
Developing a Key Skills Module for Mathematicians at Exeter

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THE NATIONAL AND LOCAL BACKGROUND TO KEY SKILLS

'Personal transferable skills - problem-solving, communication, teamwork - will come to form the stabilising characteristic of work: if higher education is to meet the needs of the economy and the individual it must seek actively to develop these generic core competences...' P Slee, CBI, [11]

Whereas higher education in the past focused almost entirely on the development of disciplinary knowledge and skills, there is now an expectation that universities should explicitly enable individuals to prepare for the world of work. Indeed, this has been government policy for well over a decade (see the White Papers [5], [6]).

Over this period, several terms with similar connotations to key skills have been apparent, for example, core skills, personal transferable skills, generic skills, soft skills, or employment skills. However, the vocabulary 'key skills' has now been established by the introduction of national qualifications in pre-university education and the workplace (see [10]).

The importance of such skills has been continuously stressed by employers of graduates, lead bodies and government, and, within higher education, by the CVCP, the CBI, the Council for Industry and Higher Education, and the Dearing Report [2], [3], [4]. More recent HE initiatives have also linked to, and further promoted, skill development, such as the broader concept of 'employability' (see, for example, [8]), and the requirement for HE institutions to provide for 'personal development planning' (PDP) for all students by 2005 [9]. Of most importance to students is that graduate recruitment processes tend to focus on skills in the demands of application forms, interviews and assessment centres. Hence, to enter the labour market, graduates need both to be equipped with such skills and to be able to describe their personal experiences and the value gained from them.

Exeter University, like other UK HE institutions, has consistently echoed these developments within its own policies and strategies, and has determined to develop its 'employability strategy' and 'will ensure that all graduates of the University, at whatever level, are equipped for a future of lifelong learning which embraces and welcomes change and development. All modules will identify the key skills that are developed, and the assessment of key skills will become an integral part of the programme.' The mathematics Key Skills module can therefore be set in the context of growing University and national commitment in this area.

'...It is not just with my work at University that my time management skills have helped me. I sometimes have to juggle work, social life and studying for my course. It is something I have had to adapt to, but I find it surprising what you can do with your time when you organise it properly.'

DEVELOPING A KEY SKILLS MODULE

Background to the module

Over past years, the former Department of Mathematical Statistics and Operational Research (MSOR) was one of the few University departments that had shown a commitment to skill development within its study programmes.

One of three departments to pilot a Career Management Skills programme in conjunction with the Careers Advisory Service, it had, in addition, organised over a period of five years, a three-day, non-credit-rated (but mandatory) session entitled 'Communication Skills' for second year students, held after the June examinations. Despite the timing and lack of credit, it was well attended and popular with students. This session was later renamed 'Core Skills' and involved many of those skills now regarded as 'Key' - oral and written skills, report writing and group work. Career awareness, job application and interview techniques and leadership skills were also a part of the agenda. At this time, the Department of Mathematics also ran a compulsory, credit-rated final-year module that concentrated on mathematical communication including essays and book reviews on mathematics and science, proof-reading and LaTeX, and a mathematical group project for written and oral presentation. It was somewhat unpopular with the student body, being insufficiently career-oriented. When the Departments of Mathematics and MSOR combined to form the School of Mathematical Sciences in 1998, it seemed appropriate to combine experiences of skill development into a newly-devised 'Key Skills' module (again updating to the current terminology). Members of the Careers Advisory Service and the Staff Development Unit were funded by the University to collaborate on this project.

The present module

The Key Skills Module is now a level-two, fifteen-credit module (100-150 hours of learning time) designed to run throughout the three years of a degree programme. It is in many ways underpinned by the skills descriptors of the National Framework for Key Skills at level 4 (the level most appropriate to activities in higher education) which use terminology such as: developing strategies, monitoring and evaluating progress, critically reflecting on progress, adapting strategies, assessing effectiveness, and identifying ways of enhancing skills (see [10]).

The module was specifically 'designed to develop a range of key skills that will assist undergraduates in academic work, in transition to employment following their degree programmes, and in their future careers', hence demonstrating that it was ahead of its time in picking up the central notions of Employability and Personal Development Planning and embedding them into approaches used. A total of ten half-day and two three-day workshops provides information and allows practical experience in areas such as:

- mathematical skills – including a complete assessment of prior mathematical knowledge, basic mathematical typesetting, and critical appraisal and communication of mathematical concepts and

results.

- key skills - study and research skills including the use of the library and internet, a survey of grammar, time management, written and oral communication, team working and task management;
- career management skills – for example, identifying career opportunities, job application and interview skills.

Students are also given guidance on developing and maintaining a personal record of their skills and qualifications and identifying opportunities to enhance these through the use of PESCA.

