominant response categories are presented below with the number of institutions citing that response given in brackets.

B1. What challenges has your department faced in physics teaching and learning in the last 3-5 years?

- declining staff numbers and the general downsizing of departments **(21)**
- the inability to upgrade/upkeep laboratory/IT facilities and laboratory staff **(14)**
- counteracting the decline in student numbers **(13)**
- the loss of traditional service teaching and the need to find new ones **(13)**
- the amount of degree and subject restructuring that has been required **(11)**
- the poor mathematical (and physics) background of incoming students **(11)**
- the increased teaching loads on staff **(10)**

B2. How has your department responded to the challenges mentioned above?

- restructuring laboratories and curricula **(14)**
- introducing new majors, degrees, double degrees (e.g. Nanotechnology) **(11)**
- introducing new computer technology to teaching (e.g. WebCT) **(10)**
- reducing subject choices **(8)**
- sharing service teaching with other departments **(7)**
- use of part-time teaching staff **(5)**
- ↑ staff training, monitoring **(5)**

B3. What directions will the teaching and learning in your department take in the near future? Why? Please note any specific changes that are planned.

- will provide more new subjects, majors, degrees **(17)**
- will provide more on-line delivery of subjects **(15)**
- will provide more service and multidisciplinary teaching **(8)**

B4. What are the strengths of the teaching and learning in your department?

- experienced an dedicated staff **(15)**
- the nexus with the research areas of specialisation **(14)**
- the interactions between students and staff **(11)**
- the quality of the laboratory program and the equipment **(9)**
- the development of new teaching ideas **(8)**
- the small class sizes due to small student numbers **(8)**

B5. Aside from traditional lectures, laboratories and tutorials, have you introduced new modes of teaching and learning?

- e-learning (e.g. WebCT) **(19)**
- undergraduate research projects **(16)**
- field trips **(11)**
- online testing and assessment **(11)**
- online tutorials **(7)**
- online/computer labs **(7)**

B6. Can you identify resources that could be developed cooperatively by the physics education community that could support the teaching and learning of physics in your department?

- other shared teaching resources (on-line and others, e.g. demonstrations, including database) **(13)**
- lab experiments, equipment **(6)**
- on-line subjects or modules - package **(6)**

B7 (part 1). Please make any general comments regarding student backgrounds entering physics, including effect of changes to high school physics or mathematics.

- most incoming students are currently weaker in maths **(20)**
- most incoming students are currently weaker in physics **(12)**
- there is a lack of uniformity in students' preparation for first year physics **(10)**

B7 (part 2). How has your own department adapted to these changes?

- allowing extra time in first year to bring students up to speed **(11)**
- bridging courses **(4)**
- $\downarrow$ maths content **(4)**

C1 (part 1). What is the focus of your undergraduate physics majors program?

- focus on experimental, applied areas **(14)**
- focus on traditional, mainstream physics areas
- focus on specialist research areas **(10)**
- focus on a broad range of topics **(6)**
- focus on theoretical areas **(6)**

