KEY SKILLS: DIAGNOSIS, ASSESSMENT AND RECORDING

Dr. R. Bartlett and Dr. Karl O. Jones

Abstract: The requirement for Key Skills development in Engineering degree programmes is well established, and is clearly articulated in publications such as Benchmark Statements [1] and Programme Specifications [2]. The improved perception of Key Skills has not been confined to educators: for a long time employers have contended the value of communication skills [3], while students see them reflecting their own needs as well as those of employers. Educators face two major questions “How can we ensure that our students graduate with appropriate Key Skills level attainment”, and “how do we show that they have them”.

Keywords: Computer-based, engineering courses, key skills.

INTRODUCTION

During the 1980s, the UK's National Council for Vocational Qualifications (NCVQ) carried out extensive research with academics and employers to get agreement on a definitive list of what are called key skills [6]. The areas developed included: Communication, Information technology, Application of number, Working with others, Improving own learning & performance, and Problem Solving. Teaching Key Skills in courses can be either 'integrated' or 'discrete': "they are integrated in the sense that they aspire to the organisational incorporation of Key Skills into vocational and academic courses; and they are discrete in that some aspects are delivered (by specialist Key Skills trained staff) independently of the intrinsic relationship between Key Skills and coursework"[4].

At Liverpool John Moores University (JMU), we have attempted to embed Key Skills throughout our electrical engineering programmes, with explicit ‘Key Skills’ modules taught at Foundation and Level 1, and then further development tied into the assessment in later years. There are three prime issues that need addressing. Firstly, our modular scheme makes it difficult to ensure that all students have access to similar Key Skills provision whichever individual route they take. Secondly, our increasingly diverse intake of students means that the skills they arrive with are also broad. This includes the range of disabilities that need considering. Finally, the need to explicitly include Key Skills within our teaching provision is relatively new, and some academics are not comfortable delivering such material. There is evidence highlighting that assessment provides a significant portion of the motivation behind student learning [5]. Thus we need to enhance our use of the assessment strategy to focus the attention of students and staff on the importance of the attainment of Key Skills, and to keep Key Skills as a fundamental part of engineering. In doing this we need to take care not to unnecessarily exclude students with disabilities from achieving appropriate Learning Outcomes, including those addressing Key Skills, by careful wording of both Learning Outcomes and assessment criteria, and a flexibility of approach. We hope to address these issues with a multi-pronged approach. As a ‘one size fits all’ Key Skills development programme is becoming less and less appropriate, we hope to enable our students to tailor their learning by increasing our use of on-line packages. The University's central services, such as the Learning Resource Team and the Careers Service, are assisting with this by developing tailor made on-line learning packages. Key Skills mapping packages, such as 'Key Skills On-line' developed by Sheffield Hallam and RAPID, have been piloted within the School of the Built Environment at JMU, enabling students to monitor their own progress, and take ownership of their own development.
KEY SKILLS IN ELECTRICAL ENGINEERING PROGRAMMES AT JMU

The School of Engineering at JMU presents programmes from Foundation Level, through three-year Undergraduate (BEng and BSc) to Postgraduate Masters (MSc). Key Skills are part of every level of all programmes, although thus far they have been more explicit at Foundation and Undergraduate Level 1. The previous structure for Key Skills delivery was to have a stand-alone module at Foundation (entitled Study, Presentation and IT Skills) and a similar module at Level 1 (entitled Professional Development). Additionally there were modules at Level 2 and 3 which provided opportunities for Key Skills development. Study, Presentation and IT Skills was designed to enable students to develop the skills necessary to be effective learners and for students to gain an appreciation of what being an engineer really means. It was delivered in Semester 1 only, with assessment consisting of eight small courseworks each related to a unique learning outcome. Professional Development aimed at developing students as effective and self-motivated learners by teaching a range of Key Skills: it also provided an opportunity for academic guidance and counselling. The personal, study and generic skills presented within the module were applied and developed in other Level 1 modules, and provided a foundation for study at higher levels and for subsequent careers. In this case, assessment was via a portfolio of evidence. The module was considered an essential element of the first year of study within the School of Engineering. At Level 2 Electrical Engineering Design facilitates all the Key Skills listed. The Level 3 Project offers an excellent opportunity for students to demonstrate their abilities in almost all Key Skills. The assessment strategy included a project report (highlighting student’s skills in IT, Improving Own Learning, Problem Solving and Numeracy), and a poster presentation (covering Communication, and Interpersonal Skills).

