



Transferable Skills In Engineering and their Dissemination

A Review of Good Practice *across the consortium*

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Stage 1 Report: **A Review of Good Practice** *across the consortium*

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Summary

In stage one of the *TRANSEND* project, the project team have gathered information from employers regarding their own graduate development activities and they have reviewed the good practice relating to skills development employed by the departments in the consortium. It is clear that employers now regard the acquisition of transferable skills as an essential component of any higher education qualification. Many employers target specific skills within potential recruits and run their own development programmes for graduates.

Across the departments in the *TRANSEND* consortium, *42 modules* have been identified which contribute to the development of student's personal and professional transferable skills and it is clear that a wide variety of teaching methods are employed. Three general approaches have been identified by the project team: a) *an embedded approach*, modules in which skills are not directly addressed, but developed through the module's technical and academic content; b) *an integrated approach*, modules which directly address skills development in an integrated fashion with the technical and academic content; and, c) *a bolt-on approach*, modules which only address skills development.

Across the consortium, each institution employs all three approaches depending upon the skills concerned, the level of the students and the constraints on resources. The project team have also compiled a list of all of the transferable skills that are addressed, at least to some extent, across the consortium, *57 distinct skills* were highlighted ranging from *brainstorming* to *time management*. However, despite this vast range of skills, certain 'common' skills are addressed by all departments: *communication* (encompassing presentation skills and report writing), *information technology*, *problem solving* and *teamworking*. Stage 1 was completed in October 1998, Stage 2 is now underway and Stage 3 is due to start in early 1999.

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1. Introduction

The provision of academic excellence within teaching will always remain an essential pre-requisite to any successful engineering degree. However, over the last decade, the development of graduates' personal and professional transferable skills has become an ever increasing priority for employers. This is reflected in the current graduate employment market, with almost every employer being able to provide a comprehensive list of the skills, attributes and qualities that they require in their new recruits.

Multi-national companies, such as BP, Esso/Exxon, ICI and Shell, support the development of these transferable skills through effective and comprehensive training courses; for example Esso/Exxon's Graduate Training Programme and ICI's Foundations of Learning. Such companies have also actively encouraged the provision of personal development activities within some academic institutions. However, it is becoming increasingly apparent that employers expect all graduates to have developed their transferable skills, to some degree, within the higher education sector.

The successful development of these skills within academia can only be achieved through the provision of effective student support and guidance; specifically, with respect to providing undergraduates with opportunities to develop and employ these skills in meaningful environments; and to conduct on-going and retrospective reviews of their individual performance and the performance of their peers. Such opportunities include professional training placements and personal skills development courses; while review processes involve site visits by academic staff during placements and extensive debriefing of students by staff and their peers during development courses.

The *TRANSEND* Project concerns the '*Effective Transferral of Good Practice in Student Support and Guidance for the Development of Transferable Skills*'. The project is being run by a consortium of four universities. The overall aim is to identify the best practices in student support and guidance methods for the development of personal and professional transferable skills, and to transfer and disseminate these methods for the benefit of others in the academic community.

1.1 About this report

This report outlines and reviews the good practice currently employed by the consortium partners and the current views of a cross-section of employers, with respect to the development of transferable skills in student and graduate engineers. The review is based on information gathered directly from the consortium partners and employers. In this document there is an

overview of the *TRANSEND* project, a synopsis of the employers viewpoint, an outline of the existing good practice employed across the consortium and a brief report on interviews conducted with members of academic staff in each department. It should be emphasised that this document should not be regarded as definitive. As the project matures it is anticipated that other sources of good practice will be identified and incorporated in this document for further dissemination.

The purpose of this document is simply:

- to raise awareness in the project;
- to convey the range of transferable skills that may be addressed in an engineering curriculum;
- to highlight some of the benefits and constraints in teaching transferable skills; and,
- to emphasise the need for these skills in the work place.

1.2 Who should read this report?

This document is aimed at *discipline based members of academic staff* who have a responsibility for, or an interest in, student's personal development and employability. It is intended that this document should stimulate their interest in the activities of the consortium partners and the *TRANSEND* project, and encourage their involvement in the project. It should be emphasised that, although the project is based around a chemical engineering consortium, the outcomes will be directed towards the wider academic community.

1.3 Contacting the Project

We are eager to expand our database of individuals who wish to introduce transferable skills development opportunities into their degree programmes, and to identify other providers of good practice in this field. If you wish to register as a departmental contact please complete and return the contact form that can be found in Appendix II at the back of this document. Alternatively, the project team can be contacted directly at the *TRANSEND* project office in the Department of Chemical and Process Engineering at the University of Surrey, Telephone: 01483 259475 or via to project E-mail account: TRANSEND@surrey.ac.uk.

