

**UNIVERSITY OF SURREY**

**School of Engineering**

**PhD Thesis**

**Considering a Teaching Framework to Support the  
Development of Transferable Skills in Engineering  
Undergraduate Students**

**By**

**DEESHA CHADHA**

**Presented as part of the Requirements for the degree of Doctor of Philosophy**

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I dedicate this thesis to my parents:

To my dearly departed Mum, Swraj, who taught me to do the right thing and my much cherished Dad, Dev, who has taught me to do things right – I wrote this for you.

## **Abstract**

The work in this thesis focuses upon research conducted in four departments of chemical engineering within Higher Education, in the UK. The work was carried out on the back of identified concerns which arose whilst working on a HEFCE-funded project which aimed to disseminate good practice for enhancing transferable skills teaching within engineering curricula. Evaluation data from the HEFCE-funded project suggested discrepancies between students' perceptions of skills development and those of academic practitioners. The purpose of this research was to establish exactly how students developed their transferable skills and addressed the question: what is the pattern through which undergraduate chemical engineering students in Higher Education effectively develop their transferable skills? Case study and grounded theory approaches were used in this research. In addition to understanding students' perceptions of developing skills, it was necessary to use that understanding to generate a framework which could adequately support the development of these skills.

Research findings suggest that students learn differently at different levels of their undergraduate studies and that mode of assessment and student motivation in learning are recognised factors which influence student perceptions. It was possible to propose a theoretical model of curriculum development which could be used by academic practitioners in Higher Education to enhance skills development in undergraduates. It is recommended that the model be tested in other vocationally-orientated disciplines, for its impact value in light of recent Government initiated changes. The thesis contributes to the skills debate by: identifying contributory factors which support students' development of skills, highlighting issues for both students and academic practitioners involved with skills development, and proposing a framework of teaching which supports students' perceptions of learning.

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## **Chapter 1**

### **Foreword**

The purpose of this thesis is to consider students' perceptions of their development of transferable skills. The research question arose as a consequence of having identified concerns between what students felt was being learnt by them and what academic practitioners felt they were teaching in terms of skills development. The research presented in this thesis was conducted to understand the skills development framework currently in place, from the perspective of the learner, and generate an appropriate teaching framework which actively supported students' perceptions of learning. My personal interest in this subject area has been presented in the following section as this contributes to the context of the research. It is followed by a section which provides the background of the research and process leading to the identification of the issues involved. A conceptual framework of research, as proposed by Maxwell (1996) has been used for structuring this thesis, which includes experiential knowledge (my engineering background), exploratory research (the TRANSEND Project) and existing theory (literature on skills and learning).

## **Introduction**

### **Personal context: The researcher**

In putting together this thesis, I have used a conceptual framework (c-f page 1-1) to clarify my stance and the approach which I have taken to this work which entails describing my own background and elaborating upon my interest in this field. I graduated in 1998 as a chemical engineer from one of the departments investigated in this research project. As part of my undergraduate degree course, I was involved with a number of skills development activities during my first and second years of study. I undertook an industrial placement in my third year during which I could see first-hand why it was important to have acquired some transferable skills. It was important to recognise the functionality of the team in which I found myself, to communicate effectively and to have a clear idea about problem solving techniques. Until this point in my education, I was not actively questioning the pattern of development of my skills or why it was necessary for me to have acquired them, but could confidently describe specific examples during which I had applied my skills knowledge and had further developed my abilities. During my final year as an undergraduate, I was involved in a group design project and began recognising the value of effective team-working skills for achieving specific goals in addition to issues related to team dynamics. I also volunteered to tutor on a skills development programme attended by second year students. It is this experience above any other which has enabled me to reflect upon my development of transferable skills and the environment in which this 'learning' was made possible. As a result of all my experiences, I became increasingly aware of the importance for engineering graduates to be able to develop and demonstrate their transferable skills in a variety of contexts and for solving a number of problems.

Upon graduation, I was invited to work on the TRANSEND (transferable skills in engineering and their dissemination) Project, a HEFCE (Higher Education Funding Council for England) funded project designed to identify and disseminate good practice in teaching for the development of transferable skills throughout chemical engineering (c-f Section 1.1). The project involved reviewing the skills development activity within four university departments of chemical engineering in England with a view to disseminating good practice to other engineering departments and institutions. In my capacity as Project Leader, I was called upon to conduct most of the research associated with TRANSEND. Whilst conducting the research, I became aware, particularly through workshops and seminars, that there was often a limited approach taken by academics to develop the transferable skills of their undergraduates. The recognised limitations seemed to occur for one of two reasons: academics were either unaware of the value of skills education or did not possess the expertise to include skills development activities in their teaching.

Specific details concerning the TRANSEND Project are related in section 1.1. When the TRANSEND Project was awarded the HEFCE grant, one of the assumptions made by the Project Management Committee, was that there were a number of examples of good practice throughout the four institutions; the grant would not have been awarded if this was not the case and readily demonstrable. Therefore, whilst conducting TRANSEND research, the questions I asked students were more concerned with 'how is this good practice' as opposed to whether it was good or not. Increasingly though, as I was asking questions of students, I found there to be discrepancies between comments made by lecturing staff and those made by students. All the institutions

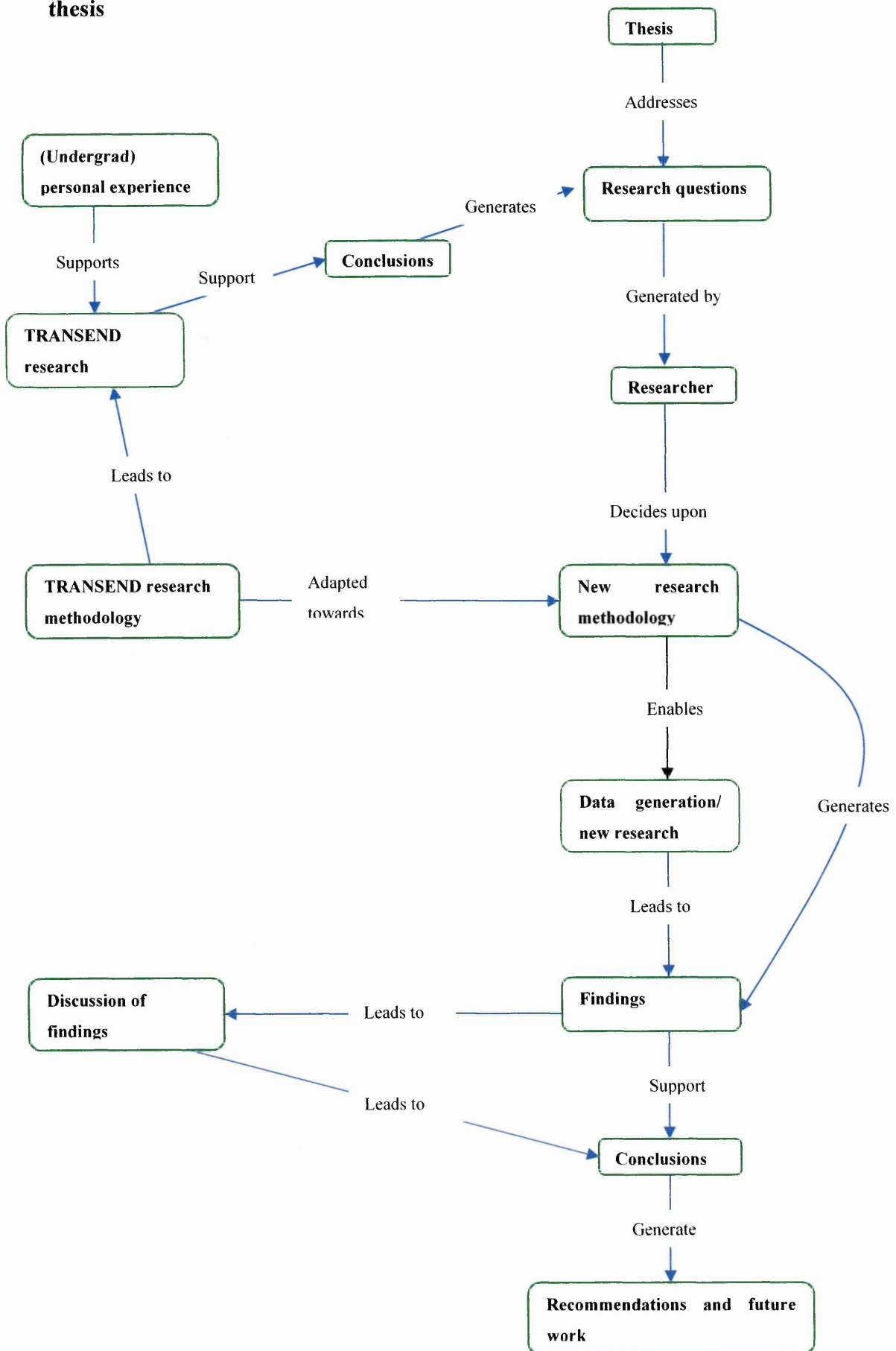
demonstrated examples of good practice, but at the same time students were not always aware of developing transferable skills effectively, what their motivation for doing so was or how such development was being measured. These initial concerns highlighted through the TRANSEND Project, represent my starting point with respect to this thesis. As a result of these initial concerns, I wanted to develop a deeper understanding of skills development. What was really going on? Also, could I use the information obtained to generate a theoretical model through which skills could be taught. Figure 1.1 shows the relationships, between the major considerations in this thesis, as I have chosen to link them.

To put the work carried out in this thesis into context Table 1.1 provides an indication of the types of institutions, number of students and where in the thesis more specific references can be found, making the specific data easier to access, as and when required. Tables 4.3 and 4.4 show the number of times particular types of data were collected and the numbers of students that attended sessions in which data were collected.

<b>Institution</b>	<b>Number of students</b>	<b>Page ref. in thesis</b>
1 – est. circa 1960's (former technology college)	Level 1 = 5	5-7
	Level 2 = 6	Appendix 2.2
	Level 3/4 = 6	Appendix 2.3
2 – old (red brick inst.)	Level 1 = 6	Appendix 2.1
	Level 2 = 6	5-15
3 – old (red brick inst.)	Level 1 = 5	Appendix 2.1
	Level 3-4 = 5	Appendix 2.3
4 – old (red brick inst.)	Level 1 = 5	Appendix 2.1
	Level 3/4 = 5	5-19

**Table 1.1: indication of types of institution, no. of students and page reference related to research groups**

**Figure 1.1: A diagrammatic representation of the main considerations in this thesis**





## **Background: The TRANSEND Project**

It is important to introduce the TRANSEND Project and highlight its achievements and failings to show the connection between the work carried out by TRANSEND and that presented in this thesis. The TRANSEND Project does not equate to my research project. It is the findings from the TRANSEND Project which have provided me with an initial start point for my research. TRANSEND is an acronym for ‘transferable skills in engineering and their dissemination,’ which was initially a three-year project beginning in January 1998. It was run by a consortium of four academic institutions, which received funding from the Higher Education Funding Council for England (HEFCE) through phase 2 of the Fund for Development of Teaching and Learning (FDTL). The overall aim of the project was to:

Identify 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

TRANSEND Grant Proposal, 1998

To achieve the project aim, in the original grant proposal a method was proposed to collect data. The ‘good practice’ referred to in the quote given was defined as “teaching ideas, methods and techniques used to enhance the development of transferable skills”; this same definition is used whenever good practice is mentioned in this thesis.

The project is divided into four stages:

- i. review and collation of existing good practice;
- ii. analysis of good practice and determination of which elements of the good practice to disseminate;
- iii. exchange of these elements of the good practice across the consortium, including evaluation of applicability and effectiveness, and identification of the most appropriate transferral technique/s; and
- iv. wider dissemination and transfer of good practice.

TRANSEND Grant Proposal, 1998

I first joined this project in July 1998 as TRANSEND Project Officer, having graduated with a B.Eng in Chemical Engineering over the Summer. One of my first tasks was to review the current provisions in place to enhance transferable skills development amongst undergraduates at accredited departments (those that have their awards accredited by the Institution of Chemical Engineers) of chemical engineering throughout the UK. It was envisaged that this would identify areas of greatest need across chemical engineering and areas of good practice outside chemical engineering to assist in the wider dissemination. I also sent out questionnaires to industrial representatives, asking them to identify the transferable skills which they valued in their new graduates. The outcomes of this stage were that a database of the good-practice providers was compiled and a report on good practice published (TRANSEND, 1999). During the review stage, forty two modules or courses were collectively identified by course providers as containing elements of good practice. After this review stage, a number of workshops were held between employers and academics to discuss and highlight concerns they had with the development of transferable skills in Higher Education.

An analysis of good practice was carried out after this review stage was complete. As such I conducted more detailed research into the good practice previously identified in the review stage. The aim of the analysis stage was to understand why the existing good practice was effective and to analyse what was good about it. As part of the aims, the Project team were required to determine which elements of the good practice could be disseminated based on a number of criteria, for example, the potential for successful transfer and the resource requirements for transfer, implementation and sustainability of the good practice. An outcome of this stage was

that an evaluation report was prepared (TRANSEND, 2000) and elements of good practice to be disseminated identified.