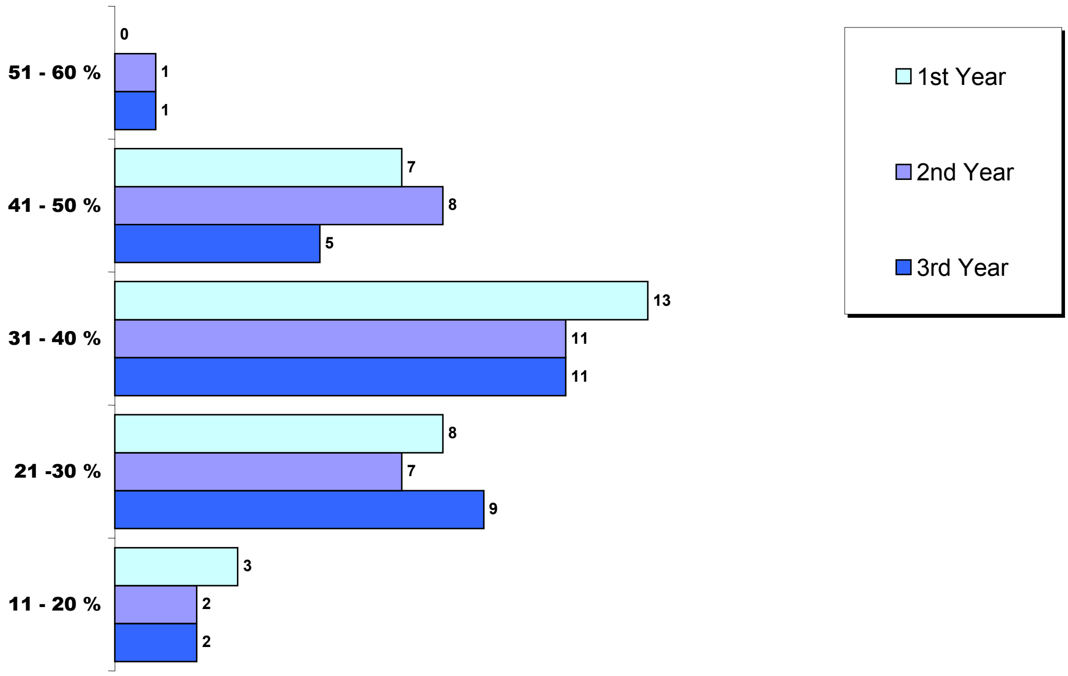
C1 (part 2). How would you describe or characterise a graduate from that program? (Please indicate if there are special skills that are particular to your graduates.)

- possessing generic scientific skills and graduate attributes **(15)**
- possessing specialised field/research skills **(12)**
- possessing IT skills **(4)**

C2. Physics departments have particular strengths within certain research areas. How is this reflected in your undergraduate curriculum? Are undergraduate students exposed to these research areas within the department?

- providing subjects within those areas **(18)**
- having students undertake projects within the research groups **(11)**
- examples of current dept research in lectures **(7)**

C3. For each of the years (1 to 3), approximately what fraction of the students' contact time in physics is spent in experimental laboratories?



C4. The following is a list of possible ways in which industry partners can be involved in the teaching of physics majors. Please tick those being currently used by your department.

- guest lecturers **(16)**
- advisory committees **(12)**
- field trips and site visits **(11)**
- optional industry projects **(10)**
- career advice **(9)**
- required industry experience **(9)**

C5. Does your physics majors program involve a component that is multidisciplinary?

- some multidisciplinary component **(14)**
- big multidisciplinary component **(6)**
- NO multidisciplinary component **(6)**

C6. Please describe the balance between applied and theoretical physics in your physics majors program.

- towards applied, experimental physics **(12)**
- towards theoretical physics **(8)**
- 50:50 **(7)**

C7. Are your physics majors informed of jobs in physics? If so, how?

- via noticeboards **(12)**
- via the lecturers **(7)**
- via website information **(6)**
- NOT explicitly informed **(6)**
- via email newsletters **(5)**

D1. Traditionally physics has been involved in teaching engineering, life science and medical science students. Please describe the changes in the past 3 to 5 years in such service and multidisciplinary subjects and the impact of these changes on your department.

- a general reduction in service teaching (mainly in Engineering) **(19)**
- move towards new areas of service teaching **(10)**
- reduction/elimination of physics content by other disciplines **(9)**
- ↑ input into curriculum by other disciplines **(7)**
- service teaching loss = ↓ funding **(6)**

D2 (part 1). Please name the newer multidisciplinary degree programs that your department has been involved in developing and delivering.

- Nanotechnology **(12)**
- Photonics **(6)**
- double degrees **(6)**

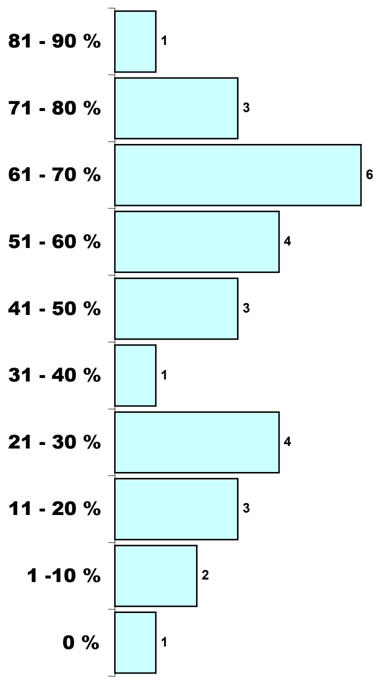
D2 (part 2). Have such multidisciplinary programs been successful?

