AUTC Physics Project:
Learning outcomes and curriculum development

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
[Telephone: (02) 9351 5982]

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		
optics		
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?