Thirteen of the forty two courses identified during the review were selected for analysis. The courses were selected on the basis of accessibility to course, an attempt to include as many levels of undergraduate study as possible and an attempt to include as many different teaching approaches as possible. Due to time and financial constraints it was not possible to analyse a greater number of courses. The analysis of good practice I conducted was focused upon these thirteen particular courses and was sub-divided into four stages: initial interview with course provider, observation of teaching sessions, interviews with students and a follow-up interview with the course provider. Due to confidentiality of data collected during the TRANSEND analysis stage, it is not possible to publish specific details regarding the courses, students, tutors or outcomes from the analysis.

Initial questions were asked of course providers. These are shown in Box 1.1. The text highlighted indicates my personal critique of the questions/comments and those in italics provides further clarification of the criticisms.

What are the perceived elements of good practice present in the course?

*Elements of good practice are simply stated without being 'justified' or evaluated as effective by course providers.*

How are the elements of good practice, you have identified, used to enhance the development of transferable skills?

*Again the questions asked are concerned with 'how is this done' as opposed to 'is it effective'.*

**Box 1.1: an indication of the questions asked of course providers interviewed for the TRANSEND Project**

Box 1.2 indicates the sort of information which was available from course providers in identifying elements of good practice and explaining their functionality.

**Element of good practice: regular reviewing of skills development by individuals and groups**

Having identified the skills development after training, students assess how well they are working in their team, and their own performance. This is carried out during debriefing and reviewing sessions. The course provider believes that this is an element of good practice as students become responsible for their own learning and develop their own skills, identify their own weaknesses and address them accordingly.

**Element of good practice: experiential learning and sharing experiences**

The students are given opportunities to develop their presentation, charting, planning and timekeeping skills by carrying out tasks in which they practise these skills and then share experiences with the remainder of their peer group. The course provider believes that this is an element of good practice as there is mutual learning and scope for improvement can be identified easily.

**Box 1.2: An example of information obtained from course providers**

Initially, when I conducted interviews with students, they were asked to discuss the elements of good practice that had already been identified by the course providers.

Some of the unpublished evaluation data indicated that not all students were aware of this development of skills or did not find the teaching techniques used particularly effective. Part of the unpublished evaluation data obtained from one course is shown in Box 1.3, a critique of which has been added alongside.

Of the skills being learnt, two students said teamwork, one said design analysis one said communication and one said nothing. *Did this student, who said nothing, really feel that they were not developing any transferable skills, and if so, why?* When asked if they felt they had developed any transferable skills during the course, three said yes, two said no – there was not enough time. *Why is it that just under half the group felt they had not developed skills?* Although one disagreed, four of the students interviewed felt that the teaching of transferable skills in this course was mainly passive i.e. the development of transferable skills was not highlighted, *does it make a difference to the learning process if the skills component is highlighted?*. Asked if the teaching methods had been effective for developing transferable skills on the course, two said yes and three said no. *If three of the five students commented that the teaching techniques had not been effective, why was this course flagged up as developing transferable skills effectively?*

**Box 1.3: An example of unpublished evaluative data obtained from administering questionnaires**

### 1.1 TRANSEND Achievements

As the remit of the TRANSEND Project was to produce material which could be used by academic practitioners to further develop transferable skills within their students, much of the material was focused towards how to implement the practice. A number of sample pages from the handbook produced by the TRANSEND Project are shown as Appendix 1. An accompanying CD-ROM was also produced which users could use as a more explicit, practical guide.

The TRANSEND Project did not provide a critique of how and why students were developing transferable skills. All the evaluative data collected during the analysis stage of the TRANSEND Project were not published. It was not within the interests or the remit of the project to publish such material. Having been responsible for conducting the evaluation research, it was possible for me to develop an idea of examples of good practice which worked well in theory but did not transfer as well to practice. The TRANSEND Project did not provide an opportunity to critically discuss the teaching techniques used and describe how effective they were for the development of transferable skills amongst students.

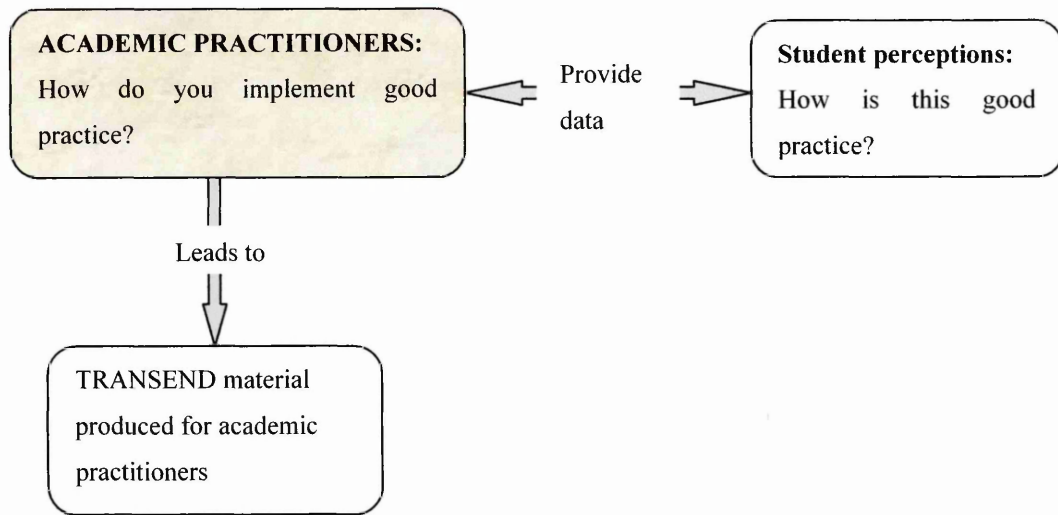
## **1.2 The Relationship between TRANSEND and this Research Project**

Whilst conducting the analysis stage of the TRANSEND Project, I became aware that the relationship between teaching transferable skills in higher education and student learning was not always transparent. It is as a result of these concerns that I wanted to develop a deeper appreciation of how students learnt transferable skills and, having understood the learning process better, whether I could identify a better way to teach such skills. The materials produced from the TRANSEND Project were to be used as teaching tools aimed specifically towards academic practitioners. Therefore the evaluative feedback I obtained from students during the analysis stage of TRANSEND was not used to develop academic practice; it was used to illustrate good academic practice without critically discussing the bad.

In conducting research for this thesis I collected entirely new data from another cohort of students at the same four institutions used throughout the TRANSEND Project. I asked different questions about the development of transferable skills than I had done

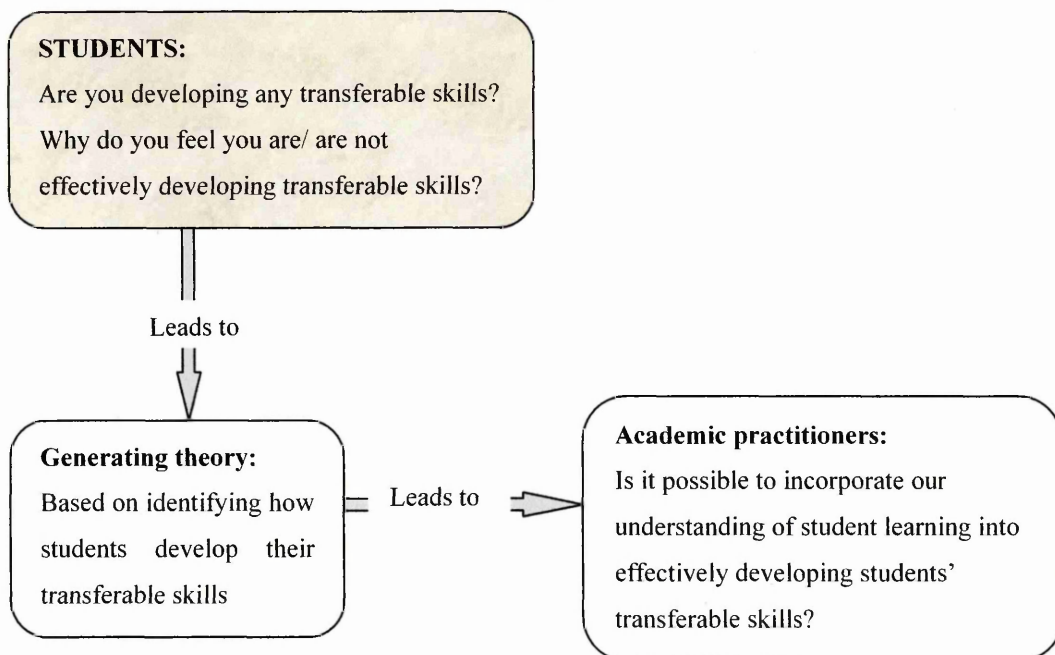
as TRANSEND Project Leader because my assumptions (particularly the effectiveness with which students developed their skills) had altered. In this work I have been a lot more critical in my assessment of skills education than I was in my role as TRANSEND Project Leader. The research conducted in this thesis is centred upon recognising the student perception of learning, and it is envisaged that student learning will inform academic practice through development of a theoretical model of learning which supports transferable-skills education. Figures 1.2 and 1.3 show schematic representations of the TRANSEND Project and this research project to illustrate how one has informed the other. The shaded boxes represent the more 'prominent parties' involved with the two projects. For the TRANSEND Project, this would be academic practitioners who were the main beneficiaries of TRANSEND Project findings. For this thesis, the emphasis is on the students who provide insight into their learning, especially of transferable skills. There is a considerable literature that describes the status quo with respect to transferable-skills teaching and learning frameworks in Higher Education.

**TRANSEND Project:**



**Figure 1.2: A diagrammatic representation of the relationship between academic practitioners and students in the TRANSEND Project**

**This PhD thesis:**



**Figure 1.3: A diagrammatic representation of the relationship between academic practitioners and students in this Research Project**

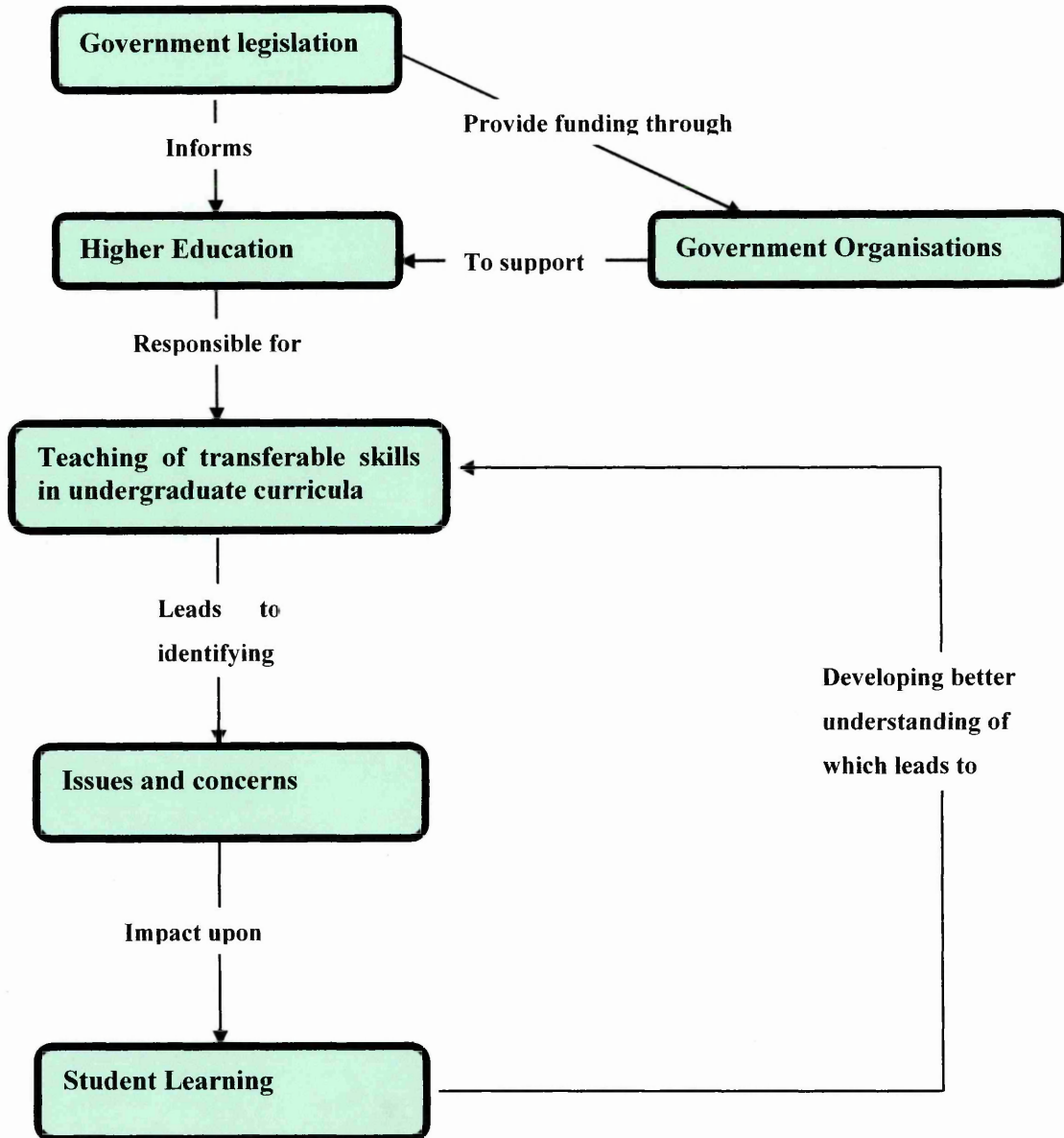


## **Chapter 2**

### **Skills and Learning**

Having identified a number of issues from evaluating TRANSEND Project data (c-f. Chapter 1), it is important to consider the current literature available on the transferable skills debate. In putting together the 'literature review' it was important for me to develop my argument and to create a structure that allows me to formulate my argument and helps the reader to follow it. Figure 2.1 serves as a diagrammatic representation of the relationships of the themes considered throughout this literature review. The story I wished to relate was one of increasing Government influence in Higher Education and the changes which are afoot as a direct consequence of the publication of a number of Government instigated white papers; (Dearing, 1997; DfES, 2003a). The white papers seem to have been produced following debate with a number of Government think-tanks and employer organisations. Consequently, emphasis is placed on what employers expect from their graduates and what the responsibilities of Higher Education are in terms of recognising and responding to these expectations.