1.4 What next?

A series of dissemination workshops are currently being planned. The first will be held at UCL on February 16 and will be aimed at chemical engineers. Subsequent workshops will be aimed at academics and employers from other engineering and science disciplines. In addition, the project team are preparing a supplementary document detailing the activities of the consortium partners with respect to developing transferable skills.

2. The TRANSEND Project

2.1 Project Overview

A consortium of four universities, led by the University of Surrey, have initiated this project; the other consortium partners being the University of Birmingham, University College London and the University of Newcastle upon Tyne. Funding for the project has been provided by the Higher Education Funding Council for England (HEFCE) through Phase 2 of the Fund for the Development of Teaching and Learning (FDTL).

The project will be conducted in four stages:

Stage 1: review and collation of information relating to existing good practice.

Stage 2: analysis of good practice and determination of which elements to disseminate.

Stage 3: exchange of these elements of good practice across the consortium, including evaluation of applicability and effectiveness, and identification of the most appropriate transferral technique/s.

Stage 4: wider dissemination and transfer of good practice.

The stated project outcomes and deliverables include:

- three dissemination conferences or workshops;
- the development and preparation of materials, documentation, workshops and tutorials necessary for effective transfer of good practice;
- reports detailing the outcomes from each stage of the project;
- the publication of a guide on *'the effective transferral of good practice in student support and guidance for the development of transferable skills'*; the compilation of a database of good practice providers; and,
- the publication of a www-site;

2.2 Project Management

A project team consisting of a project leader, a project officer and a project manager have been appointed to run the project. The project leader has responsibility for the day-to-day running of the project, they are assisted by the project officer. The project manager has overall responsibility for the project and specific responsibility for its financial management. In addition, the project manager also chairs the project management committee meetings.

The project team is based at the University of Surrey. Both the project leader and the project officer have been recruited to the project. The project manager, Dr. David Faraday, is a member of academic staff in the Department of Chemical and Process Engineering at Surrey.

The overall direction of the project is governed by the Project Management Committee. The committee consists of two representatives from each of the consortium partners, an employers representative and a representative from the Teaching and Learning Support Unit at the University of Surrey. The project team report to this committee every three months.

A Steering Group has also been formed consisting of representatives from employers, professional bodies and other academic disciplines. The purpose of this body is to provide advice and guidance to the project team on which aspects of the existing good practice should be disseminated. This body will meet once every six months.

The membership of both the Project Management Committee and the Steering Group can be found in Appendix I.

3. Review of Good Practice

3.1 The Review Process

The first stage of the project has been completed. This stage concerned the collation and review of the existing good practice present across the consortium. The outcomes of this review are reported in this section.

The project team visited each of the consortium partners at least twice. On these visits, three methods were employed to gather information regarding existing good practice across the consortium: 'one-on-one' interviews, completion of proformas and the submission of documents, relating to both good practice and to each degree programme.

The aim of these visits was to identify all of the components in each degree course in which transferable skills development occurs and identify the perceived 'elements of good practice' employed in the development of these skills. Furthermore, it was also considered important to establish the general view amongst the academic staff of each institution with regard to the transferable skills development.

All interviews were conducted by the project leader and/or the project officer and interview reports were compiled by the same. Proformas were issued to and collected from all good practice providers across the consortium. The proformas were designed to gather information regarding the skills content, the resource requirements and the perceived elements of good practice in specific course components that encompassed some element of skills development. Other documents submitted included course notes, handouts and reports from transferable skills courses, overall course outlines and timetables for academic year 1998/99.

In addition to reviewing the good practice across the consortium, it was also necessary to establish the level of skills development activity present at graduate level amongst employers. A questionnaire was prepared and sent to a number of organisations, to ascertain their views on personal and professional skills training programmes and whether their graduate engineers were involved in these programmes. Information in this area was also gathered from the University of Surrey Careers Service, from 'Engineering Casebook 1998' and from discussions with recent graduates.

During the review process it has become apparent that there is a wide range of skills that have been defined as 'transferable' skills. Across the consortium, activities relating to the development of 57 distinct skills have been identified.

3.2 The Employers Viewpoint

Information was collected from thirteen different employers concerning their graduate development programmes. Three sources of information were used: questionnaires completed by company personnel, the Engineering Casebook 1998 and direct contact with recent graduates. The employers which have provided the information presented below are: Albright and Wilson, Andersen Consulting, Bechtel Water Technology Ltd., British American Tobacco, BP Oil UK Ltd., Esso Petroleum Co. Ltd., ICI, Gillette, Lilly and Co, Ltd., M.W.Kellogg, Nestle UK Ltd., Raychem Ltd. and United Biscuits.

