

REPORT OF THE EVALUATION PANEL FOR CHEMISTRY, COMPUTER SCIENCE, MATHEMATICS AND PHYSICAL SCIENCES

18 – 22 March 2002

Introduction

The panel members thank the University of Helsinki for the invitation to carry out this review of the teaching provision in Mathematics, Physical Sciences, Chemistry and Computer Science. The arrangements for our visit were excellent and we were welcomed with unfailing courtesy by all the staff and the students with whom we had discussions. We are grateful for the time and effort that they clearly expended in preparing the documentation, which informed our evaluation, and for their patience in explaining their organisational structures under which the teaching is delivered.

The task of reviewing the course delivery in five separate departments in just a few days of meetings is daunting. Time limitations also dictated that we restricted our attention mainly to the training leading to Masters degrees.

This report is divided into two parts; the first is an overview of our findings and the second addresses the specific issues, point by point raised in the evaluation guidelines provided by the University.

Part One: Overview

The University of Helsinki provides an educational experience in which students are given the opportunity to be taught and work in departments of international renown and prestige, and have very good prospects of employment. We wish to commend the progress made in the subjects and departments under review since the evaluation carried out in 1994. In the various documents that we were given, before and during our visit, we noted two major concerns of most departments: the “drop-out” of students during the early years and the issue of training schoolteachers for secondary schools, in terms of quantity and quality. Additionally, in our responses to the University’s detailed questions there are issues that occur several times in our report.

The first concern is the funding models used by the University and the Faculty. They appear to encourage competition for students, rather than collaboration between departments. They could

even discourage departments from seeking ways to collaborate in implementing important initiatives in multidisciplinary courses.

Our second concern is the collection of information. The University centrally does not appear to collect detailed data about students. This is essential if the retention of students and related concerns are to be addressed effectively.

Our third concern is the lack of dialogue between the University, the Faculty and the Departments concerning the University's Strategic Plan. We fear that the Plan will not be effective until there is such an interaction and until the University acknowledges some of the problems facing the Faculty and its Departments if they are to meet the ambitions of the Plan.

Our fourth concern is quality assurance in teaching and assessment. There are no management systems to ensure this.

Our fifth concern is the unsatisfactory employment prospects of junior staff. Development of their teaching skills still does not appear to have a significant bearing on their security of employment.

The report below is written in terms of what we believe to be possible. The constraints are well recognised by us, given the present financial and political climate. However, some of us who are not well acquainted with the Finnish educational system were mildly surprised at the freedom students enjoy. We were not used to the idea that students could obtain a grant, enrol on a course and never attend the University, that students have the liberty to leave programmes without explanation, that students can take examinations an unlimited number of times and indeed be enrolled on a programme for some ten years before having to reapply.

This freedom is obviously cherished by students and we can appreciate why. Indeed, as we note later, we were deeply impressed by the maturity and self-confidence of the students we met, and not only those we met on formal occasions, but also those we sought out in cafeterias and laboratories. However, these benefits come at a heavy cost to the Faculty and Departments, both in extra finance to meet the students' demands and in the load on the staff. This in turn has consequences on the quality of teaching. Although the University has no measure of the effectiveness and efficiency of the teaching staff, we are in little doubt that the experienced permanent staff are left with less time than they need to consider and implement reforms and innovations in teaching, particularly for those periods in a student's career when there is greatest likelihood of drop-out.

Part Two: Detailed report on the evaluation

Faculty wide strengths and areas in need of further development

(a) Strengths

- (i) The research abilities of staff who provide comprehensive and up-to-date coverage of the disciplines under review, informed by internationally acknowledged research.
- (ii) The establishment of interdisciplinary chairs, e.g. in Physics (in Biophysics and in Medical Physics) and in Mathematics (in Financial and Insurance Mathematics) and interdisciplinary programmes of study, e.g. in Computer Science (Software Business).
- (iii) The involvement of students in research.
- (iv) The sense of belonging felt by students in the smaller departments and the subdivisions of the larger ones.
- (v) Moves to increase the supply of school teachers in science and mathematics.
- (vi) Links with schools to enhance the skills of teachers and the recruitment of students.