## Structure of Literature Review



**Figure 2.1:** A diagrammatic representation of the major themes explored in this chapter

## 2.1 Defining Transferable Skills

One of the fundamental problems I found in writing about transferable skills was in defining what they are. There is currently a huge amount of skills-orientated literature, on such concepts as: key skills, study skills, work skills etc. it is therefore important to clarify terminology when considering transferable skills. Bennett, Dunne and Carré (2000) suggest that there are difficulties in defining [transferable] skills as a number of terms are used interchangeably; they also identified another problem:

This problem of terminology is now endemic, as indicated earlier, a situation that is exacerbated by the remarkably short shelf-life of many of these skills.

Bennett, Dunne and Carré, 2000, p.6

Terminology used in the Dearing Report (1997) highlights this concern. Throughout the report mixed vocabulary is used and there are no concrete definitions of the terminology commonly used with skills, for example, study, transferable and key skills. Drummond, Nixon and Wiltshire (1998) also recognise the variability of a number of terms symbolising a similar concept, although do not regard this concern as a significant issue. Mottershead and Suggitt (1996), though, felt it was important to provide a definition for transferable skills in the research they conducted. They defined transferable skills as those which are independent of the disciplinary context. Kemp and Seagraves (1995) agree with this definition of transferable skills being independent of discipline.

There also seems to be a desire, by researchers in this field, to elaborate upon the 'context' of transferable skills. Fallows and Steven (2000) define transferable skills as employment-related skills; the transfer is from an educational context to one that is more employment based. Similarly, Bennett (2002) defines transferable skills as those that are "needed in any job and which enable people to participate in a flexible and

adaptable workforce”. It can be argued that by addressing the merit of these skills within Higher Education, it would make a great deal of sense to consider them in terms of employment of undergraduates as this is one of the indicators by which institutions of Higher Education measure their success (Bennett, 2002).

Even though transferable skills can be defined in a number of ways, they are essentially job related, but not job specific, for example problem solving and project management. One of the most comprehensive definitions is that provided by the Department for Education and Skills (DfEE, 1997), which identifies transferable skills as:

Those cognitive and interpersonal skills (application of number, communication, information technology, problem solving, personal skills, working with others and improving own learning and performance) which are central to occupational competence in all sectors and at all levels

DfEE, 1997, p.17

The definition provided by the DfEE will be used henceforth, in this thesis, when referring to transferable skills.

### **2.1.1 The Changes Affecting Higher and Further Education**

In considering the position currently occupied by transferable skills in Higher Education, it is important to recognise the changes which have taken place to accelerate the skills agenda to the platform which they now occupy in academia (Bennett, Dunne and Carré, 2000). The Dearing report of 1997 had some very direct recommendations related to the provisions for skills development.

Institutions of higher education [should] begin immediately to develop, for each programme they offer a ‘programme specification’ which gives the intended outcomes of the programme in terms of:

The knowledge and understanding that a student will be expected to have on completion;

Key skills: communication, numeracy, the use of information technology and learning how to learn;

cognitive skills, such as an understanding of methodologies or ability in critical analysis;

subject specific skills, such as laboratory skills

UK NCIHE, (Dearing Commission), 1997, p.9

It is important to appreciate the impact of such a report.

The idea of developing non-technical skills is not a new one, it was suggested in an OECD Conference (1989), but the involvement of Government in influencing Higher Education to accommodate the changes seems more recent. Bennett (2002) suggests that

Academic and Governmental literature in the transferable personal skills has extended to the provision of advice to employers regarding the skills they *ought* to want from graduates.

Bennett, 2002, p.460

Bennett's view of responsibility for teaching skills is indicative of a shift in the powers of Government and he is not alone in taking this stance, (Fieldhouse, 1998; Mottershead and Suggit, 1996). Smith and Wilson (1992) have looked at the situation from a different perspective, suggesting that the efforts to enhance transferable-skills awareness is a joint collaboration between Government and employers. Arguments in support of this view are presented in a publication, 'Skills for Graduates in the 21<sup>st</sup> Century', (AGR, 1995) which suggests that there are many forces for change having a substantial impact on the environment in which people live and work. The publication suggests that market forces have driven current trends with respect to recognising and promoting the value of skills; Even though the publication is shown to promote the needs of employers it is still Government funded and seems, covertly, to promote Government aspirations.

Governmental influence seems significant, especially in light of the powers held by central office. There are some indications to suggest that the reports and white papers published by Government have been influenced by the needs of employers. A Report published by the DfEE (1997) stated that:

Studies of employer needs have repeatedly stressed the priority which they give to personal transferable skills. When they recruit graduates they are typically seeking individuals not only with specific skills and knowledge, but with the ability to be proactive, to see and respond to problems creatively and autonomously, and all the predicted trends in the world of employment suggest that these pressures will increase.

DfEE, 1997, p.5

The needs of employers are highlighted more succinctly in the Dearing Report (1997):

The new economic order will place an increasing premium knowledge which, in turn, makes national economies more dependent on Higher Education's development of people with high level skills, knowledge and understanding

UK National Committee of Inquiry into Higher Education  
(Dearing Commission, 1997)

It is the part of the statement which reads "Higher Education's development of people" which strikes me as particularly significant; there is an implication that learning is the sole responsibility of those who teach, as opposed to those who are taught. Government-produced publications imply the responsibility for the development of skills lies with Higher Education. Atlay and Harris (2000) neatly summarise this proposition by stating that the role of Higher Education in developing students is to consider:

...wider attributes and skills alongside their subject knowledge, and academic skills are being heavily promoted by Government and industry seeking to improve graduate employability.

Atlay and Harris, 2000, p.76

There is evidence to suggest that employers and Government organisations are actively assisting Higher Education in this quest. A press release from HEFCE indicates the level of support that institutions of Further and Higher Education are receiving from governmental bodies

The HEFCE has allocated £5 million in development funds and 2000 student places for the new courses. ... The foundation degree will equip students with the technical skills, academic knowledge and transferable skills that employers increasingly demand in a range of sectors.

HEFCE, Press release, 2000.

Further, supplementary evidence of activity in this area is available from the HEFCE website, denoting the number of bids, successful and otherwise, related to skills development in Higher Education.

### **2.1.2 Transferable Skills – the Responsibility of Higher Education**

By arguing that the responsibility for skills education lies within Higher Education, it is important to consider how far academics have acknowledged and addressed this responsibility, as academic practitioners would be responsible for the implementation of skills. Fallows and Steven (2000) agree with the notion that there is an increasing responsibility on the part of universities and colleges to provide their students with certain skills and abilities which are applicable outside the curriculum, i.e. which are not discipline specific. There are a number of issues involved with doing this as is suggested by Smith and Wilson (1992) who maintain that

Deliberate attempts to foster the development of personal transferable skills raise a number of problematic issues involved in education at all levels.

Smith and Wilson, 1992, p.205

There is much support for this statement and the general unpreparedness of academics in teaching transferable skills. One of the key issues seems to be related to the assessment of transferable skills. Whilst conducting a research survey on skills in geography, Haigh and Kilmartin (1999) concluded that:

Part of the problem is the constrained range of assessment options currently deemed acceptable ... there is a need to establish forms of assessment that target a wider range of personal transferable skills.

Haigh and Kilmartin, 1999, p.205

From the research presented by Haigh and Kilmartin (1999) it is unclear what the exact nature of the problem is— even though assessment of transferable skills is considered a genuine concern amongst the academic community (Kemp and Seagreves, 1995; Atlay and Harris, 2000)— there are discrepancies involved with recognising and responding to assessment criteria. The argument presented though poses an important question - is it possible to assess transferable skills?

### **2.1.3 Assessment and Transferable Skills**

One of the concerns identified by Smith and Wilson (1992) is related to ‘subjectivity’ in assessing transferable skills, and a lack of consistency which exists as a result. They argue for further clarity in the approach to assessment, but are mindful of associated pitfalls.

The danger is that there will be a move towards over elaborate prescription and assessment of skills at the cost of knowledge, understanding and personal development.

Smith and Wilson, 1992, p.206

The implication is that a balance needs to be maintained and considerable thought put into deciding assessment criteria. Mottershead and Suggitt (1996) recommend explicit assessment of the transferable skills element in courses so that students develop awareness of the relevance of what they are learning. It is argued, however that this form of assessment may be seen as subjective, and again the question is raised of how transferable-skills education can be appropriately accommodated within an assessment regime, (Haigh and Kilmartin, 1999). Judging by the number of issues raised on the subject this is not perceived as an easy question to answer. Atlay and Harris (2000) argue that the criterion of assessment of skills requires further clarity



and a more sophisticated approach, although they comment further upon this suggestion by adding that

In addition, there was a concern about whether any accurate grading of some skills, notably 'team-working', could be undertaken.

Atlay and Harris, 2000, p.79

The implication is that a balance needs to be achieved between assessment criteria and students developing personal meaning with respect to their skills set. Kemp and Seagraves (1995) support the view that most assessment criteria are patchy and not well thought through; their research suggests that academic practitioners feel incompetent at assessing skills. In response to this suggestion, it can be argued that students are better placed to assess their own development of transferable skills. Humphreys, Greenan and McIlveen, (1997) comment that academic practitioners' knowledge and abilities would not be significant as they may not have any explicit expertise in skills education and are also not best placed to judge students' personal development.

#### **2.1.4 The Academic Perspective**

A second issue concerning the development of transferable skills relates to encouraging lecturers (and the academic community in general) of their worth. Lecturers do not always seem 'enthused' by the idea of developing transferable skills in their students (Atlay and Harris, 2000), and there is concern that transferable skills disenfranchise discipline-based academics of their expertise by requiring them to move away from a teacher-centred approach based upon 'transfer of knowledge' (Bennett, Dunne and Carré, 2000). Fallows and Steven (2000) suggest that the more overriding opposition of the academic community is towards being handed instruction from central Government on what should be included in their curriculum. It is

appreciated that this issue of resistance to change can provide problems, especially if there is an element of enforcement associated with it, and de la Harpe and Radloff (2000) argue that such change requires commitment and strong leadership, not just on the part of the academic, but also on behalf of their department and institution. The implication is that both a top-down and bottom-up approach is required. The move seems to be towards encouraging institutional change, but this may raise a question about 'autonomy' and how much responsibility lies with the lecturer in actively promoting the skills agenda.

Some research, for example on the implementation of an institution-wide approach to teaching skills argues that entire programmes need to be restructured to accommodate the quality of transferable skills required (Kemp and Seagraves, 1995). This view is in stark contrast to that of Bridges (1993) who argues that attempts to address the provision of skills need be only subtle. Although this suggestion might make the skills debate seem easier to solve, it can be argued that without wider (departmental/institutional) support students may not appreciate the different contexts in which transferable skills are applied.

## **2.2 Constructivism – Setting the Scene**

Transferable skills need to be considered in terms of a form of learning that reflects both social and psychological characteristics (Bridges, 1993; Fieldhouse, 1998). These two perspectives lead to a consideration of constructivism, and the role it can play in attempting to explain or at least explore transferable-skills development—specifically at the four institutions previously referred to.

Constructivism is a theoretical paradigm of learning which stipulates that the learner constructs his or her own understanding of knowledge (Driver et al, 1983; Abdal-Haqq, 1998). Initially it is important to define the types of constructivist frameworks available, and to do so was one of my first challenges in writing this section. In a discussion on the principles of constructivism, Wadsworth (1971), views constructivist theory very much as a dichotomy of sociological and psychological traditions. There is more recent support for this view, (e.g. Abdal-Haqq, 1998) and there is also a huge amount of literature which negates this view. Giordan, Jacquemet and Golay (1999) suggest that the context in which constructivist frameworks are considered seem significant as models were produced within specialised fields – not transferable to the more generic community – and that trying to explain everything in a single theoretical framework seems nearly impossible. So of what are the theories representative, and how do they reflect the development of transferable skills? Geelan (1997) suggests that there are at least six forms of constructivism, these are shown in the table below, but even he appreciates that there may be others ‘bridging’ one or more forms.

<b>Form of Constructivism</b>	<b>Author</b>
Personal constructivism	Kelly (1955) and Piaget (1972)
Radical constructivism	Von Glaserfeld (1989, 1993)
Social constructivism	Solomon (1987)
Social constructionism	Gergen (1995)
Critical constructivism	Taylor (1994)
Contextual constructivism	Cobern (1993)

**Table 2.1: forms of constructivism and their instigators, adapted from Geelan (1997)**

The relevance of table number 2.1 is to demonstrate just how expansive the frameworks supporting constructivist theory have become.

