Developing a key skills profile for first year computing undergraduates

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Background and rationale

On entry to the University of Wolverhampton, a significant proportion of undergraduates in the School of Computing and Information Technology (SCIT) have poor communication, numeracy and/or study skills. These weakness are perceived as being factors contributing to low achievement, as well as limiting graduates' career opportunities. Under the previous award structure (1997 – 2002) this had been redressed by a special, core, first year module, Professional Skills, which concentrated on personal and study skills such as communication, team working and time-management. Theoretically, these skills would then have been reinforced throughout the undergraduate programme. In 2001/2002 this provision was further augmented by extra, optional tuition in communication for those students who felt that they might benefit from it.

In 2001/2002, SCIT underwent its quinquennial review and, on account of conditions imposed under the modularity project regulations, combined with the need to meet the subject benchmark and professional body requirements, had to drop Professional Skills from its undergraduate programme. The new first year programme took effect in 2002/03. However, SCIT did take the opportunity afforded by the review to revamp its key skills provision, identifying assessed key skills learning outcomes in specific core modules at all levels of its undergraduate awards; although, from the perspective of this project, these assessment matrices were not sufficiently detailed to track development of key skills by individual students. The key skills should demonstrate progression from entry level, Qualifications and Curriculum Authority (QCA) level 2/3, to those of a Computing graduate, as defined within the subject benchmark, which should correspond with QCA level 4 (Murphy, 2001). Their development should also respect the suggestions for good practice put forward by the Accreditation Committee of the professional body for Computing, the British Computer Society.

It is crucial that SCIT's key skills programme, supplemented by support tuition, meets the needs of its undergraduate entrants. These needs have changed from those of previous years with the advent of Curriculum 2000 (C2000) in its feeder institutions. Before C2000, those students entering with Advanced GNVQ, a significant proportion in SCIT, had studied Communication, Application of Number and IT to Level 3, integrated with their subject provision. Under C2000, key skills are taught separately from subject provision, and include the six recognised by QCA, the additional ones being Working with Others, Problem Solving and Improving Own Learning and Performance. Also, those students with AS and A2 levels should have gained key skills qualifications and, thereby, would have acquired UCAS points. However, the recommendation from the National Qualifications Framework has been reduced to level 2 in the three key skills of

Communication, Application of Number and IT, with level 3 in one of the six only. Feedback from our feeder institutions suggested that students were opting out of key skills altogether, especially as AVCE was proving more demanding than Advanced GNVQ which it replaced. Hence, the level of key skill of SCIT undergraduate entry under C2000 could not have been predicted, but was feared to be worse than that of previous years. (Crabtree, 2002)

The innovation

The aim of the research was to produce a coherent scheme which developed, assessed and recorded the key skills of Communication, Application of Number and IT of every entrant onto the SCIT Computing Degree Scheme during the first year of their programme. These three key skills were selected because they were readily testable and the others were not (Crabtree *ibid).* It should also be noted that, in accordance with the subject benchmark, SCIT's IT key skill is based on information retrieval, in particular literature search. SCIT's curriculum is centred on training in high level IT skills so measuring progression in, for instance, word processing, would not be appropriate for SCIT's undergraduates.

Diagnostic tests were identified and acquired in the three key skill areas as follows:

Communication: Colchester Institute (paper-based)
Application of Number: Diagnosys (online)
Information Skills: Keynote questionnaire (paper-based) – adapted for the purposes of this research.

Colchester Institute was chosen for communication, on the basis of presumed ease of use by SCIT students, after reviewing several similar tests. Diagnosys was chosen as, according to Cornish (1999), it was already in use in many other comparable institutions. The software, which was purchased from the University of Newcastle upon Tyne, is supplied with a question editor that allows extra questions to be submitted. The decision was made not to add extra questions, which would not have been subject to the same quality control and validation as the original questions, but to limit the questions asked to those requiring GCSE knowledge only. Two different profiles were set, one for Computer Science/ Computing and one for the rest, the difference was that the Computer Science/Computing profile would ask questions on simple algebra, which the other would not. Lastly, it was decided to trial the Keynote questionnaire after a presentation by a member of its development team at the ILT conference in June 2002, ILTAC2002.