All of the employers provide training opportunities for graduates to develop their transferable skills. The majority offer a structured training programme for new recruits, followed by more specialised continual development programme depending on an individual's selected career path. Mentoring schemes to assist new graduates in both their personal and career development were in place at six of the companies. Others employed less formal methods but regarded monitoring of development as important. All of them believe that the individual and the employer have a joint responsibility for personal development.

Nine of the employers listed the transferable skills courses that they provide for their graduates. All offered training courses in project management, seven of them in communication and teamworking, six in time management and IT, five in presentation skills, four in interviewing, two in decision making and one in planning and organisation, creative thinking, innovation and career development.

Six of the employers listed effective communication and managerial skills as the most important transferable skills to have when working in an industrial environment. Four employers highlighted teamworking as an important skill and three highlighted leadership potential and knowledge of information technology. The other important skills that were highlighted were time management, people management, presentation skills and decision making.

In recruitment, all of the employers consider the applicant's skills base in their recruitment process and four of the employers target specific skills when recruiting graduates. Five employers believe that transferable skills development should be taught at university. All of the employers regard their training programmes as a success and rely heavily on the feedback from participants to update and further develop this activity.

3.3 Existing Good Practice

The good practice employed in each of the consortium partners is summarised below. The sections relating to Newcastle and Surrey have been written by the good practice providers in those institutions. The sections relating to Birmingham and University College have been written by the project team, based on information supplied by the good practice providers, and approved by those providers.

3.3.1 University of Birmingham

The School of Chemical Engineering at the University of Birmingham offers a number of chemical engineering undergraduate degree programmes. These are B.Eng./M.Eng. in Chemical Engineering, Chemical Engineering with Biochemical Engineering and Chemical Engineering with Minerals Engineering. M.Eng. degrees are also offered in Chemical Engineering with Management and Chemical Engineering with Environmental Management. After completing the first two years of a common Chemical Engineering course, students opt to take one of the alternative degree programmes. The M.Eng. courses are an extension of the B.Eng. courses available - advanced topics are pursued beyond the 3-year degree course.

Induction week

During the induction, the students are introduced to project work in groups of 7/8 in addition to computing and laboratory work.

Teamwork

M.Eng. students are involved in teamworking tutorials with the 1st years. Representatives from Courtauld's are brought in to train the 4th years on how to facilitate the teamworking exercises over the course of 1 day and these exercises are then carried out. The laboratory experiments for all years are undertaken in teams, selected at random, and the design projects also provide teamworking and



Developing Communication Skills

team building opportunities. **Business games** provided by BP and Esso are also used to develop teamworking skills. The BP business game is CD-ROM based and simulates a process plant. Students work in teams of 4/5 and have responsibility for managing the site, its staff, the plant and its operation. The Esso business game is also computer based and is run intensively over one day with the assistance of staff from the company.

Communication

This is initially taught to 1st years through lectures and tutorials. During the **Design Project**, the **Research Project** (Level 3) and the M.Eng. **Management Project** students are required to give oral presentations. Continual feedback is received on the styles of the laboratory reports so that the communication skills of the students can be developed.

Information Technology

This is taught to 1st years in the first week of term one. The students are taught how to use the E-mail, how to use the Internet and how to use Word, Excel and QBasic programming. During the second term, the students are taught how to use CAD and Autosketch.

Management

A core management course is taught during the third year of the degree programme. The 3rd year M.Eng. students undertake a management project run in conjunction with civil engineering students. A critical path analysis and network analysis is required in addition to a financial assessment. This project is very structured and a peer review is also carried out. The business games provided by Esso and BP also develop student's managerial skills. The Esso business game focuses on project management, while the BP business game is based around man management.

Laboratory experimentation

Laboratory practical classes are run over the first years of the degree programme usually in groups of 2. Over the third year, an open ended research project is carried out which has an industrial application and is assessed via an oral presentation and report.

3.3.2 University College London

The department of chemical and process engineering at UCL offers several undergraduate degree courses at both B.Eng. and M.Eng. level. B.Eng. degree programmes in Chemical Engineering and Biochemical Engineering are available. M.Eng. undergraduate degree programmes are available in Chemical Engineering, Biochemical Engineering, Chemical Engineering with study abroad, Biochemical Engineering with study abroad, Chemical and Environmental Engineering, Biochemical and

Environmental engineering and Chemical and Biochemical engineering. These programmes would be an extension to the B.Eng. degree courses run at UCL.