Science education seems to have been at the forefront of constructivist studies (Driver et al, 1983, 1986; Taber, 1998), in which the notion of striving towards developing understanding rather than an objective reality is presented (Adbal-Haqq, 1998). He comments that there are levels of expert knowledge in science, but also answers which can be discovered. The same has not been said of transferable-skills education which is more developmental in nature (Humphreys, Greenan and McIlveen, 1997), not tempered by 'right or wrong'. It is therefore important to consider the role of the learner and the educator, and whether they are more interchangeable than might be initially contemplated. Watts and Zofili (1998) identify with this concern by stating that:

At the core, this is an issue of power: constructivism implies what might be called 'mixed authority' teaching. It is a question of the priority of educational agenda - whose is paramount: is it that of the learner or the teacher?

Watts and Zofili, 1998, p.175

Although I would agree with the sentiment related to mixed-authority teaching, literature suggests that for developing transferable skills, the learner would get precedence for the educational agenda as their development would be personalised (Humphreys, Greenan and McIlveen, 1997).

### **2.2.1 Identifying the Role of the Learner**

Tynjälä (1999) suggested that the differences between the many strands of constructivism are related to the role assumed by the learner. Constructivism is based around the belief that recognising the learner's role is pivotal to understanding the theory, but there may be a danger of it being misinterpreted as predominantly concerned with teaching. Abdal-Haqq (1998) argues that one of the biggest challenges faced in constructivism lies in translating the theory of learning into a theory of

teaching. He centralises the challenge as “raising questions about what teachers need to know and be able to do.” This is better articulated in his protestation that

30 different students may arrive at 30 different understandings on interpretations of a concept, all of which are not equally appropriate.

Abdal-Haqq, 1998, p.5

Watts and Zofili (1998) in considering critical constructivism make a case for querying the value and effectiveness of the teacher’s intervention, but this is based on an assumption that there is an intervention by a teacher. Similarly, Biggs (1996) and Driver (1983) consider the possibilities of constructivist frameworks within curriculum design, and what the impact of learning is upon the teacher. Biggs (1996), especially, considers the effect of teaching upon assessment, and the modification of assessment criteria to fit a constructivist model. Although this may serve the teacher well, he does not elaborate upon the impact it may have on the learner.

### **2.2.2 Other Concerns with Constructivism**

Giordan, Jacquemet and Golay (1999) suggest that constructivist models do not enable the learner to make connections between concepts and instead state the case for what they have entitled an “allosteric learning model”. Their model is not unlike the human constructivist model put forth by Mintzes, Wandersee and Novak, (1997) in that it also considers deriving personal meaning from general concepts and encourages the learner to form relationships between them. Wadsworth’s (1971) interpretation of psychological (Piagetian) constructivism seems to echo this idea of personal concept formulation

Prior knowledge is reconstructed in the face of socially provoked disequilibrium. Thus Piaget’s theory is one of individual invention and not transmission. The teacher’s role is seen as primarily to encourage, stimulate and support exploration and invention.

Wadsworth, 1971, p.165

It is the reference to invention which is particularly significant. Giordan, Jacquemet and Golay (1999) draw upon Piaget's contribution in their own work through reference to a "transformation of initial knowledge in relation to the new circumstances" supporting the notion of the learner assimilating and accommodating new concepts. Cohen (1983) however points out what could be a major flaw in Piaget's theory; that it resides on what children say they think rather than on what they do. The view presented is perhaps justified, especially if individual knowledge construction is considered. Quartz, (1999) fully supports the view taken, suggesting that characterising such change during development has proven to be an enduring challenge and I would agree that the notion of understanding becomes so embedded and so personalised that it cannot easily be shared with the outside world.

Sociological constructivism has also come under scrutiny by Hedegaard, (1996) who maintains that there is a gap between the theoretical knowledge the teacher is trying to get across and a more empirical, everyday one. Teachers must be able to explain theory in terms of practice. Again the desire to conceptualise and for the learner to make sense of the subject matter for themselves is apparent. Hedegaard is supported in her views by previous work carried out by Driver and Erickson (1983), on the significance of conceptual frameworks, who seem keen to stress how pre-existing models of constructivism are embedded within those frameworks, though Tynjälä (1999) cites Driver (amongst others) as someone who has integrated the two approaches rather than arguing in support of one or the other.

### 2.2.3 Considering Positivism

It is important, at this stage to explain the 'positivistic paradigm' and why it has been rejected in this thesis as a theoretical framework through which transferable skills development is being considered. Positivism is based on objectivity, on there being a known truth which exists, which can be discovered (Avis 2003). Greenwood and Levin, (2000) expand upon this definition,

Positivistically-based quantitative researchers employ the language of objectivity, distance, and control because they believe these are the keys to the conduct of real social science

Greenwood and Levin, 2000, p.92

The reference to quantitative researchers is particularly interesting as it further implies the measurable, absolute nature of a phenomenon.

There seems to be a lack of support in the current educational literature for positivist theories, although Jonassen (1994) questions what the role of the instructor can be if individuals are responsible for knowledge construction and argues that;

Objectivist [positivist] models of instruction are useful, as are constructivist models, albeit in different contexts

Jonassen, 1994, p.37

A very interesting debate also took place between Hammersley (1995) and Abraham (1996) on positivist conceptions and the prediction of observable phenomena which demonstrate instances of universal laws. The debate concerned itself with scientific phenomena in which views about positivist or constructivist thinking are considered more black or white (for example the question of creation). Prawat (1996) has presented the work of a number of individuals who have merged positivist and constructivist traits in considering what constitutes learning, neither one is viewed as a stand alone theory.

Mantzoukas (2004) argues that positivism “negates and eradicates possibilities of representing individuals, be they participants or researchers.” He further suggests that grounded theory remains “imbued with positivism, with its objectivist underpinnings.” Although I agree with the notion that grounded theory is concerned with the categories which emerge from data, the actual categories to have emerged from the data considered in this thesis are based upon the relevance of experience and personal perception and the generation of personal meaning, (c-f. section 4.1). Students are asked about what their transferable skills education means to them, not about what it represents in an objective, external reality in accordance with a “constructivist grounded theory”, in which meaning and not truth is sought, (Charmaz, 1995, 2000). Key issues have emerged from the background to this thesis, which have been informed by literature and which lead me to ‘develop’ my research questions.



## **Chapter 3**

### **Research Questions**

#### **3.1 The Research Questions**

Having considered the literature on skills development in Higher Education (c-f Chapter 2), and based on previous experiences, (described in Chapter 1), I have identified a number of issues associated with developing transferable skills, as a result of which I have ‘generated’ a number of questions for consideration within the context of this thesis. Creswell (1998) introduces the concept of research questions as stating the problem and sees it as the first opportunity to explicitly declare the problem. The main problem, as I see it, is that the academic community does not have enough awareness or expertise to be able to effectively develop the transferable skills of their students. The assumptions made about effective development are not always accurate (c-f Chapter 1). With an increasing emphasis placed on the Higher Education community to take responsibility for this development (c-f Chapter 2) this problem needs to be addressed and soon so that students are better prepared to utilise these skills upon entering employment.

The purpose of this thesis is to develop understanding of the processes involved in students developing their transferable skills, specifically within four university chemical engineering departments. By better understanding the way in which students learn, and focusing on the student perspective, I hope to generate theory to guide the effective development of transferable skills in Higher Education that may be beneficial to the academic community.

Therefore my central research question is:

- **What is the pattern through which undergraduate chemical engineering students in Higher Education effectively develop their transferable skills?**

Although, this question is a broad question, in addressing it I hope to be able to investigate both the processes involved in the development of transferable skills and the contexts in which this development occurs. In asking this question, it is also important to determine whether students can articulate the development of their skills, and whether their development is explicit enough for them to recognise its relevance. My central research question requires me to conduct an in-depth study, commonly associated with case study methodology. In addition to achieving understanding, I should be able to generate a model supporting the development of transferable skills, through a grounded theory approach.

Related to this central question are a number of issue-related sub questions (Creswell, 1998) which have the purpose of helping to clarify the concerns and perplexities of the central themes discussed in the literature review. Issue-related questions (as described by Creswell) I have considered, consist of the following:

Sub question 1:

- **What constitutes effective development of transferable skills amongst students?**

It is important not to form any pre-conceptions related to students' development of skills or the effectiveness of certain teaching techniques, learning environments etc. but to appreciate what students perceive as successful transfer and how they measure

this transfer. What makes the transfer effective in the minds of the students and how can student responses be gauged, free from assumptions about effective teaching (and researcher bias is possible)?

Sub question 2:

- **What are the underlying factors that account for student perceptions?**

There may be a number of factors which influence students in their development of transferable skills, which are not a direct part of the teaching-learning process, for example, motivation for developing skills and assessment criteria. It is important to recognise the impact which these factors have on student learning.

Sub question 3:

- **To what extent does a constructivist learning theory enable me to understand the process through which students develop transferable skills?**

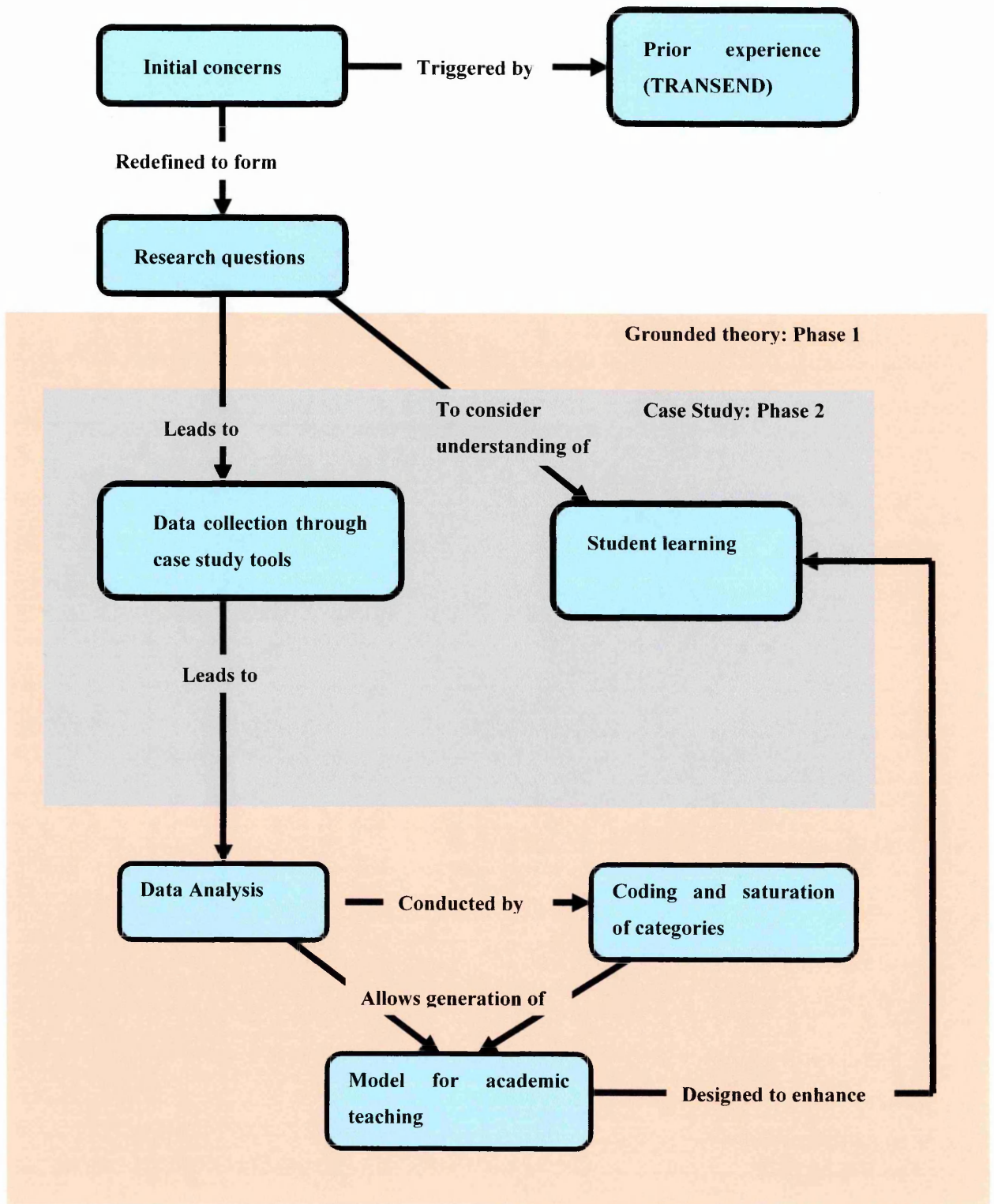
It is important to consider whether an alternative framework can be generated to support students in developing their transferable skills and how well such frameworks can be used to achieve this.

## Chapter 4

### Research Methodology

In this chapter careful consideration has been given to the most appropriate methods for answering the research questions posed (c-f Chapter 3). Figure 4.1 provides a diagrammatic summary of the research methods which have been applied in this thesis.

A grounded theory approach has been adapted as this reflects the theory-generating approach that has developed from my identified concerns (c-f Chapters 1 and 2), so that I can propose a suitable teaching framework in which skills can be developed. Grounded theory has been merged with a case study approach. The reason for this is that there are two phases to this PhD research. In addition to gaining a deeper insight of the patterns through which students develop transferable skills, I also wish to use that understanding to facilitate the teaching process. I have therefore merged methods to enable me to fulfil my research aims. These methods are mutually compatible because one enables deeper understanding of a phenomenon and the other enables that deeper understanding to be used to generate theory. Figure 4.1, indicates that data is collected using a case study methodology and analysed using grounded theory. There is currently little literature available on using particular social science methods, and relating them to other methods used in social science; it may be seen as a novel choice for use in my research. The following sections in this chapter explain how this approach has been developed within this thesis.