PESCA is a software tool designed at Exeter for PDP. It addresses exactly those elements required: an holistic approach to student development (Personal, Employment, Social, Career and Academic), an emphasis on reflection and review, and a focus on planning for self-improvement and for the future

The workshops are organised by a combination of mathematics lecturers, support services staff and visits by young graduates working for major companies. Furthermore the Army runs a challenge session, which is highly popular with the students and helps develop teamwork skills. Assessment is based on coursework completed over the three years of the module, either as an individual or as a team member. This is then maintained in the form of a personal portfolio to be submitted in the final year. Almost all activities are assessed, thereby providing an incentive to participate. Many of the key skill activities are similar to those now within skills courses in other subject areas and in other universities across the country (see [1]). What is perhaps less usual is the emphasis on progression within a single module over three years from, say, time management as an element of study skills in the first session of the module, through to job interview practice at the end of year 2 when students are prepared to accept that such skills will be useful, and concluding with a review of progress over an entire degree programme before the end of the third year.

The conceptualisation and model of progression of the Key Skills module seems ideally to fit the QAA definition of PDP - as 'structured and supported processes to develop the capacity of individuals to reflect upon their own learning and achievement, and to plan for their own personal, educational and career development' [9]. Further, the experience gained from devising and monitoring the module has enabled the School to take a lead in the development of a University-wide system of student self-appraisals designed to support key skills,

employability and career-management alongside effective academic learning.

'The key skills [module] actually did shock me into seeing how empty my CV was and encouraged me to go out and do some work to make me look more employable.'

OBSERVATIONS AND ISSUES TO ADDRESS

As staff involved in the development of the module, we would like to make some observations and raise some fundamental issues that relate to organisation and management and to impact on students.

Expertise of staff - Many academic staff have little or no experience outside the University sector and little understanding of or interest in the recruitment process and the world of work that the vast majority of students will be facing. Such people are not necessarily those best suited to teaching key skills. This is a further reason for having a separate module – so that it can be run by enthusiasts who are willing to support a broader approach to curriculum provision. However, we have found the module to be extremely time-consuming, not just in its initial preparation, but also in its delivery and assessment. For this reason, at least one different member of staff is encouraged to participate in the collaborative team of three each year, having the benefit of broadening staff knowledge of key skills as well as sharing the burden of work.

Relevance to students - There can be little doubt from the quotes above that this module has had a deep and long-term impact on a proportion of students, though it is difficult even at this point to know how widespread this is. The problem remains that some students find it difficult to see the relevance of Key Skills from the beginning of a university career. Many believe that a degree is only about gaining disciplinary knowledge. It is at the point that a student applies for vacation jobs or full time work in their final year that recognition of the benefits is most apparent, but it is often only after gaining employment that students report fully valuing the relevance of skills initiatives.

Involvement of employers – The input of employers into the module (eg the Army and PriceWaterhouseCoopers) is one of the most successful aspects of the module since it is highly valued by both staff and students. It is also important for forging good relationships with potential employers and for reinforcing the legitimacy of the 'skills message'. Care is taken to ensure that input is seen as part of an overall process of skill enhancement, not just as something that is randomly thrown in.

Attendance & compulsion - The greatest disappointment has been the negative attitude of some students. Despite the compulsory nature of the module in the first two years, we have experienced non-attendance from both the top and bottom of the ability range. This seems to be due to issues of relevance, as outlined above, to lack of confidence in becoming involved in more participative forms of learning, to a perception that there was nothing new to be learned, but also to attitudes such as '*I chose to study Maths so that I didn't have to write essays.*' At first, agreement could not be reached within the School to make the module mandatory for all students across all three years. It was strongly argued that it should not be possible to fail a degree, or perform less well in a final mark, because of a lack of ability or interest in key skills; students could therefore opt very early on not to attend as they had no intention of gaining credit through this route. Following a review, the prevailing view has changed, and, from 2004-05 onwards, the module will compulsory – a move that will at least, in the main, overcome the issue of non-attendance.

Setting expectations - With the first cohort of students, the bulk of year 1 Key Skills activity was timetabled after the end of year examinations, as previously organised in MSOR. With the larger numbers involved and less close contact with students, this timing proved unsuccessful. Moving the introductory input to the first week of the first semester now means that expectations of the culture are set from the very beginning rather than being bolted on at a later date. This is important in raising the status of key skills and also allows an emphasis on basic study skills when it is most needed.