- quite successful **(10)**
- only attracted small numbers of students **(7)**
- only moderately successful **(6)**

D3. More institutions are offering double/combined/joint degrees. Have these programs been successful in your department? If so, how?

- popular and (largely) successful **(16)**
- not yet widely popular **(12)**
- mainly attract high achievers **(11)**
- large % of their physics majors **(5)**
- good employment opportunities **(5)**

D4. Approximately what fraction of your departmental income from teaching is from service and multidisciplinary teaching (not joint degrees)?



D5. How well supported is your service and multidisciplinary teaching?

- very well **(11)**
- the same as all other teaching **(10)**
- badly **(4)**

E1 (part 1). Are there any special features associated with teaching, subject content or assessment of students that are particularly effective/successful in your situation/department?

- undergraduate project work **(7)**
- weekly tutorials **(7)**
- online supplementary material **(6)**
- assessment regularly **(4)**

E1 (part 2). How have you measured their effectiveness and what are the outcomes?

- student evaluation surveys **(11)**
- student/staff liaison **(4)**

F1. How has your curriculum changed in the past 5 years in response to changing perceptions of employment opportunities?

- by introducing named/new degrees **(12)**
- put greater emphasis on generic skills **(7)**
- introducing topical subjects **(5)**
- It hasn't **(5)**

F2. How does your department ascertain the suitability of your graduates for their various employment destinations? Do you obtain feedback from employers? If so, how?

- no direct feedback **(11)**
- informal feedback only **(10)**
- formal feedback, built-in **(5)**

G1. How does your department contribute to the training of school teachers? Please provide example(s) of both in-service and prospective teacher training.

- generally teaching to prospective physics teachers **(21)**
- providing in-service training through courses, development days, workshops **(15)**
- teaching into a double degree with Education **(14)**
- direct contact with school teachers through AIP, school visits **(10)**
- running courses training physics teachers **(7)**

G2. Is your department concerned about the shortage and training of high school physics teachers? If so, does your department plan to contribute to the training of high school physics teachers or increase its involvement with the Education faculty?

- all institutions stated that they were concerned
- just over half of them have some type of program in place to offset this trend

H1. Are there any forums for discussion of physics education (teaching innovation) within the department? If so, please provide examples of some of the forums.

- departmental committees, staff meetings **(7)**
- Faculty T&L forums **(7)**
- informally over tea/coffee **(7)**
- departmental T&L forums **(5)**

H2. How does your department (or faculty) support staff interested in curriculum enhancement and investigating issues related to teaching and learning of physics? Are staff who employ innovations in teaching and learning valued?

- resources, financially, and with sharing of teaching loads **(18)**
- encouraging staff to further their T&L qualifications **(15)**
- rewarding teaching in promotions **(6)**
- T&L innovation awards **(5)**
- dependent on available time**(5)**
- NO special support **(5)**

H3. Is there a mechanism for training new teaching staff (tutors, sessional and academic staff)?

- encouraging/requiring new staff to complete university run generic T&L courses **(22)**
- mentoring under senior staff **(7)**
- by providing dept run training courses **(6)**
- teaching cert. required **(4)**

C.2 Student Focus Groups

The student focus groups were run according to the protocol reproduced in Appendix B4. The top three responses to each question are set out below, for each of the six institutions where focus groups were conducted.