**Figure 4.1: A diagrammatic representation of the relationships between research strategies used in this thesis**

## 4.1 An Introduction to Grounded Theory

Grounded theory was first put forward by Glaser and Strauss in 1967 as a method supporting the emergence of data in formulating a new theory. The stance of the two co-origins was that generation of theory is considered more appropriate for social sciences than starting from a hypothesis, with a logico-deductive theory. They claimed that

We have taken the position that the adequacy of a theory for sociology today cannot be divorced from the process by which it is generated. Thus one canon for judging the usefulness of a theory is how it was generated.

Glaser and Strauss, 1967, p.129

The argument enables would-be researchers to explore further variables and relationships within the field of research, the research is not limited to a question of “does it work”? Since it was first published in 1967, the views of Glaser and Strauss have diverged along two dimensions; what is meant by grounded theory and its application. Glaser (1992) emphasises the emergence of data as opposed to it being forced and that data are used to formulate new theories, not fit pre-existing ones. Robrecht (1995) states that the notable diversifications between Glaser and Strauss have,

Encourage[ed] the production of grounded theory with poorly integrated theoretical explanations resulting from violations of the original premises of the grounded theory method

Robrecht, 1995, p.171

Her comment demonstrates that there are grey areas in grounded theory, which have resulted in debates on its application. Melia (1996) devoted a ten-page discursive paper on the differences of approach and opinion between Glaser and Strauss with respect to grounded theory concluding that the differences were present from the outset, but only seem to have been detected much later than the publication of “The

Discovery of Grounded Theory.” I appreciate this may well be the case and Glaser (1992) himself suggests implicit differences existed. I feel I am therefore justified in adapting the theory, if I follow the overlying principle of “emergence”.

#### **4.1.1 The Relationship between this Work and Grounded Theory**

One of the criteria for developing grounded theory is that it is based on an ‘identified concern’, (c-f Chapter 1). It is only later that I have formulated specific research questions, to guide the analysis of these concerns. The researcher enters the field of study and a problem or concern is brought to their attention.

Of course, he does not know the relevancy of these concepts to his problem – this problem must emerge – nor are they likely to become part of the core explanatory categories of his theory

Glaser and Strauss, 1967, p.210

The four institutions involved with the TRANSEND Project were regarded by HEFCE as generally demonstrating areas of good practice in developing undergraduate transferable skills, (they had successfully bid for the grant), (c-f Chapter 1). However, discrepancies existed between the programmes and quality of learning of students’ transferable skills which have resulted in the work cumulating in this thesis. Even though I formulated research questions (c-f. Chapter 3) they were done so to enable the investigation of a concern. It can be argued that one should remain “anthropologically strange” to the field of study, (Garfinkel, 1967), for example by not having any previous knowledge or preconceptions, although I question the plausibility of the suggestion and whether I would have recognised issues worthy of investigation if this had been the case.

A second commonality between grounded theory and the work carried out in this thesis is the use of theoretical sensitivity. Theoretical sensitivity is concerned with the

knowledge and understanding which the researcher has of the field of inquiry and brings to the research, (Glaser, 1992). Theoretical sensitivity plays a pivotal role in constructing this thesis as I both graduated as a chemical engineer from one of the four institutions involved with this research project and also played an instrumental role in the TRANSEND Project. Glaser (1992) suggests a need for caution with respect to the use of theoretical sensitivity by commenting that:

The requisite conceptual skills for doing grounded theory are to absorb the data as data, to be able to step back or distance oneself from it, and then to abstractly conceptualise the data

Glaser, 1992, p.11

However, Glaser suggests that if the researcher does not have theoretical sensitivity, (s)he will not end up with grounded theory. This begs the question: how involved should one be with the field of research to be able to generate an adequate grounded theory? It can be argued that theoretical sensitivity is instrumental in defining categories and understanding their significance but that objectivity is required in maintaining a professional distance from the data.

Another aspect which Glaser and Strauss (1967) have highlighted as causing occasional problems is related to how much data one is expected to consider in generating grounded theory. They argue that since no proof is required in generating theory, not all available data need be considered. The only requirement is for saturation of data, i.e. those categories in which most data is accommodated, during analysis of data are used as a basis upon which to generate theory. Theory is formulated through saturation of categories, as opposed to infrequent responses for some categories. In separate studies carried out on illuminative evaluation, Parlett and Dearden (1977) agree with this sentiment and also state that:



Behind such questions lies a basic but erroneous assumption: that forms of research exist which are immune to prejudice, experimenter bias, and human error. This is not so. Any research study requires skilled human judgements and is thus vulnerable.

Parlett and Dearden, 1977, p.21

It may be difficult to disagree with this statement; just because data is gathered within a social science as opposed to a purely scientific context, does not mean interpretation of data is not exposed to some degree of subjectivity. More importantly though, the methods and principles of grounded theory are related to making suggestions about generation of theory, not testing previously formulated theories.

When using a grounded theory approach, an important criterion to consider is theoretical sampling (Taber, 2000; Conrad, 1978; Glaser, 1992), establishing new avenues of data collection as data is analysed and becomes known. As Taber (2000) comments

The researcher's 'theoretical sensitivity' during the analysis of data leads to hunches that suggest the next stage of data collection

Taber, 2000, p.471

The criterion has only partly been fulfilled in this research project as a result of attempting to balance further understanding with retaining the consistency required of case study methodology. A number of institutions were involved with this research project and it was important to retain a structured and consistent line of questioning to retain credibility in the eyes of colleagues. Students were required to elaborate upon their perceptions of transferable skills education, but in an attempt to retain credibility of the research, the questions asked of students did not differ.

#### **4.1.2 How is grounded theory evolving?**

Reference should be made to Chapter 5 which shows how grounded theory has been applied to the emergence, categorisation and coding of data within this research project. It should be appreciated that grounded theory is not a prescriptive method and the theory has been adapted to accommodate a number of other considerations. Glaser and Strauss (1967) did however depict the four stages of a constant comparative method: 1) comparing incidents applicable to each category, 2) integrating categories and their properties, 3) delimiting the theory, 4) writing the theory which is as prescriptive as they chose to be. Turner (1981) summarised the stages of grounded theory through construction of a suitable framework. The stages can be applied to this thesis and aptly demonstrate how grounded theory has been applied.

Stage	Notes	Examples in the thesis
Develop categories	Data was transcribed and viewed to develop categories (and sub categories) which accounted for all the data.	Ref. to table 5.2
Saturate categories	Categories were applied to all the data.	For example, Box 5.1
Abstract definitions	Instances were compared in which categories were applied to data based on similar tools.	For example, figures 5.1-3 and A1-6
Use definitions	Significant patterns began to emerge of learning or learning approaches.	Chapter 5 which shows both samples of data and data analysis.
Exploit categories fully	Additional categories could have been developed, although those developed are comprehensive and enable me to answer my research questions.	For example tables 5.2.1-3 which denote the categories for mind maps.
Links between categories	Developing awareness of what the data meant in terms of student learning.	Chapter 6
Conditions of links	Queries raised about whether the findings are related to teaching strategies, learning levels, assessment etc at this stage.	Ref to section 6.2
Connections to theory	Potentially related to constructivist learning theory	Ref. to section 6.3 and chapter 2
Comparisons of extremes	Develop testable theory that supports learning transferable skills.	Is seen as future work, alluded to in Chapter 6.

**Table 4.1: table showing stages of grounded theory in this thesis, adapted from Turner (1981)**

Glaser and Strauss (1967) went to great lengths to point out the differences between verifying and generating theory and that verification should only be part of a theory if it enhances the generation of it (usually through comparative analysis). In this thesis, my main consideration is the generation of theory, but there is a slight overlap with verification in ascertaining whether there is “any connection to theory”, as Turner (1981) phrases it. A constructivist learning theory (c-f Chapter 2) is considered in this

thesis as a fruitful paradigm for developing transferable skills; grounded theory is a method concerned with generating a theory based on the emergence of data. A query is therefore raised at this point, how can both grounded theory and case study methodology be accommodated in this work? As has been seen earlier, there are different interpretations made of grounded theory and of constructivism and its application, it can therefore be adapted to suit this work. The grounded theory, which I formulate from considering the emergence of data, may also indicate that students learn skills in accordance to constructivist learning theories.

#### **4.2 To Qualify or to Quantify?**

To answer the research questions, an appropriate methodology is required. Further clarification on which type of data to collect can be sought by considering the following question: “what type of data is demanded to answer the research questions?” An important consideration is whether purely qualitative, purely quantitative or mixed research methods fulfil the research criteria. McBride and Schostake (1996) argue that

Where a quantitative researcher might seek to know what percentage of people do one thing or another, the qualitative researcher pays much greater attention to individual cases and the human understandings that feature in those cases.

McBride and Schostake, 1996, p.11

The thought of quantitative researchers working in percentages is an interesting one. If the numbers game were to be played, it could be argued that quantitative research was more precise, more measurable, but in determining individual or group understandings it is not always possible to be so numerical in describing a potentially complex situation, (Denscombe, 1998). I must also consider the potential audience and how they may conceivably work from the data to make sense of it and use it for

their own understanding i.e. achieving credibility. Mason, (1996) for one, feels that it is reasonable to apply a mixed method approach:

I do not think research practice has to involve stark either or choices between qualitative and quantitative methodology. Partly this is because neither quantitative nor qualitative methodologies are the unified bodies of philosophy, method and techniques which they are sometimes seen to be.

Mason, 1996, p.144

There is no reason why both qualitative and quantitative methods of data collection cannot be used simultaneously, even though the leaning (of the researcher) might be towards one or the other, depending on what the purpose of the data is assumed to be.

Creswell (1998) describes 3 models of combined design: a 2-phase design, a mixed-methodology design and a dominant - less dominant design which all support the use of both qualitative and quantitative data collection to varying degrees. The model supports the approach I would have liked to take in collecting my data. (Even though purists may argue that methods cannot be mixed, literature implies support for the application of mixed methods). For this thesis, the emphasis is greater upon qualitative data than quantitative because I am less interested in determining numbers and associated frequency than I am in determining the perceptions students have of their learning. Marshall and Rossman (1995) further argue this point by suggesting that a single question, "do the data help confirm the general findings and lead to the implications?" is sufficient in leading the researcher to consider a particular approach for the collection and analysis of data.

### **4.3 The Suitability of Case Studies**

Having decided upon the type of data I need to address the research questions (c-f Chapter 3), a decision needed to be made about a suitable strategy of data collection.

Case study is considered a viable option as it enables me to study student learning in great detail and focus the research (Denscombe, 1998; Gray, 2004). One of the preliminary problems surrounding case study, however is in its definition. Burton (1996) states that

Despite their popularity there is not a unanimous view across the social sciences about what constitutes a case study... For some researchers case study research includes a single case otherwise the research is regarded as comparative and not case study research.

Burton, 1996, p.79

It is important to clarify how case study is being defined in this thesis, to avoid any confusion surrounding the central focus is of this research. Bassey (1999) suggests that

'What is a case study?' is a good example of a question easy to ask and difficult to answer

Bassey, 1999, p.22

To get around this difficulty, Bassey has presented the views of other researchers in the field without drawing attention to his own view. Stake (2000) has been braver and professes a case as being the specific one, the implication being that it is this specificity which makes a case, a case. Even Stake (2000), though, admits very little agreement between his definition of case study and that of other distinguished researchers. He has attempted to seek explanation for this discrepancy by commenting that,

Seen from different worldviews and in different situations, the same case *is* different. And however we originally define the case, the working definition changes as we study.

Stake, 2000, p.436

With such difference of opinion, I have come to the conclusion that I must decide for myself what constitutes **case** and what constitutes **case study** within this thesis. De Vaus (2001) agrees with Stake about the case being “the one, the object of study”, following on from this I have defined my case as the development of transferable skills in Higher Education. The ‘object’ has been purposefully selected as a particular phenomenon as opposed to an event, group or organisation as this actively focuses my study, from which it is possible to investigate specific events, relationships, experiences or processes related to the phenomenon (Denscombe, 1998). There are however four units of analysis through which the case is being studied. These provide some replication and are theoretically comparable with one another as examples are taken from four chemical engineering departments with students of similar abilities, and backgrounds who are being asked similar questions about their education.

Walker (1983) highlights some common problems related with his own attempts at using case study, namely that subjects tailor their views to suit the researcher and tell them what they believe they want to hear. Stenhouse (1980) agrees with this view stating that

We have as yet a long way to go in developing parallel critical techniques to discount the biases and distortions which may arise from an observer’s attachment.

Stenhouse, 1980, p. 56

Denscombe (1998) is much more philosophical about this concern, recognising it as very hard to not be prone to the observer effect. To an extent, this is a more acceptable problem to have to deal with – it supports the enhancement of theoretical sensitivity (c-f Section 4.1) enabling identification of the problem and understanding of the data which is an important criterion for this research project.

Another identified concern, worth highlighting is Walker's (1983) reflective comment on "embalming" in which he argues that:

Once fixed, the case study changes little, but the situation and the people caught in it have moved even before the image is available

Walker, 1983, p.163

His argument is supported by De Vaus (2001) who also refers to case studies as within a "time dimension". The implication which arises is that data gathered and findings presented would be different if the study was repeated five years hence. I agree with the suggestion, but would question how much students' values and their attitudes to learning alter (given a similar group undergoing similar experiences); I have made the assumption that they would not alter greatly, based on the research which was conducted on behalf of the TRANSEND Project and for this thesis (two years apart).