(b) Areas for further development

- (i) The link between the University's Strategic Plan and the strategic objectives of some departments.
- (ii) The development of funding models, which effectively encourage and reward interdepartmental and interfaculty collaboration, rather than competition, in the provision of service teaching and in the development of new joint courses.
- (iii) Quality assurance procedures in the delivery and assessment of teaching, and in the evaluation of student feedback.
- (iv) A system of mentoring for newly appointed staff to develop their teaching and assessment skills.
- (v) A reduction in the variability of the effort required to achieve particular amounts of credit.
- (vi) More study opportunities in Biological Sciences, access to which seems to be restricted.
- (vii) The apparent loss of students in the first two years. Where these result in transfer to other University of Helsinki programmes, and graduation through other departments or faculties, their early years' training should be properly recompensed, see point (ii) above.

- (viii) Increased publicity in schools for the flexibility of the courses offered by the University of Helsinki.

Departmental strengths and areas in need of further development

(a) Strengths

The coverage of the fields of education in the Departments under review is comprehensive. A considerable range of courses is available to students who appear to appreciate the flexibility to select modules to meet their individual needs and interests. For example, there are several coherent lines of study identified in Mathematics and Computer Science. This was less evident in Chemistry and Physics. The Departments of Computer Science and of Physical Sciences have strategic plans, although in the latter it did not feature strongly in the thinking of the physics professors about future developments. The Department of Computer Science is applauded for conducting periodic and fundamental reviews of its overall programme.

Multidisciplinary is a key goal of the University. There are encouraging signs that departments are responding to this by the creation of some new chairs and by steps taken by staff to develop new programmes.

(b) Areas for further development

The Department of Chemistry currently is structured in Laboratories and much of the teaching is carried out on that basis; it should carry out, as a Department, a holistic review of its teaching programme at all levels, ensuring that the overall programme is coherent and that the allocation of time is reasonable in terms of the demands on students' time. The Departments of Physical Sciences and Mathematics should make, or update, their medium term plans in the context of the University's Strategic Plan.

The Relationship between Teaching and Research

Almost all the staff we met were active researchers who embraced the concept of research-led teaching. We are aware of the prestigious research ratings of the departments under review, and research clearly has an essential role in training in the later stages of the Masters programme. In Physics the junior staff make commendable efforts to illustrate their lectures with topical examples. In Chemistry the seminars given to first year students by researchers from industry as well as

academia exemplify good practice and should be adopted by other departments. On the other hand some of the equipment in the student laboratories did not convey a “state-of-the-art” impression.

We are concerned that the staff, appointed to lectureships, should have time to develop fully their careers both in research and teaching (see “Training in Teaching”, below). Good research is rewarded in various ways. Quality in teaching should receive similar recognition. The awards given for good teaching achievements are appreciated by teachers and departments, and this practice should be continued.

The flexibility provided by the person-hour system (1600 hrs per year) should be more fully exploited, for instance by giving staff with a heavy teaching load the possibility of a sabbatical term, as is the case in the Departments of Computer Science and Mathematics.

Learning Atmosphere

The learning atmosphere in Astronomy particularly is excellent and it is also markedly good in the relatively small Swedish-speaking units in the larger departments. The atmosphere is generally good for advanced students in all departments. We were, however, concerned over a small number of worrying exceptions. We noted that efforts to bring about further improvement in the early years were evident in Mathematics and Chemistry.

Study Guidance and Support Services

The guidance available to students (personal and academic) is not as well developed as in some other countries, although it was not clear that Finnish students would take advantage of a greater provision. We suggest that the University should develop more robust systems for tracking the progress of students and discovering the reasons for changing or discontinuing courses of study. We commend the efforts of departments that are trying to do this for themselves. A good university database is a prerequisite and its establishment is an appropriate task for the central administration.