DEVELOPMENT RATIONALE

In reviewing our approach to Key Skills, we have tried to accommodate both the new regulatory requirements on Higher Education and a philosophy based on research evidence. The UK’s Further Education Funding Council has reported [7] that “internal structures can sometimes hinder rather than assist good practice”. Furthermore, the consequence of selecting one delivery method over another needs to be understood prior to implementation. For example, work by Selwyn [8] has highlighted poor attendance among A-level students on compulsory IT courses: showing the difficulty of motivating students for courses which are seen as ‘bolt-on’. In contrast, many establishments aspire to develop and assess Key Skills by complete integration within vocational and academic coursework [7]. This process has been adopted comprehensively throughout the University of Luton [9] resulting in a culture change both for students and academics. Like others we consider that the acquisition of skills is far more effective if they are practical and developed in context. Kelly et al [4] suggest that Key Skills should be integrated as much as possible into the mainstream academic study to ensure that Key Skills achievement is seen by students as part and parcel of their learning. Evidence shows that Skills and subject knowledge work best when interleaved, and that Key Skills embedded within subject tasks are absorbed more effectively [10]. The recently introduced QAA (Quality Assurance Agency, responsible for ensuring the quality of Higher Education in England and Wales on behalf of the government) Requirement for Programme Specifications has formalised the need to clearly articulate the Key Skills that students can expect to develop during their studies, and where they will be taught. JMU has been in the vanguard of modular schemes, and thus has written modules in terms of Learning Outcomes for a number of years: module pro formas have been enhanced to embrace Key Skills. This information is made available on the Intranet, giving students full information on their modules, so they can make informed choices of options.
The Special Educational Needs and Disability Act [11] for Higher Education states “Educational providers must not treat a disabled person less favourably than they would treat others for a reason that relates to the person’s disability”. Also “If a disabled student is at a substantial disadvantage the educational provider is required to take such steps as are reasonable, that is make reasonable adjustments”. Obviously, to behave otherwise would be unethical, never mind illegal. Any developments to our delivery and assessment of Key Skills must be accessible to all our students. This means that care must be taken that any resources used are accessible regardless of disability [12]. For example, any web-based resources would need to be accessible with a screen reader and preferably conform to web content accessibility guidelines to at least Double-A standard [13]. Also, assessment tasks need to be designed to reduce irrelevant discrimination due to disability. For example, it may be appropriate for an oral presentation to be replaced by a signed presentation using a British Sign Language interpreter [14]. Appropriate solutions are generally individual but need to be planned well in advance. Communication skills and group working require perhaps more forethought than other key skills when ensuring that disabled students are not treated less favourably. Assessment criteria also need to be carefully defined to ensure that alternative forms of communication can be used where appropriate. Adjustments need to be made on an individual basis as the capabilities of individuals will obviously vary. Assessing key skills reliably is often challenging, and if adjustments are made for students with disabilities, this will be made worse.

STAFF PERCEPTIONS

Electrical Engineering staff of the School of Engineering were presented with a questionnaire on Key Skills to ascertain their views on current & future delivery methods, and their opinion of Key Skills provision. The responses show that staff seem to know what Key Skills are, and consider them as a fundamental part of a degree. While it would appear that just over half of the staff teach Key Skills, all staff feel that they have the ability to teach them. Of those staff who replied that they currently teach Key Skills, 33% of respondents said their teaching was in 'a dedicated module', 33% stated their teaching was in 'subject module' and 33% replied that their teaching was within both types of modules. It is interesting to note that nearly all staff feel unhappy with losing subject teaching time to cater for Key Skills teaching (Table 1). When asked where Key Skills should be taught, 20% of respondents stated it should be in dedicated modules, 10% said it should be subject modules and 70% wanted the teaching to cover both approaches. Staff views on who should teach Key Skills to our students produced the most varied response ranging from JMU Centre Staff to all Electrical Lecturers, with the more dominant option being a trained specialist within the School.

KEY SKILLS SOFTWARE SUPPORT

The use of software in Key Skills delivery falls into three loose categories – diagnostic software, learning packages and tracking software. There is now a considerable volume of Key Skills related software available, much of it suitable for Higher Education. ‘Key Skills On-line’ [15] combines diagnostics with learning packages to enable the user to evaluate their current skills, and then develop areas of weakness through appropriate exercises. This is particularly useful at the start of any programme as it allows students to engage in a personalized course of development, matched to their own background. The package was particularly developed for HE as part of the Teaching and Learning Technology Programme funded by the Higher Education Funding Council for England (HEFCE) and the Department of Higher and Further Education Training and Employment (DHFETE). The ‘Information Skills’ [16] package is a good example of an
open publication general package that has been customised to fit our particular institution. It consists of an integrated set of on-line tutorials on identifying information sources, searching them effectively, and handling the information once it is found. The system is based on TILT, developed by the Digital Information Literacy Office for the University of Texas System Digital Library. The RAPID Progress File on-line package [17] is a sophisticated CV and Key Skills tracking system matched to the requirements of professional Institutions. It allows students to store evidence of their achievements, easily identify the areas they need to work on, and plan and reflect on their progress. It was originally developed in a Civil Engineering context, as a government funded project led by Loughborough University, and has been widely piloted [18]. ‘Prospects Planner’ is a diagnostic package focusing on personal career planning, used in the second year Career Management module and available through the Higher Education Careers Service Unit.