#### **4.3.1 Generalising from Cases**

Yin (1981) points out some of other failings of case study, mainly that there is a lack of rigour and little basis for scientific generalisation. It is the reference to generalisation which is particularly significant and Yin is not alone in finding generalisability problematic, (Mason, 1996; Denscombe, 1998). If one of the fundamental characteristics of case study is its particularity (or specificity) it could be argued that it would not be possible to generalise. Denscombe's stance on generalisation is an interesting one:

Although each case is in some respects unique, it is also a single example of a broader class of things

Denscombe, 1998, p.36



Stake (2000) supports the sentiment that there are no typical examples which lead to one case study being considered a norm and representative of the phenomena the study was investigating. Bassey, (2000) attempts to deal with the issue of generalising by re-interpreting it as “fuzzy generalisation” suggesting that there is a possibility that something will occur a certain way because it previously did so. In this thesis, generalisations have been made which have led to generation of a teaching framework which actively supports students’ development of transferable skills, (c-f Section 6.5). I feel I have been able to create a fuzzy generalisation from my research findings as four units of analysis were used to investigate the case, which provides an extensive and detailed picture of transferable skills development in chemical engineering in the UK. The manner in which I have defined ‘case’, specifically within this thesis also implies a broadness of investigation rather than specificity. I have also made an assumption that my research groups are comparable as are the teaching-learning frameworks. An interesting argument presented by Arkey and Knight, (1999) is that;

Problems come when researchers try to make generalisations that go beyond what the research design can support.

Arkey and Knight, 1999, p.59

I felt that this was not the situation in this thesis and that my generalisations are adequately supported by my research design.

#### **4.4 Reliability**

Achieving reliability depends heavily on the tools used to conduct the research in question. Silverman (2001) in his definition of reliability proposes it to be the degree of consistency, but points out that research does not have to be valid to be reliable. The researcher is faced with having to answer a number of different questions as a result of trying to attain reliability (Miles and Huberman, 1994) and the concern of

establishing a degree of consistency (Mason, 2000) becomes an over-riding theme. Arskey and Knight, (1999) are in support of these views; that consistency is akin to reliability. They further comment that;

Findings would be unreliable if it turned out that some questions were explained to some respondents who were puzzled by them, but not to other puzzled respondents.  
Arskey and Knight, 1999, p.53

Admittedly this consistency is more difficult to establish for qualitative than for quantitative data as there is no numerical evidence or error bars to indicate how the methods and associated research practice can be depended upon. Silverman (2000) presents a further argument suggesting that the problem occurs in not being able to produce reliable measures of social life. I agree with this idea of social science being in a state of constant flux and agree that reliability should not mean replication which is difficult to achieve but consistency and rigour with applying the appropriate tools of the research method. The stance taken by Askey and Knight suggests that close attention should be paid in determining the degree of consistency concerning data collection. Indeed critiques have been provided of all the data collection tools that were applied throughout this research project.

In addition to considering the research tools, it is important to address whether the manner in which students were selected for the study was consistent so that those selected were representative of the variety and difference of opinion in the group, and able to provide honest, personal accounts. Concerted efforts were made to ensure that this was the case. Course providers were consulted prior to the research to nominate students who could represent the class, although by doing this there was an accepted danger of course providers selecting those students who spoke well of their courses or

who they were friendly towards. The selection was carried out on a basis of good faith and with the rationale that the course provider was better placed to understand how the class was made up and how best to select a varied group who would contribute openly and honestly in the data collection process.

Establishing a degree of consistency goes further than merely data collection and should be considered with respect to data analysis also, (Patton, 2002). Miles and Huberman, (1994) relate the importance of coding checks which illustrate adequate agreement. There is a transparency attached to my data as a substantial amount of it (with associated analysis) has been presented in Chapter 5 from which it can be seen that reliability (consistency) of data analysis (through categorisation and coding) has been achieved. On being handed parts of transcripts and associated codes, a couple of colleagues were also invited to determine whether their analysis and subsequent interpretation of findings matched mine. There was little difference between the analysis conducted by my colleagues and that conducted by myself from the samples used.

#### **4.4.1 Questionnaires**

I used questionnaires as part of my data gathering strategy, as I felt they provided an opportunity for students to put their perceptions down on paper exactly as they chose to articulate them. It is suggested that by allowing students to use their own words, there is minimal danger of misrepresentation, (McNamara, 1997). The questionnaire provided a very general understanding of students' perceptions of the course. I chose not to design a lengthy questionnaire, as this would have taken more time for students to complete, the end result is that short questionnaires of six questions are perhaps not

sufficient for understanding students' backgrounds, experiences and aspirations. The questionnaire used for the pilot study was adapted from those used in the TRANSEND Project, as I felt they provided an appropriate initial framework and build on the link between my initial concerns (c-f Chapter 1) and my emerging research questions (c-f Chapter 3). Sudman and Bradburn, (1982), also support the adaptation of pre-existing questions for questionnaire design, arguing that it is a necessity. The questions were piloted once on a number of postgraduate colleagues, Box 4.1 shows the first prototype questionnaire that was piloted. I appreciate that my colleagues may have demonstrated a better understanding of this research than undergraduate students who made up the actual research group. For this reason they were perhaps not an ideal choice to have acted as a pilot study. However my choice concurs with the recommendation of Gray (2004) who suggests that pilot studies should be conducted by individuals who are not part of the target group. Box 4.1 contains a list of the questions which made up the pilot questionnaire; the text highlighted in yellow indicates parts of the question which I have regarded as significant and the prose in purple italics provides my own critique of the questions.

#### Draft questions for Questionnaire

Age

Gender

Country of origin

*Information gained here, although useful may be considered too personal. Is it right to include such variables in the study?*

Did you undertake any transferable skills activities during the course?

*This question would imply a yes or no response, but would require students to have understood what is meant by (or my interpretation of) transferable skills activities.*

How would you rate your level of transferable skills attainment?

Excellent/ good/ average/ unsatisfactory

*This 'closed question' means that the responses can be easily analysed, but a tremendous assumption is made that students did develop transferable skills (however unsatisfactorily). There is no 'not applicable' in the question. The meaning of 'transferable skills attainment' is not made clear.*

What transferable skills activities did you undertake during the course?

*Again the implication is that students did develop skills, there is nowhere for students to suggest that they were involved with no transferable skills activities?*

Do you think that there was a structured programme with respect to skills development throughout the course?

*This question is rather ambiguous, is the meaning actually course or undergraduate study and if so can level one students answer such a question?*

If so, how do you think this came about? What was the structure?

*This question is essentially 2 questions, which would require 2 separate responses.*

Do you think that your social background/ gender/ age has any bearing on your need for and/ or ability to develop transferable skills?

*This question would not be needed in this questionnaire as the research was not directed towards looking at how 'group make-up' affected development of transferable skills. Again, it is a number of questions rolled into one.*

If so, how?

*This question can only be answered if students said yes to the question above. It would be difficult to answer anyway as students are being asked to analyse their development, which is something the questioner should be doing from responses.*

#### **Box 4.1: A critique of the pilot questionnaire questions**

More general concerns with the draft questionnaire are related to the ordering of the questions, which is a priority in constructing good questionnaires (Sudman and Bradburn, 1982). A question about attainment has been asked prior to one about what activities students were involved with, the problem being that students may have not been given sufficient opportunity to reflect upon the activities undertaken prior to being asked how well they undertake them. The questionnaire, which was finally

administered to students, is shown in Box 4.2. The questionnaire has also been critiques in the same way as that which appears in Box 4.1.

### Questionnaire questions

What do you think the aims and objectives are of this course/ module in terms of developing transferable skills?

*Assumption is made that students understand the difference between aims and objectives. There is also a suggestion that students are aware of developing skills in this course.*

What do you think you will learn with respect to transferable skills during this programme?

*This question should have been presented before the one above and it would have been less presumptuous to ask students if they thought they would learn any skills at all. In the question above, the reference is to module/ course whereas for this question it is to programme. It is not clear whether these terms are interchangeable or represent different ideas.*

How do you think this learning will occur?

*Students seem to be expected to speculate upon their learning even though they are currently completing the course. Students may also not be conscious of the differences between learning and teaching. Also, is the question about approach or process, or both?*

How will you judge your success in having developed certain skills at the end of this course?

*It is not made clear what these 'certain skills' are, are they transferable or technical. Also, what represents 'success' for the students.*

Do you think that this course contributes to the learning of transferable skills throughout the undergraduate teaching curriculum or your experience of it to date?

*It would be easy to misinterpret this question as it presents an either/ or scenario which is not the intention.*

If so, how does it fit within the undergraduate teaching curriculum or your experience of it to date?

*This question actually relates to the analysis that I should be carrying out. The question asks too much from the student in both interpreting its meaning and responding to it.*

**Box 4.2: A critique of the questionnaire questions used in collecting data for this thesis**

Although the final version of the questionnaire was less personal than the piloted one and there was a more coherent order in which the questions were posed, there is still an assumption that students develop transferable skills and are aware of this development. In hindsight, I feel that the last question which makes up the questionnaire proved particularly difficult for students to answer. It caused confusion amongst students resulting in most of them not responding to it. The problem is not an uncommon one (Drennan, 2002), but nevertheless, one which could have been avoided. However, many informative, descriptive data were produced from administering the questionnaire.

One of the concerns I had was in timetabling the questionnaire/interview sessions. Students were either returning from, or going to lectures and there was always difficulty in persuading them to attend the sessions. As I began administering the questionnaires, I became aware of the problems that students may have encountered in interpreting and answering some questions, but it was important to administer the same questionnaire to all students and therefore the questionnaire remained unchanged, as suggested by Gorard, (1996). A small number of students also elected to complete the questionnaires 'in their own time' which proved problematic as they were required to re-visit their learning at another time and I could not gauge spontaneous responses from them. Gray (2004) also readily identifies with this concern.

#### **4.4.2 Mind (concept) Maps**

The usefulness of a concept/mind map seems to depend upon how it is used. For example, in a study conducted by Slotte and Lonka (1999) on understanding scientific

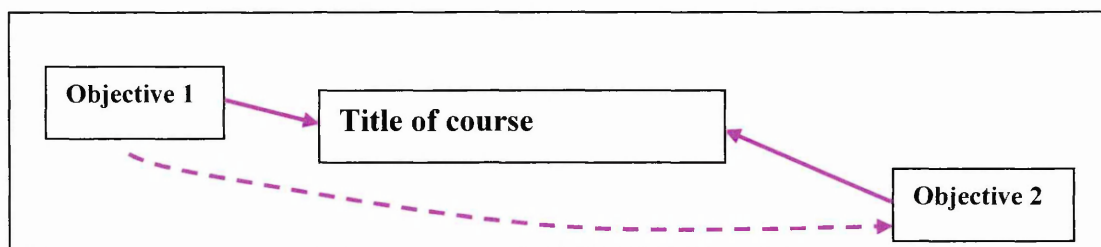
concepts through mapping, it was concluded that mapping can lead not only to both quantitative and qualitative increases in the learner's knowledge, but can also lead to misconceptions. The concept maps I asked students to complete however were designed to enhance my understanding of students' learning; nothing was construed as a misconception. Kinchin, Hay and Adams (2000) support my position claiming that the 'invalid links' in a student's map reveal much about the thought processes that lead a student along a particular path of understanding. In reality there are therefore no invalid links. I used mind maps to gain some understanding of how students viewed the relationships between the learning outcomes of the course, which is similar to the manner in which they had been applied by Turns, Atman and Adams, (2000). I wanted to ascertain whether students saw links between the outcomes and whether they could elaborate upon them. I wanted to design something which students could use to demonstrate the individual approach they took to their course/learning. I also wanted to give them free range to think about the course without the implicit suggestion that it had anything to do with the development of transferable skills (by presenting something innovative and challenging).

Students were given mind maps to demonstrate whether they perceived links between the course objectives and what those links were; the amount of direction provided in completing this task was kept to a minimum. There was also an element of spontaneity about the mapping exercise because students were unprepared and were handed maps once the session began. According to Slotte and Lonka (1999) spontaneous completion of maps results in students forming fewer links between concepts, but I feel that this comment is unjustified for the context in which I used the maps. Mainly because, as I have stated earlier, the exercise was about personal



reflection and I feel that this was made clear to students. As an educational technique concept mapping has been used fairly often in engineering, providing a basis for reflection and integration of new knowledge with previous knowledge (Vega-Riveros, Plarciales-Vivas and Martínez-Melo, 1998).

The mind maps could have been designed to provide more information than they did. Had students been presented with nothing more than a blank sheet of paper, they would have had to construct their own frameworks demonstrating how they learnt. I was concerned that given such freedom students would not focus sufficiently on the task and there would be no common thread between the completed mind maps providing little basis for comparison. Another design concern was the layout of the map, which is diagrammatically represented in figure 4.2. The title of the course was placed in the middle of the map whilst course objectives were placed around this title. A few students found it easier to associate the objectives to the course title (as for the solid arrows) than to one another (as for the dashed arrow).