1. What features of your physics studies has most helped your learning?

	1st year mainstream	*1st year service*	*3rd year*	*postgraduate*
1	**1.** regular assessment **2.** examples in class **3.** lab and group work	**1.** worked examples **2.** inspirational lecturers **3.** study guides	**1.** good study guides **2.** experience as a student **3.** working at own pace	
2	**1.** student/staff communication **2.** worked examples in lectures **3.** notes on the web	**1.** interesting lecturers **2.** practical components **3.** regular quizzes	**1.** lecturers ability to teach **2.** web based resources **3.** good course structure	**1.** lively lectures **2.** small class, interactions **3.** practical experience
3	**1.** assignments **2.** worked examples in lecture notes **3.** practicals	**1.** handouts in lectures **2.** worked examples in class **3.** mid semester exam		**1.** challenging content **2.** enthusiastic lecturers **3.** low student / teacher ratio
4	**1.** smaller classes **2.** tutorials **3.** helpful lecturers	**1.** examples in tutorials **2.** notes on the web **3.** demonstrations	**1.** regular small assessment **2.** problem solving assessment **3.** notes on the web	**1.** Honours year thesis, research **2.** interested lecturer **3.** labs
5	**1.** problem solving **2.** lab courses **3.** tutor explanations	**1.** teacher's knowledge, communication skills **2.** tutorial questions **3.** concepts not problems	**1.** regular assignments **2.** tutorials **3.** examples in lectures	
6	**1.** practical lab sessions **2.** physics studio workshops **3.** theory/practical balance	**1.** practice (perplexing) questions **2.** lecture notes **3.** weekly assignments	**1.** continuous assessment **2.** studio learning environment **3.** problem solving in tutorials	**1.** peer support **2.** taught how to learn, problem solving **3.** practical, labs
7	**1.** access to knowledgeable teachers **2.** tutorials - tutors & other students **3.** immersion in physics "world"	**1.** overview of each section & references to textbook **2.** relevance of tutorials to lectures **3.** group work in practicals	**1.** working through problems in tutorials & assignments **2.** applying "maths tricks" to physics problems **3.** starting with the "story" - maths	**1.** continual assessment - assignments **2.** labs - hands on, physics in action **3.** collaborating with other students

2. What do you think are the valuable skills and knowledge you have gained from your physics studies?

	1st year mainstream	*1st year service*	*3rd year*	*postgraduate*
1	**1.** experimental, lab skills **2.** organisation, co-operation **3.** time management	**1.** logical thinking skills **2.** problem solving strategies **3.** understanding of basic principles	**1.** ability to optimise problems **2.** problem solving skills **3.** systematic appro. to problems	
2	**1.** problem solving skills **2.** better approach to problems **3.** how things work, laws	**1.** background knowledge **2.** experimental method **3.** everyday physics applications	**1.** problem solving skills **2.** understanding of how technology works **3.** thinking in terms of models	**1.** maths and computer modelling **2.** problem solving, logic **3.** research methods
3	**1.** physics description of everyday **2.** logical thinking **3.** calculation skills	**1.** description of everyday things **2.** good general knowledge **3.** teamwork		**1.** learning how to learn **2.** independence with support **3.** problem solving
4	**1.** analytical skills **2.** understanding of fundamentals **3.** skills in synthesising	**1.** understanding of fundamentals **2.** logical thinking **3.** problem analysis	**1.** analytic, problem solving skills **2.** can see how things work in everyday **3.** logical thinking	**1.** problem solving **2.** logical thinking
5	**1.** ability to apply **2.** power to understand **3.** analytical skills	**1.** application of basic physics concepts **2.** basic physics concepts **3.** how to approach problems	**1.** operating equipment **2.** understanding physical processes **3.** application to other disciplines	
6	**1.** data processing using computer software **2.** problem solving **3.** lab report writing	**1.** application of physics to other disciplines **2.** everyday applications **3.** report writing	**1.** problem solving, logical / critical thinking **2.** research skills **3.** communication, report writing	**1.** scientific way of thinking **2.** analytical skills **3.** report writing
7	**1.** learning & experimentation using scientific method **2.** application of physics to mathematics **3.** application to the real world	**1.** error analysis **2.** problem solving skills **3.** scientific instrumentation	**1.** computational skills **2.** identifying what is essential, negligible **3.** using maths in science	**1.** analytical approach to thinking **2.** problem solving skills **3.** mathematics

3. Have your physics studies related physics to other areas of science and technology? If so, how?

[first year service] Has your first year physics related physics to the needs and directions of your degree? If so, how?