THE MODIFIED APPROACH

We feel that there are four points that need to be considered during any programme design in terms of Key Skills Management: (1) Initial assessment; (2) Support to enable students to independently develop their Key Skills; (3) Involvement of Key Skills specialists, and (4) Quality Assurance should remain a focal point. The approach we are now adopting makes best use of Central resources while maintaining a significant amount of embedded delivery. Although some dedicated Key Skills modules are provided, a substantial body of Key Skills are presented within a engineering context, also all modules are required to build Key Skills into their design.

Foundation Level: The Key Skills module at this level has been reviewed, redesigned and re-titled to Engineering concepts and Study Skills. Based around a series of plenary lectures given by guest speakers on engineering disasters such as the Chernobyl nuclear accident, the module is delivered over two semesters with small group tutorials. The aim is to enable the students to develop the skills necessary to become effective learners while gaining an appreciation of real world engineering issues. Assessment is by a series of courseworks about the disasters, each requiring a different set of Key Skills. ‘Key Skills On-line’ package is used during Induction week to allow students to undertake self-diagnosis.

Level 1: As with the Foundation students, ‘Key Skills On-line’ is used for self-diagnosis. The reviewed Professional Development module has kept its original concept, aims and delivery method, although its Learning Outcomes have been refined and expanded to ensure exposure to all elements of the NCVQ’s identified Key Skills. Additionally the module is now only presented to the BEng students. Students on BSc programmes have had a new module designed for their particular needs titled Practical Key Skills. Practical Key Skills has the same aims as Professional Development, but also includes basic laboratory skills. It is delivered over two semesters, with semester 1 containing a mix of laboratory sessions and tutorials which develop a range of skills associated with laboratory work (using log books, familiarity with basic instruments, as well as taking measurements, presenting data and analysing results). Semester 2 focuses on a team project that involves information gathering and further laboratory work. The emphasis is on teamwork, project management, and the presentation of information both in the form of written reports and oral presentations. The assessment consists of a log book and lab report for semester 1, and written and oral presentations for semester 2. Our IT Skills provision has been reviewed using the European Computer Driving License [19] as the comparison syllabus.

Level 2: Electrical Engineering Design remains much the same, providing many
opportunities for Key Skills development and assessment. The numerous assessments for this module underpin both the subject specific areas and Key Skills. A new module has been developed for Level 2 called Career Management, which aims to provide students with the confidence, skills and knowledge to make realistic, well-informed career and lifestyle choices. Students are also given opportunity to develop their ability to review and adapt their plans in the light of changing priorities and circumstances. Students also develop independent learning skills by exposure to diverse experiences, including on-line and off-campus interaction and working within Action Learning Sets. The module is delivered wholly on-line, although it is supported by an initial lecture to introduce students to the materials, the system and the assignments. The diagnosis software ‘Prospects Planner’ is used to good effect within this module. Additionally, students are expected to attend five Action Learning Set sessions. Staff from JMU’s Career Development Service present this module, though the assessment is done by engineering academics.

Level 3: The Final Year Project maintains the previous assessment methods and continues to have the Project Talks. The format and topics of the talks have been enhanced to ensure coverage of all the Key Skills and to make use of the ‘Information Skills’ on-line package. Additionally the marking scheme for the individual assessment elements have been modified to ensure a more explicit relationship between work completed and Key Skills: marking schemes and grade descriptors have been given to students so that the relationship between their project and Key Skills is transparent.

DISCUSSION
The underlying rationale for implementing key skills in HE is that skills development should be a conscious process for the learner: this view challenges the idea that, somehow, by studying at university or by a process of osmosis from contact with academic, students acquire all the learning skills they need. Making skills acquisition an explicit process means that it can be explained, practised and embedded into learning. The next clearly identified element which needs to be included within our provision is Progress Files. It is expected that this will be facilitated by utilising the RAPID software. Although when surveyed, staff generally felt competent to teach Key Skills, there was a clear preference for specialist input to our Key Skills provision. This does not at first fit easily with the benefits of embedding Key Skills within the curriculum, but the careful use of on-line resources provided and maintained by specialist staff can combine the best of both worlds: specialist Key Skills delivery integrated into subject based modules.

Although software packages such as ‘Key Skills Online’ allow for diagnostic self assessment by students, there is still no software available that can assess such key skills as ‘working with others’. In on-line learning environments, the definitions of key skills need careful consideration. ‘Working with others’ for example, can be done on-line via mailing lists, bulletin boards, discussion groups etc. and the skills required are not identical to those used in working in face to face groups. Assessment of Key Skills can be mediated on-line, for example via emailed reports, video links etc., however, human input to the marking process is still required [20]. It is obvious that the skills expected of students at the end of their university careers will be higher than the skills expected at the outset, in other words, their competencies will develop over the course of their HE programme. Institutions need to recognise this, and provide resources and support to maintain this evolution.

REFERENCES
Table 1 Delivery of Key Skills

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ABOUT THE AUTHORS
Dr. Karl O. Jones, Dr. Rebecca Bartlett School of Engineering, Liverpool John Moores University. Phone: +44 151 231 2199, E-mail: k.o.jones@livjm.ac.uk or r.bartlett@livjm.ac.uk.