**Figure 4.2: A representation of how mind maps were presented to students**

Regarding administration of the mind map, a problem arose in getting the information from course providers about the objectives of the courses. Data obtained from the mind maps were difficult to analyse and also time consuming as each map had to be viewed and studied separately to determine what the picture suggested. I initially

viewed the map as a whole, whether students had related the learning outcomes with one another or not. Turns, Atman and Adams, (2000) refer to the analysis stage in terms of appropriateness of links, but as my criterion for making informed judgements about the maps was not based on what was appropriate, I considered them without evaluating them. I then viewed the maps in terms of terminology students had used for which it was important to be consistent, (Freeman and Jessup, 2004). Mind mapping is also often seen as a study tool, in this particular context it was used to find out more information about something.

#### **4.4.3 Interviews and Focus Groups**

I selected interviews as a case-study tool as they provided immediate responses to questions. Students were not given time to prepare answers and were required to be spontaneous as opposed to reflective with their responses. With the interviews, students were required to elaborate further on what they had indicated on their mind maps. Interviews were semi-structured so that student responses were undirected and unstructured. There was also opportunity for me to become more aware of personal information and feelings. Michell (1999), from her experiences on running focus groups about bullying, points out how interviews, rather than focus groups, enabled in-depth exploration of the experience of victimisation. With respect to the design of the interview sessions, they hinged upon one comment:

##### **“Elaborate upon your mind map”**

The form of questioning selected meant that students were able to say as much or as little as they wished to. However, it became redundant if students commented that ‘everything is on the mind map and I have nothing further to say’. Even though this did occur, it was very rare. It could also be argued that an opportunity was missed to

ask more detailed individual questions of students, but I wanted to understand students' approaches to the course and have them say to me 'I am fulfilling the learning outcomes in this manner and there is/is not an implication of skills development in my learning strategy.' I also wanted the approach I took for interviewing to be consistent, which required me asking the same questions in the same manner.

Focus groups of five or six were used to provide spontaneous group responses which could highlight students' attitudes towards skills development. The session encouraged students to move the conversation in different directions, introducing a number of key issues which were not raised otherwise. The focus group questions presented to students were more structured, but not directed. Fontana and Frey (2000) argue that the role of the interviewer is to be directive, so that the participants do not deviate from the proceedings, but I found this to be too restrictive. It would also not have exposed me to different perspectives from which I could generate a grounded theory. I also ran as many focus groups as I could organise in the time allocated.

Webb and Kevern (2001) argue that:

If several focus groups are conducted in a similar way and then the *transcripts* are subjected to a grounded theory type of analysis, this does not fulfil the criteria for grounded theory.

Webb and Kevern, 2001, p.802

In the above comment, the criteria mentioned refer to those associated with theoretical sampling in grounded theory methodology. Although I agree with this comment which draws attention to a very correct procedure for generating grounded theory, categories continued to emerge from the data as transcripts were analysed. It was not possible to have saturated the categories until all the focus groups had been run. One

of the greatest advantages of using focus groups as opposed to interviews was that I could witness how individuals interacted with one another and how conversation could flow from a single question. Kitzinger (1994) has done much work on running focus groups in nursing, and comments upon this participant interaction as the most important feature of a focus group. Research suggests however that the recognition of participant interaction is rarely reported upon or recognised (Webb and Kevern, 2000; Webb, 2002). I was fortunate enough to run a number of focus groups during which students, actively debated issues amongst themselves and shared their experiences willingly as was the case for Michell, (1999). The focus group questions were piloted as for the questionnaires. A critique of the piloted focus group questions are presented in Box 4.3.

## Pilot focus group questions

Was there a natural progression in transferable skills development throughout the course?

*Difficult to answer if students have just started the course; and again there is an implicit suggestion that students did develop transferable skills. This question also does not prompt a discussion as it can be answered by a yes or no.*

How can you outline this progression?

*This question assumes that students have answered yes to the preceding question and are able to appreciate the course structure in terms of developing skills.*

Did your learning build upon concepts previously defined, or were the concepts introduced as new material?

*This question is too directed. Again the implication is that students could answer yes or no without prompting much of a discussion. Also it is not made clear what the learning is in reference to.*

Was this demonstrable, and if so how?

*The question is implicitly asking students for an analysis of the teaching and how they have responded to it. The researcher conducting the investigation should carry out such analysis.*

Was your learning influenced by any other factors, for example the learning environment, peer group, lecturer responsible?

*By starting the question with a "was", students could again just say yes or no without moving the discussion any further.*

If so, what was this influence? How did it affect your learning?

*Two questions rolled into one. The questions can only be considered if students recognise an influence—, which is not easy to do.*

### **Box 4.3: A critique of the pilot questions designed for focus group sessions**

The focus group questions were piloted once upon colleagues, as for the questionnaires. Lack of opportunities for repeated piloting of focus group questions is not an uncommon problem, (Bloor, Frankland, Thomas and Robson, 2001). The difficulty mentioned was in running the focus group and gaining the barest preliminary impression of the resultant transcript data, this is a concern with which I

empathise as very few occasions arose for piloting questions before involving actual research groups.

#### Final focus group questions

What do you think the aims of this course or module is in terms of teaching transferable skills?

*As for the questionnaire, an assumption is made that skills are being developed. There might be no aims, which students can recognise with respect to developing transferable skills.*

How do you think that you are learning transferable skills throughout the duration of this course or module?

*This question can be very easily interpreted as how transferable skills are being taught, students are not necessarily aware of what they are doing to learn.*

How are you going to judge the success of the material taught?

*This question did little to prompt a discussion.*

How would you evaluate this course in terms of teaching transferable skills?

*Students had great difficulty in understanding my meaning of this question with many responses coming back as 'yes it was good'. Poorly written.*

#### **Box 4.4: A critique of the questions designed for focus group sessions**

After collecting interview data it was transcribed using a Dictaphone, to ensure I did not misquote what participants said, (including all the 'um's and yeah's'). Running the focus groups and particularly transcribing data took a long time to complete (an experience shared by McLafferty, 2004) as *everything* said had been recorded, but this served as a much better technique than relying upon memory (Webb, 2002). I was also aware that my presence may have had an effect on the students; this could have been either negative or positive. When I met students I dressed fairly casually and also emphasised the fact that I had recently graduated as an engineer so that I might seem more approachable and credible. I was also able to use the technical terminology of

the discipline and was therefore seen as a member of the engineering academic community. At the end of the session some students commented that I had encouraged them to think about what they had learnt. I thought that this was a positive outcome as it reflected an indifference to me as a visible presence, (researcher presence is further addressed in Section 4.7). Students seemed more interested in just getting on with it and answering the questions posed. My experience is in contrast to that of McLafferty (2004) who found students were suspicious of her, which subsequently affected group dynamics (as she was a recognised researcher of the discipline she was investigating).

#### **4.4.4 Observations of Teaching Sessions**

Observation of teaching sessions was used to give meaning to the words and contextualise the other data I gathered from interviews and mind maps. The interaction between actions, behaviour and attitudes could be examined more closely (Silverman, 2000) whilst also providing an opportunity to ‘understand’ the teaching-learning environment better by observing and making notes upon the teaching techniques applied, student responses and the relationship between the two. I had to identify my own role in the observation process, as I was previously acquainted with the material— both as a student and whilst gathering research data on behalf of the TRANSEND Project. It was not easy to determine this role as Angrosimo and Mays de Pérez (2000) found out whilst conducting research in anthropology;

Within the interactive context of observational research, roles mutate in response to changing circumstances and are never defined with finality

Angrosimo and Mays de Pérez, 2000, p.684

I could identify with what Gray (2004) defines as an “insider”, but I also feel that I maintained professional distance by not focussing upon my experiences and only making notes upon what I observed at the time. To assist me in maintaining this

distance an observation schedule was devised to be used whenever a teaching session was observed so that a record could be kept of the observations and I could also retain focus on what I was looking for from the observations. Such a strategy has been advocated by others (Mason, 1996; Denscombe, 1998). The schedule was devised to take notes on what the teacher initiated and responded to and what the students initiated and responded to. A completed example of the schedule is shown in table 4.2. The text highlighted yellow indicates what is initiated or responded to and the text in purple italics is indicative of the type of notes I added throughout the session.

Lecturer	Initiation	<b>Sets group task</b> <i>Tries to engage students by giving them something to think about</i>
	Response	<b>Facilitates discussion</b> <i>Keeps an eye on students to ensure their discussion is relevant and flows</i>
Students	Initiation	<b>Group discussion</b> <i>Students willing to debate ideas, shows enthusiasm</i>
	Response	<b>Summarise discussion</b> <i>Onus on student to show significance of task in achieving outcomes</i>
Teaching-learning Environment		<b>Student-centred</b> <i>Teacher is trying to actively engage students in the learning-teaching process</i>

**Table 4.2: an example of the observation schedule used with sample comments and discussion**

The strategy employed was to observe, intently, the lecturer in the first half of the teaching session and the students in the second half of the session. I began observation using this format but found that it was problematic for two reasons.

- It prevented me from observing the interaction between the two groups if I was observing one at a time;



- It was possible to miss something of relevance initiated by either the lecturer or students if I was observing the other party at the time.

The strategy was modified after the first few observations as it was not enabling me to look at the whole picture. In the modified strategy, I simultaneously made notes on students and the lecturer throughout the session, therefore providing me with fuller data. Baszanger and Dodier (2004) support the need for what they have termed an empirical approach to observation incorporating the big picture rather than individual components of it.

A coding system was also introduced so that I could measure my observations against a list of criteria, for example of whether the lecturer asked questions and set tasks of the students. It was hoped that the comments would be easier to refer to, and simpler to analyse, if a suitable code was introduced for this purpose. A copy of the coding system used is presented as Appendix 4 in this thesis.

Lüders (2004) points out that whilst identification of the observer's role can be problematic, many researchers encounter difficulties in appreciating the stages involved in the observation process. Whilst conducting their research on home care of people with dementia, Briggs et al (2003) encountered a number of problems related to methodology of observation, including:

1.) Gaining access to the site: when collecting data for this thesis, it was difficult to obtain access to particular courses if lecturers were not aware of my intention or were unable to negotiate access on my behalf, which reduced the number of sessions I could observe particularly at Institution 4.

2.) Remaining unobtrusive during the observation. My experience was entirely different to that described by Briggs et al (2003). Whereas their studies required the researcher to visit the homes of individual participants, the research I conducted was mainly limited to the classroom where I was not often noticed and little or no attention was drawn to my presence.

One of the most important criteria I had to consider in running the observation sessions was that of being an “ethical observer”, (Malin, 2003), i.e. not being influenced by my relationship with the students or academic practitioner. The notes from my observations are littered with such comments as ‘students responded well to the session’ or ‘students responded apathetically’; the notes are all based on my opinion of how students responded and tend to include value judgements based on interpretation of data. As I have made clear in the section on grounded theory, some subjectivity is useful for a study of this nature and I also feel that I am able to differentiate between a positive learning experience and a more negative one through interpretation of data. I appreciate that the consequences of misinterpreting the data would have been serious and would have affected the theory which was generated from interpreting meaning in the data collected. Whilst putting together the timetable for the sessions I wanted to observe, it was not always possible to attend those sessions of particular interest during which the students were more active and the learning environment more student-centred. Within the scope of my financial and time limitations, I was still able to observe a number of course sessions during which students were actively engaged with the teaching.

## 4.5 Collecting data

Time and financial constraints impacted upon the amount of data I could gather. Distance between institutions, availability of courses and my availability to attend sessions and collect data were also contributing factors in the amount of data it was possible to collect. Table 4.3, is a representation of the type of data which was collected and the frequency with which various data gathering tools were used. The numbers are shown for questionnaire sessions, mind maps sessions etc. per level per institution.

	<i>Inst. 1</i>			<i>Inst. 2</i>			<i>Inst. 3</i>			<i>Inst. 4</i>		
<i>Levels</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>1</i>	<i>2</i>	<i>3</i>
1a. Mind maps	1	2	2	1	2	n/a	1	n/a	1	2	n/a	2
1b. Interviews	1	2	2	1	2	n/a	1	n/a	1	2	n/a	2
2. Observations	2	3	2	2	0	n/a	1	n/a	1	1	n/a	0
3a. Focus groups	1	2	3	1	1	n/a	2	n/a	0	2	n/a	2
3b. Questionnaire	1	1	2	1	1	n/a	2	n/a	1	2	n/a	1

**Table 4.3: table denoting the number of times and types of data that were collected based on levels and institutions**

The number of students that attended each of the sessions or were involved in observed teaching sessions can be viewed in table 4.4. For example, the notation 5/5 in the first column indicates that from the original research group of 5 students, all 5 completed mind maps.

	<i>Inst. 1</i>			<i>Inst. 2</i>			<i>Inst. 3</i>			<i>Inst. 4</i>		
<i>Levels</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>1</i>	<i>2</i>	<i>3</i>
1a. Mind maps	5/5	4/6, 6/6	6/6, 5/6	6/6	6/6, 5/6	n/a	5/5	n/a	5/5	5/5, 4/5	n/a	5/5, 5/5
1b. Interviews	5/5	4/6, 6/6	4/6, 5/6	6/6	6/6, 5/6	n/a	5/5	n/a	5/5	5/5, 4/5	n/a	5/5, 5/5
2. Observations	e/g x2	e/g x3	e/g x2	e/g x2	n/a	n/a	e/g x1	n/a	e/g x1	s/g x1	n/a	n/a
3a. Focus groups	5/5	6/6, 5/6	4/6, 6/6, 5/6	6/6	5/6	n/a	5/5, 4/5	n/a	n/a	5/5, 4/5	n/a	5/5, 5/5
3b. Questionnaire	3/5	6/6	5/6, 6/6	6/6	3/6	n/a	3/5, 4/5	n/a	4/5	5/5, 4/5	n/a	5/5

**Table 4.4:** table denoting the numbers of students attending sessions in which data was collected based on levels and institutions

Key for table 4.4;

e/g – entire peer group observed

s/g – sample group observed only

From table 4.4, it can be seen that the numbers of sessions and frequency of student attendees are low for some levels/institutions, especially with respect to those attending questionnaire sessions. However, I was more interested in data quality than data volume. Therefore I was less concerned with occasional non attendance as the data I gathered was still rich in detail.