Retention of students during the first year is a key issue for most departments. The use of experienced staff, who are proven good teachers, is commended in the early years. Efforts to monitor student progress in Mathematics, and to develop study skills and research interest in Chemistry are noteworthy.

The new buildings provide very good facilities for teaching and learning. The size of the laboratories in Chemistry places some restrictions on the size of group that can be accommodated at one time, but their availability for students to use at times convenient to them, is particularly valued. The library and IT facilities are good. The building used by the Department of Astronomy is conducive to an excellent learning environment.

Most departments have initiated a teacher tutor system. This commendable practice should be continued and developed further to increase student participation and satisfaction. Researchers should participate in tutoring as a way of integrating research and teaching.

Student–Centred Learning

Finnish students seem to be particularly mature and self-reliant compared with their peers in many other countries. They value the flexibility of choice of courses and the opportunities to study independently. Some departments provide texts or web-based material that render lecture attendance optional, but then retention of the traditional lectures does not save staff time.

The move to e-learning is particularly strong in Computer Science, but there is also a promising international collaboration for basic material in Mathematics and we noted plans to develop e-learning in Chemistry. There are moves to group learning in some departments.

Teaching Methods

A significant proportion of lectures seem to follow closely a recommended textbook. In Physics and Chemistry, the first year lectures seem to be badly attended, even given the phenomenon of the drop out of future medical students. We urge that the lecture programme is reconsidered in terms of the motivation of the students. It may be that the style in which lectures are given could be examined. In Mathematics, lectures are well attended but the quality and quantity of the support materials are variable.

There is apparent variability in the student effort required to gain a credit unit on different courses. The Faculty should take action to assess and standardise the workload required. In our experience students in most departments are overloaded if they are to achieve a Masters degree within 5 yrs. In the experimental sciences and Computer Science the value of laboratory-based learning is not sufficiently reflected in credit units.

Training in Teaching

With the possible exception of Computer Science, most newly appointed staff receive insufficient training and guidance in developing their teaching skills, apart from IT skills, notwithstanding the availability of university courses in basic teaching techniques. Some new staff are given a full teaching load immediately, making it difficult for them to maintain or develop the research programmes which will underpin their career progression. The junior staff we interviewed, and most of the senior staff, said they would welcome the introduction of procedures to ensure appropriate training, mentoring and monitoring.

We suggest that:

- (a) New teaching staff should receive mentoring from a more experienced member of academic staff who could advise on training in teaching and the balance between their teaching and research effort. There may be some advantages if the mentor is not a close research associate.
- (b) Some of the lectures given by each member of staff should be observed by other members of staff, so that advice on delivery, content and pace can be provided to the lecturer.
- (c) New members of staff should attend appropriate training courses to help them with lecturing, small group teaching, assessment and the use of IT.

Learning Results

The standards attained by students achieving Masters and PhD degrees are appropriate. Departments have yet to formulate plans for graduation at the Bachelor level. To treat the Bachelor programme as simply the first stage of a masters degree may not always be appropriate. The requirements for a doctoral degree meet international standards. We note that the time required to obtain a PhD in Mathematics is excessive and invite the department to consider whether the level demanded for the doctorate is too high and whether some more guidance and supervision are needed.

Flexibility

The degree programmes are very flexible in principle, but in practice there are restrictions in course choice arising from timetabling clashes and movement between sites. There are particular restrictions on the number of students allowed to take minor courses in Biological Sciences. This is

particularly surprising given the rapid scientific developments that are taking place. These obstacles need to be overcome if they are not to hinder future multidisciplinary developments envisaged by the University.

Departments have considerable and justifiable concerns over the planned administrative reorganizations. Splitting the faculty into two parts, as suggested by the campus-based administrative model, could make it more difficult to reach the goal of increased interdisciplinary co-operation. The plan to combine the Department of Mathematics with the Rolf Nevanlinna Institute and the Department of Statistics (from another faculty) needs a funding model to be developed that takes into account the various needs and forms of operation of these units.