Induction week

Induction week takes place over the first 5 days of the first semester and is focused upon introducing the students to university life and the nature of work in such an environment. The following occurs during the week:

Day 1 Departmental and computational registration

Day 2 Departmental welcome, freshers' reception

Day 3 Introduction to programme of events, student tutoring, 1st year programme, coping with lectures, safety and experimentation

Day 4 Departmental information session, time management and student welfare, and a tour of the UCL science and engineering library

Day 5 Word processing - talks and hands on session, presenting yourself on paper - CV's and careers

Study week

The study weeks are held once every semester and incorporate much team working activity throughout the four years. During the first year, students visit an industrial site and then have to present their findings in teams via a poster. In their second term, the level 1 students have to present one of their laboratory experiments as a poster in groups, this is then assessed. For the second year students, the term one study week is taken up with a teamwork and project management workshop, CAPE (Computer Aided Process Engineering) project work, which should develop the teamworking and management skills of the students. During term two, the level 2 students work on engineering drawings, a process engineering project and CAD (Computer Aided Design) exercises. In term one of level 3, the students carry out a mass and energy balance and in the second term, the students perform a HAZOP (Hazard and Operability Study) and do their P&ID (Process and Instrumentation Diagram) layouts.

Teamwork and project management training workshops

Training programmes on teamwork and project management are organised with the assistance of staff of the UCL Higher Education and Research Development Unit (HERDU). Two programmes are run, one for level 2 students, that consists of the "*effective teamwork through projects programme*" for two days and a second for the level 3 students consisting of a "teamwork refreshers day" lasting over a day. This is externally funded, with members of Esso and the Coverdale Organisation assisting in the delivery. The project is driven by the importance for students to acquire transferable skills such as teamworking and project management as a basis for subsequent professional practice. Some of the



The Team in Action

generic models behind this programme are: experimental learning i.e. task based reflective practice (reviewing the process), having an agreed model for planning and action, and selecting a quality criteria for task product.

Design project

The design teams work in groups of 6 and each team has to report to a member of the academic staff, they then monitor the progress and deadlines set for the groups intermittently throughout the project.

The two days, devoted to covering the "teamwork and project management" contributes to the computer aided process-engineering course. The training helps to provide



Peer Review

a structure for setting common aims and agreeing plans, while raising a range of team working issues. A prize is donated by P&G, given to the best team according to published criteria.

Career development programme

This consists of a series of careers lectures, tailored to the needs of each year and presentations at strategic times concerning, for example applying for vacation work, completing application forms, interview skills, researching opportunities and post graduate studies. There is also individual student liaison with the department careers tutor and department and university wide recruitment presentations by companies.

Industrial Year Placement

The department organises industrial years for those

students who are suitably qualified and wish to take up an extra year. A “*plan of work*” has to be agreed between the student and the tutor prior to the placement year and the year placement is for a minimum of 9 months. Students are accredited for their industrial year and have to produce a report while out in industry.

3.3.3 University of Newcastle upon Tyne

The Department of Chemical and Process Engineering offers two undergraduate degree programmes; the three year B.Eng. (Hons) and the four year M.Eng. (Hons). The first three years of both courses are common. A B.Eng. (Ord.) programme is offered, but only to those deemed not able to meet the criteria for an Honours classification. Students can elect to spend a year in industry, usually at the end of Stage 2.

The aims of the degree programmes are to produce graduates who have a coherent understanding of Chemical Engineering, combining a sound theoretical grasp with practical experience, and an awareness of their responsibilities to society and the environment. To achieve these aims, course modules therefore include a significant level of ‘transferable skills’ content, which is embedded transparently into the course structure.

Computer literacy and programming skills

All students are required to be relatively competent in the use of computer technology and in writing simple programs to help them in their work. Good programming practice is taught formally in Stage 1 and assessed via assignments. Instructions on the use of ‘office’ software is given informally, on an ‘as-needed’ basis. However, students are encouraged to attend the University’s Computing Services’ ‘*show-and-tell*’ sessions that teach the use of ‘standard’ software. All our students should leave with a fair degree of competence in the use of word-processors and spread-sheets. As of the 1998/99 academic year, there will be formal instructions in EXCEL, MATLAB and SIMULINK (applications which have become standard tools in solving engineering problems) in favour of FORTRAN-77.