The diagnostic tests were administered in Welcome Week to students who attended the sessions, and, early in the following week, the results were notified to first year tutors to inform obligatory counselling sessions with first year students. "Students at risk" as highlighted by the ILP and diagnostic tests were counselled first. If deemed necessary, students could thence be directed to the optional support sessions in communication, or additionally numeracy, run in SCIT on Wednesday afternoons, or to SCIT option modules which laid emphasis on key skill development. Information skills were taught and assessed specifically in History of Computing, which also was one of the modules developing and assessing communication.

The outcomes

Communication (2002/2003)

Level	Computing Degree Scheme (%)*	HND (%)
1	12	15
2	16	22
3	65	59
Above L3	7	4
No. of students	218	74

* Includes Computing Information Systems for Business and Computing for Business

All but 12% of the undergraduates were found to be working at an appropriate level. 7% of the undergraduates had reached the general level expected of a graduate, although Computing specific aspects of communication required development, e.g. communicating with a client to analyse the requirements for a system. For comparison, the HND students were slightly less capable than the degree students; this was to be expected, as the HND has lower entry requirements. Students assessed at level 1 were directed to the extra support sessions. However, contacting the students by email took more time than anticipated, because of the time-lag in establishing all first years with an email account. Take-up was low, although it received a stimulus in early December after feedback to students from the first assessed work on History of Computing.

On analysis of the end of year data, the proportion of students on the Computing Degree Scheme, diagnosed as weak in communication skills, that did not progress from year 1 was the same as the year as a whole. However, the students achieved only one A grade amongst all their modules, which suggests that weakness in communication militates against full individual achievement. With the HND, only two students out of twelve with weak communication skills progressed from year 1. The analysis needs to be repeated in 2003/04 and further investigations undertaken.

Application of Number

Data for 2003/2004 are included for comparison.

(2002/2003)

Course	No. of students	Average result	Average true	Average time (min)
Computer Science	108	33	44	36
Computing	57	20	29	32

(2003/2004)

Course	No. of students	Average result	Average true	Average time (min)
Computer Science	99	33	47	32
Computing	38	24	34	32

These results are for all Computing Degree students taking the test. The average result is based on all questions, the average true is based on all those attempted. Computing students did less well than students on the more specialised Computer Science degree. Students with an average result of less than 20 were directed to the optional support sessions as it was considered that they either lacked personal application or mathematical knowledge. Again take-up was low.

(2002/2003)

Course	No. of students	Minimum	Maximum	Average result
Computer Science	99	5	78	34.70
Computing	51	5	56	20.53

(2003/2004)

Course	No. of students	Minimum	Maximum	Average result
Computer Science	85	0	91	34.82
Computing	34	5	69	24.88

Both sets of data are for students who took 20 minutes or longer on the test, as it was deemed that students who did not take that length of time had not afforded the test serious attention.

Further work was done correlating the diagnostic test results in 2002/2003 with examination results in the core 30 credit programming module for Computer Science. Leaving out any student, who did not take either the diagnostic test, or the examination in that module, produced the following table, figures in %.

Diagnostic test result	F1 – F3	E4	D5 – C10	B11 – A16
Low score	17.8	5.5	17.8	12.3
Average score	2.7	0	2.7	17.8
High score	0	4.1	1.4	17.8

These results indicate that a low score in the diagnostic test is a good indicator of poor performance in the examination in the core Computer Science programming module. However, a low score in itself does not indicate that the student will fail the examination. Acting on this data, in 2003/2004 students with poor mathematical skills have been directed by Admissions to the Computing degree.

Although, judging by the diagnostic test results for 2003/2004 it appears that this policy has not been wholly successful.

