

Institutional and Departmental Student Support

Support Offered to Natural Science Students at Cambridge University

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Abstract

Nine years ago members of staff within Physical Sciences at Cambridge University began recognizing that some students were having problems not only with the Mathematics Courses but also with applying material from A level in the context of their scientific subjects. The mathematics workbook was introduced to assist students with revision prior to starting university. On completion the student is asked to fill in a questionnaire that helps to define the problem areas. This is presented to their supervisor. The supervision system is a fundamental feature of Cambridge teaching and one of its main strengths. The student sees a supervisor – most commonly in a group of two undergraduates, sometimes in a group of three and only exceptionally one-on-one – to discuss his or her work for at least an hour once a week. Such support is ongoing and essentially provides individual attention to those students who lack fundamental mathematical skills.

The Execution

The University of Cambridge is a large and complex federal institution where the system of college supervisions is a distinctive feature of the teaching and learning. Supervisory sessions provide highly focused individual support for student centred learning. This vital aspect of student experience complements the formality and routine nature of the lectures. The tutorial aspect of the supervision provides stimulation and a close scrutiny of progress, thus enabling the student to benefit from academic and pastoral support.

The pattern of supervision is composite, being organised across the thirty-one colleges, with the Director of Studies in each College playing a central role. For Physical Science students at St Johns College these supervised sessions take place each week. Each supervisor is responsible for two students; the sessions provide ongoing support, practical examples and guidance. This allows for the development of individual interests and offers student support within the broad framework of the set curriculum.

During the last nine years these supervisory sessions have played a crucial role in dealing with the growing number of entrants who are apparently very well qualified (e.g. three to four “A” grades at “A” level) but lack the ability to understand, or confidence to apply, essential parts of mathematical subjects. Students demonstrated they had not really absorbed what they had been taught. Faced with mathematical analysis in the middle of (say) a lecture in Physical Chemistry or a Problems Sheet in Physics, many students could not recall the necessary mathematical methods.

In dealing with this situation, approximately nine years ago the Faculty of Mathematics introduced the mathematics workbook. The workbook is intended for students coming to Cambridge to study the physical science options of the Natural Sciences Tripos.

In the first year of the Natural Sciences Tripos, there are three distinct mathematics courses: Mathematics (courses A or B), Quantitative Biology and Elementary Mathematics for Biologists. The mathematics workbook is posted out prior to the beginning of the university year, to all those entrants intending to take Mathematics (courses A or B). For those who have taken a “single” mathematics A level, it involves some material which is explicitly covered in the first year. It provides a useful set of revision problems for those students who have already mastered almost all of the material during a “double mathematics” A level course. If presented with anything new the student is referred to the textbook, Mathematics – The Core Syllabus for A Level by L. Bostock and S. Chandler, published by Stanley Thornes.

Attached to the back of the mathematics workbook there is a questionnaire, asking the student to indicate which questions they had difficulties in answering. This information is sent back to the lecturers. The supervisors also review this information and during the first session they go through the questions which the students could not understand. This gives an indication of the “problem areas” and they can be dealt with during future sessions.

The mathematics workbook is very much focused on the problems at the interface between school and university. Once the student has entered the Cambridge teaching system, student support in dealing with the maths problem is based on working independently and engaging in discussions with the staff.

What Support Was Needed?

Basically through the supervisory sessions, support is ongoing. As problems arise supervisors can deal with them. The supervision is extremely flexible. There are worked examples handed out, which are gone over during the sessions. The questions are carefully designed, some taken from past exam papers. The university provides courses in supervising for members of staff as well as post-doctoral research assistants and graduate students in appropriate disciplines.

The Barriers

In the first year of the Natural Sciences course students have to take four more-or-less equally weighted subjects, of which a mathematical subject is one. Their timetable is therefore very heavily loaded and it is difficult for them to find time to fit in additional work.

The Enablers

Academics that are teaching in later years of various Natural Science subjects are very dependent on the first year maths course being successful. Students are strongly encouraged to get on top of their maths in the first year using the supervisory sessions. The colleges are all different institutions and they are small enough to react to such a problem as the growing deficiency in basic mathematical skills.



How Can Other Academics Reproduce This?

The Mathematics Workbook was introduced during the period when the University was starting to realize that students were having problems not only with the Maths Courses but also with applying the things they should be familiar with from “A” level in the context of their scientific subjects. St Johns College appointed a Teaching Fellow because the Teaching Fellows in Natural Sciences were concerned about the results of the first year maths exams in the immediately preceding years. In 1993, the Workbook was introduced as an “initial diagnostic tool”. It is a formal exercise designed for incoming students. Those interested in the workbook should email:

faculty@maths.cam.ac.uk

The supervisory system is taken very seriously; it is an intense hour and provides valuable support for the students. It is built into the already existing teaching system at Cambridge and other institutions wishing to implement the system need to be aware that it is very resource-intensive.

Quality Assurance

The supervisors write an assessment report at the end of each term and the students write a self-assessment report of their own progress as well as on their supervisors. The precise handling of the self-assessment reports varies from Director to Director.

In St Johns College, the Director of Studies system involves someone at the top of the pyramid, who is the overall Director of Studies in Natural Sciences and then there are Directors of Studies in each of the subjects within Natural Sciences. Their job is to line up the undergraduates with their supervisors and to monitor the performance of students and supervisors. In many instances the Director of Studies will also be a supervisor in that subject. Meetings with the overall Director of Studies and the Subject Directors precede the start of supervisions. In addition to Directors of Studies, each undergraduate has a (pastoral) Tutor who receives copies of all the supervisors' reports and discusses them with each student on a one-to-one basis as part of a review of that student's overall progress and development.