Teamwork

Throughout the course, students have many opportunities to work in teams. **Laboratories** in Stages 1 to 3 involve working in pairs and partners are arbitrarily chosen. The mini design project in Stage 1 introduces process design and integrates the material learned in the first year. Groups of between 5 to 6 students study the given problem and they have to come up with a collective solution. Again the group members are assigned arbitrarily. All Stage 3 students carry out the mandatory **Plant Design Project**. Each project group comprises about 5 to 6 students. However, Plant Design group members are selected to ensure that each group includes students with a spread



Solving ‘Engineering’ Problems in Teams

of ability. The design groups have to meet deadlines with clear deliverables, and therefore have to work as a cohesive team. This is enhanced by a series of lectures on project management given by a Royal Academy Visiting Professor from industry. Although formal instruction about team work is not given, laboratory and project supervisors keep a close eye on group dynamics and provide advice, either to individuals or the group, on how and why they should work as a team.

Communication skills

Report writing - all laboratory and project work are accompanied by written reports and these are assessed, with feedback given using a standard assessment sheet. In Stage 1, the students are required to produce both ‘short’ and ‘long’ reports, depending on the experiment, thus introducing them to different reporting procedures. Stage 1 students are given instructions on how to write technical reports. Stage 4 students are given further instruction on how to write research dissertations.

Presentations - Stage 1 students are required to prepare a short talk on a chemical process which they have researched in the library and present to staff and fellow students. In Stage 2, students give a presentation on a (not necessarily technical) topic to a small group of students and a member of staff. At the end of the Stage 3



Communication is Essential for Effective Teamwork

plant design project, each group has to make a presentation to a panel of staff and visiting industrialists. Stage 4 students are given instruction and guidance on how to prepare poster presentations of research results, and these are appraised by panel of staff and industrialists.

Information retrieval skills

In Stage 1, students are given instructions on how to search for information; in the University's Library and the WWW. Stage 3 are given further instruction on how to search technical databases, while Stage 4 students are guided on the literature searches in conjunction with their final year research projects.

Engineering research skills

Stage 4 students spend their last semester carrying out a research project. The students are given preliminary instructions on how to approach engineering research, while project supervisors provide further research training during the course of the projects. Most of the project areas are closely associated with the research interests of the Department and many of their work are published in refereed technical journals.

Career and personal development

All students are encouraged actively to think of their time at University as integral to their career development. The Department works in close liaison with the University's Career Services so that students are equipped with the necessary job application and interview skills. Advisory seminars are conducted throughout the year for all stages, and individual advice and guidance is readily provided via 'careers clinics'. Supplementing these, are seminars by alumni. A common emphasis is that 'a degree alone is not enough'.

Other opportunities

There are a number of opportunities which provide further acquisition of transferable skills. Proficiency in another language is an obvious advantage and students can opt for a language elective instead of technical ones. In addition to the **Industrial Year** out option, students are encouraged to undertake relevant vacation work and to attend courses conducted by industry. Visits to companies in the chemical and process industry also provide an opportunity for interaction with practising engineers. Students also have an opportunity to participate in the '**Students into Schools**' initiative, where they work as tutors. There is also an optional half module on the **Management of Student Tutoring in Schools**. These activities help to instill awareness and self-confidence. Finally, there are opportunities for students to take on positions of responsibility within the Department as committee members of the **Chemical Engineering Society**; the Staff-student committee which operates with



Student Social Events

students as Chairmen and Secretary and the Departmental Board of Studies. Student representatives are also welcome on the committee of the Northern Branch of IChemE. They can also be involved with student recruitment initiatives and activities.

3.3.4 University of Surrey

The University of Surrey offers three year B.Eng. degrees in Chemical Engineering, Environmental Chemical Engineering, Chemical and Bioprocess Engineering and Chemical Engineering with a European Language. In all cases there is the option to undertake an additional year of professional training in industry. Four and a half year M.Eng. degrees are offered in Chemical Engineering and Chemical and Bioprocess Engineering. Both of these programmes include a compulsory professional training placement. With the exception of Chemical Engineering with a European Language all courses have a common first year and transfers can be made as late as the end of semester 3. Foundation level entry is available for all degree programmes. The opportunity to undertake a placement overseas is available and is taken up by approximately 15% of the placement students each year.