Information Skills (IT)

The adapted Keynote questionnaire assessed students' perceptions of competence in a number of skill areas and the importance they attach to them. The skills fell under the following headings: IT skills, learning to learn, library skills, working with others, communication, numeracy. The students found the questionnaire difficult to complete correctly and the responses could not be examined in any degree of detail. The data were analysed by taking a random sample of 50 and finding the median values for perception of

competence. The competence ratings were no experience, little experience, OK, quite competent, very competent.

Skill area	Median competence level
IT skills	Either quite or very competent
Learning to learn	Mostly quite competent
Working with others	All quite competent
Communication	Mostly quite competent (some OK)
Numeracy	All quite competent

Taking library skills in more detail:

Skill	Median competence level
Use of a library catalogue or OPAC	OK
Familiarity with Dewey classification	Little experience
Familiarity with Harvard citation	No experience
Use of any citation or referencing system	OK
Use of journals for research	Generally OK
Use of Boolean operators for searching	Little experience
Undertaking a literature review	Little experience
Differentiation of academic from non-academic resources	Little experience
Use of the Internet for successful searching (under IT skills area)	Very competent

It can be seen that students were much less confident with skills required for information retrieval than with skills in other areas.

Student take-up of the support sessions was low and it was felt that a model of incorporation into core first year modules would be more effective. The core programming module for Computing was revalidated for 2003/04 to include some mathematical content for the Computing students, who were weaker in application of number. History of Computing was also revalidated and substantially reorganised to emphasise the development of information skills, as well as provide additional support in essay planning and writing and reflective writing, through the use of specialised software packages.

For 2003/04, the SCIT student support sessions were re-badged as the SCIT Student Support Centre. The activities, whole class and individual, were refined and relabelled, and made more assessment specific, to provide added appeal to students.

Benefits

It is hoped that some of the students will benefit from the opportunity to improve their key skills, resulting in improved achievement at the University, and improved employment and life prospects. The University and the School should benefit from this improvement in student achievement. Staff have benefited by reconsidering the content and delivery of their modules to enhance key skills; hence some staff are more aware of these issues than they were previously. The project has forced a re-examination of SCIT's delivery of student support in communication and numeracy skills.

Evaluation

This project has energised a process of gradual improvement in the development of key skills in its undergraduate population by SCIT. It is hoped to see this improvement recorded in module evaluation reports and student feedback in the 2003/04 academic year. Information skills are to be measured, using a newly simplified Keynote questionnaire, at the start and end of History of Computing in 2003/04. Improvements in student progression and employability, which it is hoped will occur, will take longer to feed through and may be affected by other factors.

Future developments

It is intended to purchase an online package to develop key skills in English, to be published shortly by Sheffield Hallam University. It is hoped to integrate use of this package into module delivery and assessment for 2004/05.

Students with skills in written English evaluated as poor in assessments in 2003/04, are to be encouraged to visit the SCIT Student Support Centre, by providing those students with feedback on their work, but withholding the mark, until they have visited the Centre and, with the guidance of a tutor, improved the English of a significant proportion of their assessment.

References

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Murphy, R. (2001) *Assessment Series No. 5: A Briefing on Key Skills in Higher Education*, York: LTSN Generic Centre, pg. 6.

Sambell, K. (2003) "I was really dreading handing in my first assignment!": Students' perspectives of assessment strategies that work to support their learning in the early stages of a course *in* ILTHE *What works? Reviewing good practice for learning and teaching in higher education, June 2003, Warwick University, UK.*

Diagnostic Tests

Communication: Key Skills Diagnostic Assessment Levels 1 – 3. Colchester Institute, Sheepen Road, Colchester, Essex, UK.

Information Skills: Keynote Questionnaire, Keynote Project, Nottingham Trent University (modified).

Application of Number: Diagnosys v3.0, Dr. John Appleby, Newcastle University. See <http://cebe.cf.ac.uk/learning/habitat/HABITAT3/dignos.html> for details.