	1st year mainstream	*1st year service*	*3rd year*	*postgraduate*
1	**1.** connections with maths **2.** connections with computing, eng. **3.** connection with IT (and skills in)	**1.** direct relation with real life problems in engineering **2.** areas liked in physics, liked in engineering **3.** not specifically, only broadly	**1.** overlap with chemistry at the atomic level **2.** everything related to physics **3.** astronomy and elec. eng.	
2	**1.** basis for much of engineering **2.** basis for lots of maths **3.** nanotechnology	**1.** foundation – crosses over to all courses **2.** provided the experimental skills **3.** refreshing of skills helpful	**1.** physics is core which relates to other sciences **2.** makes understanding other subjects easier **3.** relates to almost all other subjects	**1.** physics makes you aware of all its applications **2.** all bits come together at the end **3.** don't remember
3	**1.** algebra a huge part of physics **2.** chemistry: energy & atomic structure **3.** problem solving in maths & chem.	**1.** general overview of physics **2.** good explanations but sceptical as to use **3.** backg'd platform for other sciences		**1.** case studies helped relate physics to other areas **2.** conceptual under-pinnings merge **3.** methodologies similar for s & t
4	**1.** physics is integrating by its nature **2.** gives a reason for learning maths **3.** chem. overlap: thermodynamics	**1.** helps with skills in chemistry and maths **2.** not sure of direction of degree **3.** helps with chem. & mech. eng.	**1.** helps with maths **2.** helps to understand popular science articles **3.** understand eng. subjects better	**1.** by nature physics covers other areas: maths, chem. **2.** scope for branching out in degree **3.** no
5	**1.** application of engineering principles **2.** maths **3.** use of graphs	**1.** understanding of concepts, can be applied other areas **2.** maths: e.g. vector analysis **3.** relate to solving life problems	**1.** ??? **2.** communications **3.** engineering	
6	**1.** better understand theories in chem: thermodynamics **2.** in other lab disciplines: use physics application **3.** in a very general way	**1.** knowledge about equipment used in other areas **2.** physics concepts relate specif'lly to other areas **3.** focus: technical aspect of degree	**1.** applications covered briefly at end of unit **2.** glazed over, only covered in passing **3.** not applied much	**1.** applications of physics to everything **2.** physics concepts can be applied to everything **3.** industry applications
7	**1.** biology (molecular), chem. (atomic), geology (Bragg's) **2.** chemistry derives from physics **3.** applications to space eng.	**1.** some parts reinforce concepts in degree, others not relevant **2.** general information relevant to degree **3.** technology used during pracs	**1.** computational applications to technology **2.** scientific method – implicit, many areas **3.** molecular biology and maths	**1.** not generally to other areas **2.** applies to physics related technology **3.** quantum mech - computer techno.

4. Have your physics studies helped you find out about employment opportunities for physics graduates? If so, how?

[first year service] What is the value or usefulness of your first year physics studies to your degree?

	1st year mainstream	*1st year service*	*3rd year*	*postgraduate*
1	**1.** lecturer shows career path as postgraduate/researcher **2.** a sense of a range of options - no specifics **3.** no specific info	**1.** introduction to which field you will choose in eng. **2.** establishes knowledge base across all areas **3.** physics provides tech. knowledge	**1.** NO! **2.** no access for externals **3.** perception: not many options	
2	**1.** no - should provide more information **2.** nanoscience talks about careers **3.** no – internship may help	**1.** foundations with following subjects **2.** opens eyes to appl'ns in the real world **3.** no ideal situation exist in life	**1.** not a lot of info is passed on - no common approach **2.** internships are good but mostly with govt dept **3.** science industry partn'ship needed	**1.** government institutions **2.** limited opportunities exist **3.** not much, bits only, v. general
3	**1.** no - too early to think about physics related jobs **2.** no - doesn't relate to employment options **3.** ???	**1.** expands knowledge base **2.** basic understanding of all sciences required **3.** not worth a whole semester		**1.** lecturers tell you about experience of other graduates **2.** info on noticeboards, types of job available **3.** summer sch'ship provide exposure
4	**1.** small class told about main paths for physics majors **2.** opportunity to go to workshop on jobs **3.** advisory day talks - science careers	**1.** little relevance - see no relationship with solar energy **2.** not yet useful - expect it will in later years **3.** helps with other subjects	**1.** need more suggestions about portability - outside physics **2.** aware of options due to physics careers seminar **3.** need for H.S. physics teachers	**1.** no **2.** no -need to find out for yourself
5	**1.** not yet **2.** ideas of various possible employment paths	**1.** provide a broad view of physics **2.** big impact on other parts of studies **3.** lead to studying of other subjects	**1.** talks by special guests **2.** informed by the lecturer on work in research **3.** IBL - help to look at jobs available	
6	**1.** only about dept research groups **2.** eg of different areas used in lectures **3.** lecturers talk of physics teaching	**1.** provides fund. understanding & practical implementation **2.** provides useful foundation to degree **3.** not highly useful to degree	**1.** told little about opportunities - past graduates info needed **2.** 'work experience' type unit would be helpful **3.** only PhDs – need to see industry	**1.** can use physics knowledge, skills in many areas **2.** if specialising in physics need further study **3.** dept newsletter
7	**1.** talking to physicists inside and outside uni **2.** exposure to P/G students **3.** no	**1.** apply understanding gained in physics to other subjects **2.** useful, future research career in science **3.** feel for which subjects to do	**1.** work exp. would be useful - what does a physicist do? **2.** no! (despite having sought this advice) **3.** general answers - optics, photonics	**1.** NO!!