Level 1: Aim - to create a skills base essential for engineering and to raise awareness in the value of other key transferable skills.*

During **Induction Week** new students are introduced to the core transferable skills which are to be developed throughout the degree and the teaching methods to be employed. In **Design and Communication** students develop transferable skills vital to their academic studies and development as engineers. This module covers library use and literature search skills, report writing, the preparation and understanding of PFDs (process flow diagrams) and P&IDs (piping and instrumentation diagrams), and the use of computer packages employed in these areas. In addition, it includes an introduction to

** this aim is specifically with respect to personal development and not the overall teaching aim for each level.*

design, conduct of meetings, minute taking and an introduction to presentation skills. In **Chemistry 1** and **Chemical Process Technology**, students work in small teams for literature searches, laboratory work, problem solving and report writing. Providing a valuable foundation in the development of these skills. In **Computing** students are given a grounding in basic information technology skills - using word processors, spreadsheets, databases, etc.

Level 2: Aim* - to introduce and develop the theoretical concepts underlying key transferable skills and provide the opportunity and environment for their development.

In **Industrial Practice** students are guided in the development of those transferable skills essential to successfully negotiating the recruitment process for professional training: preparation of a curriculum vitae, completion of application forms, interview practice and training, communication skills, an introduction to technical problem solving and creative thinking. A tutorial-based environment in employed, with a strong emphasis on student-centred learning. Students attend company presentations, at which they get the chance to meet and discuss placements with current professional training students and recent graduates. This module is



The Leader's Role

available for all level 2 students to attend, but is a pre-requisite for those who wish to undertake professional training (typically >80% of level 2 students).

Personal Skills Development is divided into two parts. **Part 1** is heavily concerned with the development of communication skills and introduces the key principles of teamworking, leadership and problem solving. Students are required to give four presentations (of differing duration and type), to take part in a series of nine competitive debates (from politics to sport) and to take part in communication skills development exercises. In addition, students discuss the basis of leadership and teamwork and undertake technical problem solving tasks in teams.

Part 2 is an intensive three day course focusing on

Leadership, Teamwork & Communication Skills. In this course a number of underlying concepts are presented to the students for them to consider in their own personal development. These include Belbin's team roles, functional leadership, the Maslow needs hierarchy, Herzberg's motivators and hygiene factors, action centred



Teamworking in a Different Environment

leadership. Student's are presented with the opportunity to develop their skills and test these concepts through a series of exercises. At the end of each exercise the team debrief the exercise and discuss the learning outcomes. The debriefs are facilitated by the team tutor's, a level 3/4 student, a postgraduate and a staff member.

In between parts one and two of Personal Skills Development, students have the opportunity to test their team working and academic skills on a technical problem. Students undertake a **Design Project** in small teams of three or four in which they have to propose a design for a C₃-C₄ splitter. At the end of the project students give a technical presentation as part of the Personal Skills Development module.

The **Advanced Leadership, Teamwork & Communication Skills** course builds directly upon the experience gained and skills developed in the Personal Skills Development



Setting an Example

* this aim is specifically with respect to personal development and not the overall teaching aim for each level.

module. Although, the students are placed in a more challenging, outdoor environment and given significantly more challenging tasks, the teaching principles are exactly the same as those employed previously. In addition to undertaking the course, students have to raise money to pay for their course fee, currently £320 (1998).

Level P: Aim* - to encourage and monitor the further development of transferable skills in a work based environment.

As part of **Assessment in the Work Place** students are visited at least three times during their professional training placements. Students are required to organise these visits as professional business meetings. A typical visit would include an extensive one-to-one interview with the visiting tutor (a member of the academic staff), a site tour (where appropriate), a private meeting between the visiting tutor and the student's supervisor and Head or Department/Section, followed by an open discussion. Students are encouraged to reflect on their development in the work based environment with respect to academic, technical and personal skills. Areas of strength and weakness are identified, together with opportunities for further development.

In the **Debriefing** module student's must give an oral presentation and present a poster on their professional

training placement. The oral presentation takes place at the company on the last site. The poster presentation is given back at the University. In both cases, the student's peers and supervisor are invited to attend.

Level 3&4: Aim* - to provide opportunities for the integrated development of academic, technical and personal skills.

Support and guidance is provided by the department's professional training staff with regard to **Graduate Recruitment**. This is further supported through the strong links which exist between the department and the University's Careers Service.

In the **Design Project** students work in design teams to produce an overall process design of a specified process plant. Technical and teamworking problems are dealt with separately through a tutorial system. **Research Projects** provide a student with the opportunity to manage a small project. These projects require time and resource management skills as well as problem solving.

Process Engineering Operations and Management has been specifically designed to provide an opportunity for the integrated development of academic, technical and transferable skills through their application to realistic engineering problems. This module was developed



Technical Problem Solving:

students look for a plant based problem (main picture), while the process engineer (inset) identifies another problem.