Embedding of skills - Whilst it is possible to address aspects of skills within the normal academic work of the School, it was decided that there would be advantages in a separate Key Skills module, thereby allowing an explicit approach to skill development and allowing time to address broader and more specifically employment-related topics than would easily be covered in a subject module. However, a separate module leads to the problem of skills being perceived as isolated from other aspects of curriculum development. Ideally, students should be required explicitly to reinforce skills growth through their use in other modules, in new contexts and with increasingly difficult subject content. But, as yet, few academics are prepared to accept the importance of working in this way to ensure connections between modules, and planned opportunities for transfer of skills are rare. However, the introduction of mini-projects helps to ensure that students have to focus their attention on skills throughout the year.

Integration of students – through the Key Skills module, students quickly get to know their peers and this enables mutual support in all aspects of their work to become acceptable and natural. Early team-building activities help to break down reservations and this has benefits that extend into other modules in terms of group cohesiveness and individual confidence gained by accelerating the settling-in process. This impact has been specifically recognised by tutors in the context of group tutorials.

Assessment – Assessment has probably been the most difficult aspect of module planning, due in part to the nature of traditional assessment within the discipline. For example, we can check that the student has uncovered a specific fact as a result of a research activity but we cannot easily look at the efficiency of their research process. It is the latter that we seek to foster in the student but the former that we measure. Of particular difficulty has been the question of whether we should assess *output, process, or student perceptions and experience*. For example, with regard to a group project, is it appropriate (i) to assess the output of the project itself (e.g., the written report, the oral presentation); (ii) to assess objectively the group dynamics (e.g., by observation); or (iii) to assess student perceptions of their experience (e.g., through reflective essays and diary-keeping)? In fact, we have used elements of all three, but it has been a matter of long debate and considerable compromise. A further difficulty is that in process-based learning, it is not generally easy to make up work if a session is missed, for example, through illness.

Reflective approaches to study – there was a mixed response to learning from self-review, which underpins much of the module, although many students who completed the module enjoyed this broader, more reflective and personal approach. As one aspect of this, PESCA was completed in great detail by a number of students, but others could not perceive the purpose. Again a shift in expectations needs to be fostered, with undergraduates recognising that personal awareness, employability and pursuing a career are not features of development that can be left to the final stage of a degree.

Gathering feedback from students - Maybe one of the most important findings from this module is that student opinion on the value of provision changes over a period of time, as students move from finding requirements difficult and unexpected to recognising that they are really worthwhile. This suggests that 'reflective' activities need to be fostered as part of an ongoing process that has long-term as well as short-term implications. It also

suggests that to gather feedback data on a longitudinal basis is of specific relevance and should perhaps be given greater attention in higher education.

Student choice – This module seems to fit uneasily with the current philosophy of 'student choice' and the strategic tendency of students to opt for the module that 'looks easiest' or does not move beyond areas that appear familiar. Provision for Personal Development Planning probably needs, in its most effective mode, to challenge and enable students to see beyond their natural inclinations, to provide the experiences that allow personal growth and development of potential - the 'push in the right direction' and the gaining of 'self-belief' that is apparent in the student comments presented above.

Student employability – Despite the evidence of the marked impact of the Key Skills module on student learning and personal growth within higher education, and reporting of this impact on the job-seeking process, we do not in fact know whether this has enabled students to gain employment more readily, or to raise their expectations for employment, or where the long-term benefits may lie. However, anecdotal evidence from PGCE tutors at Exeter supports the view that students benefit considerably from key skills activities.

We hope that some of these observations and issues may be taken up within future discussion in this publication.

'The next step now is to continue to use and practise all these acquired skills until they become natural. I am still intimidated by the idea of standing alone in front of an audience and expressing my own ideas but I know that it will get easier the more I do it. Throughout my career, I would expect all key skills to play a significant part and, now I know exactly where to improve, tasks I find difficult seem much more achievable.'

OUTLINE OF MODULE

Year 1: Introduction to the notions and vocabulary of key skills; Recording a skills portfolio using PESCA; Learning to learn; Practical team exercises (courtesy of external organisations, including the Army); Study and research skills, including time management; Written communication; Basic mathematical typesetting in LaTeX; Team working & task management, including a mini-project in small groups.

Year 2: Career awareness; Job application skills; Job interview skills; Technical report writing and oral presentation. Practical team exercise including an

associated team report and oral presentation in small groups

Final year: Critical appraisal of mathematical documents and publications; Preparing mathematical documents and visual aids, including further mathematical typesetting; a reflective essay on the development of the individuals skills, within and without the module, over the University career; Construction of a cross-referenced portfolio of the work done during the course of the module.

The ratio of assessed work contributing to the final mark is approximately 2:2:1 over the three years.

'There are many things which occur where you have to be able to adapt quickly and think on your feet. ... If you are confident you will be able to face anything you encounter during your life. I now feel happier when I am thrown in the deep end, ... I believe I will swim eventually. It may take me a bit longer, but it is not out of my reach. There are different aspects of my personality which have been reinforced and nurtured into something useful and very rewarding'.

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