Quality Assurance

In general, quality assurance systems are poorly developed and are overly reliant upon feedback and course questionnaires: we comment elsewhere on the mentoring of teachers, monitoring of lecturing and reviews of programmes.

In relation to feedback and course questionnaires:

- (a) The change from end-of-course questionnaires to web-based responses allows feedback earlier in a module, but the completion rate for returns often appears to be too low to be helpful. Hard copy requests or other methods of getting a higher percentage of returns (e.g. solicitation by e-mail) should be sought.
- (b) The summaries of comments should be communicated to the teacher concerned and the department's teaching committee. The departments' responses should be reported annually to the Faculty and to the students.
- (c) Similar feedback on other teaching activities such as laboratory work should be sought.
- (d) The structure of the feedback forms in use should be evaluated. Students should be encouraged to report problems in a way that does not require them to suggest solutions to the problems.
- (e) The departments were keen to point out student feedback as the primary form of quality assurance of individual courses. In the development of the curriculum as a whole, student involvement seemed to be less appreciated. Student feedback and participation in this process should be encouraged.

In relation to assessment we suggest a more collegiate approach, with departments as a whole taking responsibility for assuring the quality of the assessment process. For example, in relation to examinations:

- (a) The University should consider whether students' identities should be unknown to examiners when scripts are being marked.
- (b) Exam questions could be moderated by a second member of staff to assure that the level is appropriate as well as the scientific accuracy and the clarity of the language.
- (c) A selection of exam scripts could routinely be double marked to ensure consistency in the application of the marking scheme.

International Activities

The departments provide a considerable number of courses in the English language to accommodate incoming students and have nominated staff in advisory roles. We did not have an opportunity to evaluate the arrangements at doctoral level, but we were not made aware of any problems in this provision. Staff are active and often prominent, in relevant international organisations.

The correspondence between credit points of the University and established ECTS credits should be normalised, in order not to confuse students taking part in international exchanges.

Bilingualism

The Swedish programmes in all departments are well appreciated by students and appear to be adequately resourced. We were surprised that a significant proportion of the Faculty's course handbook was only available in Finnish.

European Standards

The standards attained by the Masters and doctoral students on graduation is at least comparable with other European countries. It appears to take Finnish students somewhat longer to graduate at both the MSc and PhD levels. We are concerned that the overall workloads may be too high.

Objectives and Their Attainment

Although the departmental aims and objectives were not always clearly stated, we were able to confirm in our discussions that all departments did have appropriate objectives. These often focussed on producing professional practitioners in the subject disciplines. For example, we noted that in the Departments of Physical Sciences and Chemistry, the students had opportunities to practise their problem solving skills to fit them for a wide range of employment. We were pleased to note that in both the Departments of Chemistry and of Computer Science business courses featured in their planning and we suggest that this development should be considered by other departments in order to increase the career options of their graduates.

Only in Computer Science was there an obvious link between the University's strategic plan and the commensurate departmental plan; however, it was not clear that the University had asked Departments to develop their teaching in lines with the University's strategic goals.

University - School Collaboration

All the Departments are well aware of the importance of encouraging links with schools, to help in the recruitment of students and in increasing the quality of teaching. The nature of these links are varied and include visits of staff to schools, visits of school teachers and students to laboratories and Departments, producing newsletters, e-mail correspondence and the production of school texts. We feel that these efforts are admirable but may be made more effective if reviewed and done on a Faculty basis, so that experiences can be exchanged and evaluated.

We were very interested in the development of courses for teachers *within* some Departments and commend the establishment of posts. This will help to solve the crucial problems that occur because of the shortage of well-qualified science and mathematics teachers. However we are concerned that adequate support is provided for the staff, for example, in giving dedicated space in the experimental sciences, for their students must be able to work in an environment that resembles that in a school. Furthermore, we hope that, where large numbers of students take the courses, the staff are supported in a manner equivalent to those who are teaching other courses.

Funding needs to be made available to replace LUMA grants which have supported some of these important activities.

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