* this aim is specifically with respect to personal development and not the overall teaching aim for each level.

through funding obtained through the University's Teaching and Learning Innovations Group (TLIG) and through contributions from BP Oil UK Ltd., Esso/Exxon and ICI. Throughout the module environments are created in which students have to employ all of their skills to solve problems relating to process safety, plant operation and maintenance, environmental management, research and optimisation and financial management. In addition, four case studies are provided by industry which are solved by the students in small teams.

Students are also provided with the opportunity to be trained as **Tutors** for the **Leadership, Teamwork & Communication Skills** courses. Between 6 and 15 students elect to be trained each year. The one day training programme aims to reacquaint students with the concepts introduced on the course and provide training in facilitating debriefs and task reviews.

Post-experience: Aim – to provide further opportunities for personal development for graduates.

Once trained as course tutors many of the department's graduates return to assist the intensive Leadership, Teamwork and Communication Skills courses.

In 1995 and 1997, appropriate technology projects were undertaken in **East-africa** (Kenya and Tanzania) by teams

of graduates from the department, supplemented with students drawn from the local communities. These projects provide opportunities for both personal and professional development. The project team have complete responsibility for the personnel and financial management of the project. Each team member has to raise their own funding to participate in the project (~£1,700).

Other Opportunities

The department actively encourages and supports the activities of the student **Chemical Engineering Society** and the alumni body, **SUCkERS** (the Surrey University Chemical Engineering Reunion Society). A member of staff holds a non-voting position on each of the executive committees.

Practicals are incorporated into modules by module organisers at all levels in the curriculum. A laboratory round is arranged in which the students undertake these practicals. Students work in small groups and have to prepare written reports. Teamworking, planning and information technology skills are required for these activities.



East African Project: post-experience professional development opportunities.

3.4 Interviews with Academic Staff

Interviews were conducted with members of staff at each of the consortium partners to determine:

- their views on the need for the development of transferable skills in an academic degree programme;
- their perception of the success of the good practice in place at their institution;
- their opinion on changing or expanding their activities based on good practice identified elsewhere; and,
- the resource implications associated with the teaching of transferable skills in their department.

The interviews were conducted on an informal basis, although guideline questions were prepared in advance. The following is a summary of the comments received from those interviewed.

3.4.1 University of Birmingham

(4 out of 30 members of academic staff were interviewed)

Two of the staff members interviewed commented that the teaching of transferable skills is of considerable importance and there is to be more emphasis placed on the teaching of transferable skills during the next academic session. Three of those interviewed said that transferable skills were essential for graduates to be effective in industry and there is support from all members of staff within the department for the teaching of these skills. The department is continually looking into methods to further develop its transferable skills programme, but also make it relevant to the core modules taught.

3.4.2 University College London

(4 out of 12 members of academic staff were interviewed)

All those interviewed in the department are very enthusiastic about transferable skills development and incorporating it into their degree course. The opinion of two lecturers interviewed is that students learn a great deal from modules which incorporate transferable skills. One member of staff commented that the development of transferable skills makes students more efficient in their working environment and in their approach to their academic learning. The teaching of transferable skills has received substantial support within this institution, however one lecturer suggested that staff could be more actively involved with such programmes, to establish a better working relationships between themselves and the students.

3.4.3 University of Newcastle upon Tyne

(8 out of 16 members of academic staff were interviewed)

There are strong links between the careers service and the department, which is important as the careers service provide much useful and relevant information to undergraduates throughout their degree courses. All members of staff interviewed are of the opinion that there is a huge amount of support for the students to develop their transferable skills; the Head of Department is actively involved in the transferable skills courses taught within the department. Two members of staff are of the opinion that the problem solving skills of the undergraduates need to be emphasized more than they are at present. Four believe that having effective communication skills, both written and oral is also significant.

3.4.4 University of Surrey

(8 out of 15 members academic staff and 3 other staff members were interviewed)

Eight of the interviewees are of the view that the development of transferable skills is an important and relevant aspect of the degree course and that these skills are essential for professional engineers in industry. Seven staff members interviewed are of the opinion that the opportunity for a great deal of transferable skills development is provided in the department and it is continually emphasised throughout the degree programme. Two members of staff are heavily committed to the integration of a personal skills development programme for undergraduates which runs from induction week to beyond graduation. A more extensive skills development programme is in place that prepares those students wishing to undertake a professional training placement. It is also apparent that the senior management of the department are highly committed to skills development activities.