Appendix D: AIP Accreditation

D.1 Information for Universities seeking to have a qualification accredited by the Australian Institute of Physics

(1) Issues considered in the accreditation process.

In examining an individual course for accreditation purposes, the accreditation panel will consider the following factors:

- the general academic practices and standards of the education institution;
- the objectives of the course and the methods adopted to achieve these objectives;
- the standards of admission to the course;
- the duration of the course;
- the breadth, depth and balance in the subjects involved and the intellectual effort and demands of the course;
- the methods of assessment of student progress;
- the arrangements for practical training and experience as part of the course;
- the teaching staff conducting the course, their numbers, professional qualifications and experience and their educational expertise;
- the accommodation and facilities available including equipment, libraries, laboratories, workshops etc.

Each University requesting accreditation of a course or courses will be required initially to provide the information listed below in a clear and concise form and subsequently to host a visit of up to one day's duration by an accreditation panel. This panel will normally comprise 3 members of the full Accreditation Committee of the AIP.

(2) Documentation required:

(It is anticipated that most of the documentation required could be extracted by Universities from existing Handbooks and similar publications.)

- a statement of the objectives of the course;
- a statement of the requirements for completion of the degree (or the degree sequence for which accreditation is sought);
- a calculation of the amount of physics and mathematics in the course which shows how it is believed to satisfy the AIP requirements;
- detailed syllabi of all units, classifiable as physics or mathematics, which could be included in a properly constituted course including details of texts, and the relevant pre- and co- requisites;
- a description of a typical program of study leading to the award of the degree;
- a statement of the method of assessment used and their relative weightings;
- brief resumes of the physics staff involved in teaching the course and a summary list of all physics staff which includes their highest qualification and professional memberships. If this qualification is not in physics then the highest physics qualification should also be given;
- any other material considered relevant by the University.

D.2 IEAust Policy on accreditation of professional Engineering programs

This section reproduces the Policy as issued by the Council of IEAust in November 1997. Minor amendments have been made, such as substitution of the word program for course. Clauses of the Policy are numbered as in the original issue.

(1) Preamble.

University education provides the learning base upon which competence for a professional engineering career is built. It is important that the education provides the graduate with the generic attributes listed in Section 2 below. It is equally important that the education process be accredited by the Institution of Engineers, Australia (IEAust) to give confidence to the students, the universities and the profession that the education will indeed provide a graduate with the required attributes. Through the process of accreditation of university education, as the representative of the profession, IEAust will:

- ensure that graduates from an accredited program are adequately prepared to enter and to continue the practice of engineering;
- promote best practice;
- promote the standing of accredited programs to members and potential members of the engineering profession in Australia.

(2) The Generic Attributes of a Graduate.

Graduates from an accredited program should have the following attributes:

- ability to apply knowledge of basic science and engineering fundamentals;
- ability to communicate effectively, not only with engineers but also with the community at large;
- in-depth technical competence in at least one engineering discipline;
- ability to undertake problem identification, formulation and solution;
- ability to utilise a systems approach to design and operational performance;
- ability to function effectively as an individual and in multi-disciplinary and multi-cultural teams, with the capacity to be a leader or manager as well as an effective team member;
- understanding of the social, cultural, global and environmental responsibilities of the professional engineer, and the need for sustainable development;
- understanding of the principles of sustainable design and development;
- understanding of professional and ethical responsibilities and commitment to them;
- expectation of the need to undertake lifelong learning, and capacity to do so.

(http://www.ieaust.org.au/membership/res/downloads/AccredManual.pdf)