3.4.5 General Concerns

A small proportion of the staff interviewed at each institution, approximately a third overall, believe that the teaching of transferable skills is time consuming; especially for dedicated courses. Approximately the same number, also commented on the conflicting pressures on academics time of research, teaching and administration, and the resultant lack of staff availability for skills development. It was suggested that qualified individuals could be recruited to teach skills development courses, although this is considered costly. It was a general view that transferable skills development should be incorporated more into the core modules already in existence, for instance the design projects, which are taught in each department.

4. Stage 2: Analysis

In Stage 2 the project team will:

- identify elements of good practice;
- determine 'what is good' about the elements of good practice identified;
- determine which elements of this good practice we wish to, and can, disseminate; and
- publish a summative evaluation of this good practice.

It is recognised that it will not be practicable to simply transfer entire modules or courses, as they stand, between institutions. Therefore, in Stage 2 the project team will identify specific elements of good practice within the generic good employed across the consortium. They will also assess why these elements are effective and analyse 'what is good' about them. As such, an evaluation strategy is being developed by the Project team in consultation with Professor Karen Evans and Gillian Nicholls of the Department of Educational Studies at Surrey. The methods to be employed in this analysis will include focus groups, interviews with current and former, providers and receivers of the good practice, direct observation of the good practice and reviewing student feedback and peer recognition documentation. The criteria for assessment will include the student outcomes obtained from the implementation of the good practice, measured against the stated teaching aims and objectives, and the level of retention of knowledge and skills conveyed through the good practice.

It is recognised that within the scope of this project it will not be possible to disseminate all the elements of good practice which have been identified in Stage 2. Therefore, the project team, in consultation with members of the Steering Group, will prioritise the elements of good practice. This selection will be based upon a number of criteria:

- the potential for successful transfer;
- the student feedback and peer review analysed previously;
- the absence of the good practice in other institutions;
- the resource requirements for transfer, implementation and sustainability of the good practice (manpower, consumables, equipment, experience, etc.); and
- the usefulness of the skills and knowledge gained to the educational, personal and professional development of the receiver and, ultimately, to the employer.

Clearly, at this stage it is not possible to identify the specific elements of good practice that will be disseminated. However, some of the elements that will be considered are:

- *Introduction to transferable skills training - induction week.*
- *Assessment and monitoring of transferable skills development.*
- *Training and use of student tutors in the development of transferable skills.*
- *Development of transferable skills through technical problem solving.*
- *Application of transferable skills to process operations and management.*
- *Development of communication skills through presentations, debating and creative thinking.*
- *Experiential learning through debriefing and review.*
- *Integrated development of leadership, teamwork and communication skills.*
- *Facilitation of personal and professional development in the work place: site visits to during professional training placements.*
- *Development of job seeking skills: preparation of application forms, CV's and interview training.*
- *Creative problem solving.*
- *The development of transferable skills through team based process design projects.*

Appendix I

The names of people on the committee was correct at the time of going to press.

Project Team

Project Leader	Miss Deesha Chadha	UniS
Project Officer	Mr. Colin Kruger	UniS
Project Manager	Dr. David B.F.Faraday	UniS

Project Management Committee

Chairman	Dr. David B.F. Faraday	UniS
Institutional Project Leaders	Dr. Peter Norman	UoN
	Prof. Jonathan Seville	UoB
	Dr. Stef Simons	UCL
Institutional Representatives	Dr. David Bogle	UCL
	Dr. Andrew Merchant	UoB
	Dr. Ron Schulz	UniS
	Dr. Ming Tham	UoN
Industrial Liaison	Mr. Ian Carr	Esso
Teaching & Learning Support Unit	Miss Vicki Simpson	UniS

Steering Group

Industrial Representatives	Mr. Jeff Branston	Courtaulds
	Mr. David Godden	ICI
	Miss Julie Nicolls	Coverdale
	Mr. Simon Richards	BP Oil UK Ltd
	Mr. Martin Timms	Esso
	Mr. Steve Oglesby	AspenTech
	Mr. Nick Amott	Fluor Daniel
IChemE	Mrs Sue Fortunka	Education Development
HEFCE	Mrs Sarah Turtin	FDTL
UniS Key Skills Project	Mrs Penny Burden	UniS
Other Academic Disciplines	Dr. Neil Ward	UniS
	Mr. Mike Huxley	UniS

Appendix II

Departmental/School Contact Information

Family Name	<input type="text"/>
Forename	<input type="text"/>
Title	<input type="text"/>
Position	<input type="text"/>
Department	<input type="text"/>
Institution	<input type="text"/>
Address	<input type="text"/>
Post Code	<input type="text"/>
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Fax	<input type="text"/>
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