#### **4.6 Subjectivity (bias)**

My concerns on subjectivity/ bias form an umbrella around the issue of validity rather than being a section within it. It is also viewed as driving the research methods and questions. Patton (2002) suggests that the researcher is the instrument in qualitative inquiry and as such their relationship between the subject and the field of study should be made clear from the outset. In doing this the researcher's credibility (and associated biases) may be exposed. Steinke, (2004) supports this position, arguing that

it is necessary to elaborate upon the researcher's explicit and implicit positions as these invariably influence perception, the choice or development of the methods used, and thereby the data collected and the understanding of the issue. The context of the research and my preliminary experiences has influenced my research stance and the research questions I have formulated and help to form the conceptual framework, (Maxwell, 1996). In addressing validity of my data collection, I need to ask whether my assumptions and experience inappropriately influenced the direction I took. A degree of subjectivity is important in conducting research of this nature (c-f. Section 4.1) and I also made my position clear at the outset of this thesis (c-f Chapter 1). Marshall and Rossman (1995) do not see this as necessarily problematic stating that

A qualitative research proposal should respond to concerns that the natural subjectivity of the researcher will shape the research.

Rossman and Marshall, 1995, p.145

The implication is that subjectivity is almost expected, and is a position supported by Ellis and Bochner, (2000) and Miles and Huberman, (1994). Essentially one is asked questions about integrity and of interpreting results accurately. It would not have been in my interest to do so as I was hoping to learn more about an area of interest, not to answer a particular question about it. Therefore a grounded theory approach was better than one which is hypothesis generating as there was no particular target I had to have reached other than achieving a clearer understanding of the issues involved.

#### **4.7 Validity**

Validity is viewed as a more important consideration for qualitative data than reliability. Mason suggests;

It is possible to argue that an obsession with reliability – which may occur precisely because it can be 'measured' – inappropriately overshadows more important questions of validity

Mason, 1996, p.146

Feldman (2003) supports this notion of validity being more important than reliability, especially if findings are used to support change, (as they are in this thesis). In considering the importance of validity, a number of issues have to be dealt with. Even though there is some consensus on the importance of validity, there is much disagreement on what it stands for and how data (both collection and analysis) can be validated effectively. Feldman (2003) attempts to articulate the first of these problems by stating that

There are good reasons to seek ways to avoid dealing with the validity issue in qualitative research especially because it is so difficult to define validity

Feldman, 2003, p.28

Silverman (2000) recognises the definition more clearly, as meaning “truth value” or of constructing a truth, but sees a difficulty in conceptualising this definition, as do Lincoln and Guba (2000). There is disagreement in what constitutes ‘rigorous research’ and the idea of validity has been a difficult one to address in this thesis. Concerns arose in establishing the context in which “truth value” is being sought (Arskey and Knight, 1999; Miles and Huberman, 1994). Lincoln and Guba (2000) understand this concern, identifying truth in both methodology and interpretation. Mason (2000) encourages researchers to ask a number of questions of themselves including (1) what potentially can generation methods tell you and (2) how well can they do this? Mason provides a comprehensive list of concerns associated with validity, and directs the researcher to think about validity by posing a number of, what she considers relevant, questions. The proposed framework is helpful as I am unable to “prove with certainty” that I have ‘told the truth,’ as it may be observed by the reader. It can only be done with degrees of confidence. A number of criteria need to be established in determining the validity of this research; which can be done by

posing a number of questions as is the suggested strategy used by Mason, (2000) and Patton, (2002). Miles and Huberman, (1994) produced a list of criteria/questions which consider validity, and which include such questions as: following up surprises, replicating a finding and looking for negative evidence. Even though their list was not exhaustive, I felt it covered too many criteria which are not applicable to the definition of validity I have used. It has therefore been adapted for use in this thesis to reflect my interpretation and understanding of the term 'validity'.

#### **4.7.1 Triangulation**

A number of researchers look towards 'triangulation' as providing a plausible framework which can be used to confirm validity of the findings, (Silverman, 1993, 2000; Mason, 2000). However, this view is also not universally accepted. Seale (1999) comments that

Even if all the different methods in a methodological triangulation exercise converge on the same thing, apparently agreeing with each other, how can we know that they are correct?

Seale, 1999, p.474

Data were triangulated, to support this research project's validity by using a number of data-gathering sources including interviews, observations and mind maps. Examples of triangulation of data can be found in Appendix 2, samples of data. One of the criticisms levelled at triangulation is in appreciating that all of the tools used have different purposes and fulfil different criteria, (Flick, 2004). The argument presented is a convincing one, but in my research there was considerable overlap between the questions asked of students, especially between interviews and focus groups. Patton, (2002) also seems to support the stance I have taken by commenting that;

Consistency in overall patterns of data from different sources and reasonable explanations for differences in data from divergent sources contribute significantly to the overall credibility of findings.

Patton, 2002, p.555

Miles and Huberman, (1994) err on the side of caution when considering triangulation, arguing that;

Disconfirming evidence is absent or feeble. This is a heady and very dangerous time, and it usually means that you are knee deep in the 'holistic fallacy': putting more logic, coherence and meaning into events that the inherent sloppiness of social life warrants

Miles and Huberman, 1994, p.273

Their comment relates to dangers of the researcher being so pre-occupied in proving something, that the findings become easily and readily supportable. Exercising caution with this issue is also recommended by Patton (2002). I appreciate that such a problem exists, but my research was not directed towards championing particular findings.

#### **4.7.2 Corroboration of the Findings**

An important consideration in achieving validity is in seeking confirmation of the findings. Steinke (2004) refers to this as 'member check' in which data is presented to the subjects being researched. Miles and Huberman (1994) highlight the importance of such a move and argue that good explanations deserve attention from informants who supplied the original data. Corroboration of data with students was quite difficult to achieve. Part of the solution lay in tape-recording all the interview and focus group sessions after having sought permission from the research students. This meant that I ended up with exact manuscripts of students' words. As I met most of the students twice, there was opportunity for them to view transcripts as the data were being gathered. Students were made aware of general patterns and whether there was



anything 'of significance' to report in terms of interpretation of data. These confirmation sessions were met mostly with a confirmatory nod of the head; students appeared to display faith in my ability to not misinterpret or misrepresent them or were not sensitive about the data I was collecting. When the writing-up phase of this thesis began, the students had started their Summer holiday and were not contacted during this time. Although efforts could have been made to contact students, an assumption was made (based on previous experience) that they would provide general approval of the records made.

#### **4.8 Ethics**

The ethical nature of this research has to be considered, particularly with respect to protecting the identities and interests of those involved, (Denscombe, 1998). Although I had envisaged students remaining unidentified whilst collecting data, this was difficult to implement as I could not then establish their holistic approach to developing skills, if for example, I could not tell which student had completed which mind map or given which interview. Students were therefore asked to put their names to all the written data I obtained from them i.e. questionnaires and mind maps. They were also asked to identify themselves whilst speaking to me (responses were recorded). Retaining confidentiality of data is a concern highlighted by Silverman, (2000), but students were willing to allow me to use the data for presentation in this thesis.

Prior to asking the students to actually do anything, I received informed consent from them, (Gray, 2004). Students were told of the research I was conducting, why I was conducting it and how their input would be used. It was emphasised that the questions

being asked of them (c-f Section 4.4) were concerned with their development rather than their opinions of the academic practitioners. The majority of students did not mention other names when discussing their development of skills. It was also agreed that if they wanted, their names could be changed to protect their identities once data had been analysed. Although this option was available to them, no one expressed an interest to remain anonymous.

## Chapter 5

### Presentation and Analysis of Data

This chapter displays a sample of the data collected. To re-iterate, data collection was conducted using a case study approach and analysed through a grounded theory approach. The categories and sub-categories which developed from data, were coded by colour and number for clarity. All the categories and associated codes identified from my data have been presented in this chapter. Data from one student representative of each level has been shown as 'boxed data' to allow the reader to understand the process through which I analysed the data collected. Further examples of 'boxed data' are presented in Appendix 2 of this thesis.

The examples of data presented as boxed data are preceded with background information on the courses investigated; this has been provided to put the examples into context in terms of quality of skills development as perceived by the academic practitioner. The excerpts of transcript presented are interwoven with tables, which illustrate the main and sub categories and their representative codes. I have also attempted to exhibit evidence of my analysis of the data. All those comments which appear in red italics in this chapter form part of my analysis by way of personal notes. Coloured, numerical boxes next to the transcribed data also highlight part of my analytical strategy; they are the codes representing the categories identified from data.

Table 5.1 denotes which students' data have been used. The levels mentioned in this chapter refer to levels of undergraduate study, for example, level 1 students are in their first year of undergraduate study. The teaching strategies mentioned in this chapter and throughout this thesis refer to the following: 1.) Skills development is not made explicit and does not impinge upon technical teaching (embedded); 2.) Skills development occurs alongside development of technical skills and students are aware

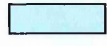











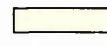
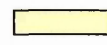


of it (integrated); 3.) Skills development is explicit and exclusive of technical skills (bolt-on).

Name	Institution	Level	Teaching Approach	Where in thesis
Cara	1	1	Embedded	Box and figure 5.1
Mohammed	1	2	Bolt-on	Box and figure A4
Roger	1	3-4	Integrated	Box and figure A6
Lewis	2	1	Bolt-on	Box and figure A1
Timothy	2	2	Integrated	Box and figure 5.2
Rachel	3	1	Bolt-on	Box and figure A2
James	3	3-4	Integrated	Box and figure A5
Scott	4	1	Embedded	Box and figure A3
Niall	4	3-4	Integrated	Box and figure 5.3

**Table 5.1: students selected from representative groups to show exemplars of categories identified within the data**

Fort-nine students took part in the research for my thesis. Fifteen were female and thirty-four were male; thirty-three were home students (from the UK) and sixteen were from overseas. Mature students did not take part in this study because they were not sufficiently representative of the class as a whole.

Table 5.1 shows the colour coding scheme which was applied to the categories identified from data, (for example for mind maps and follow-up interviews). The first column denotes the tool used to gather data, the second column shows the main categories which emerged once data were viewed and transcribed, the third column shows the sub categories which emerged from the main categories and the fourth column shows the colours used to code the main categories. For simplicity, a different colour has been allocated for each case-study tool used to gather data. For example, all categories identified through observation data have been colour coded shades of blue, for mind maps shades of green and so on for the remaining categories.

Tool	Category	Examples of some sub categories	Category colour	Table ref.
Observation	Attitudes of students and lecturers	Keen, attentive, bored, inspired,		5.2.4
	Impressions	Focus is more on process than content, particular idea or aspect focus upon, lots of questions asked, views and ideas freely expressed		5.2.5
	Environment	Learning is student centred, group interactive sessions, lectures, onus on development of transferable skills, both technical and transferable skills being developed		5.2.6
Mind Maps	Approach to completing maps	Students view objectives separately, students view objectives collectively prior to completion		5.2.1
	Working from objectives	Students relate course objectives to other things in curriculum, relate course objectives to experiences, relate course objectives to what they think will/ should happen		5.2.2
	Use of words and expressions	Activity/ exercises, helping/ guiding, teams/ groups, getting information and knowing how to use it, understanding problems and concepts, basic knowledge and skills		5.2.3
Follow-up interviews	Approach to learning	Ref. made to what students have been told, ref. made to what students are allowed to learn, whether students have guided their own learning, what students have been made aware of in their learning		5.2.7
	Identification of the process	Building information database and then using parts of that knowledge, developing an appreciation of skills alongside the technical work done,		5.2.10
Questionnaire	Identification of transferable skills	Understanding, looking at the bigger picture/ employment, communication, team development, finding things out for yourself		5.2.12
	Learning methods	Experiential learning, lectures, trial and error, team working methods, through assessment		5.2.13
	Structure of skills development	Learning is related to core technical components, building awareness, growing in confidence, recognising the usefulness of the course		5.2.11
	Success criteria	Improving level of confidence, recognition of improvement in using transferable skills, assessment criteria		5.2.14
Focus groups	Identification of aims/ objectives	Getting the best out of what you're good at, showing that you achieve more working together than individually, ensure that students are at the same level		5.2.15
	How are aims/ objectives achieved	Experience and trial and error, pooling together different skills and qualities, opportunities for solving problems and learning from them, feedback and constructive criticism		5.2.16
	Evaluating success criteria	Results and assessment, gaining in understanding and confidence, continue to do things – unaided but competently, reflection		5.2.8
	Fulfilling criteria	Guidance given but student is also independent, motivated to learn, enthusiastic about the teaching approach used		5.2.9

**Table 5.2: the categories and associated codes identified from data**

## 5.1 Categories Developed for Mind Map Data

When considering mind map data, the reader is asked to consider the maps in relation to tables 5.2.1-3 which highlight the categories and associated codes I developed from the data which emerged. For example, the mind maps completed by students either contained links or they did not. One of the categories which emerged from my data subsequently was whether they considered the course as a whole or made up of many parts. Sample mind maps can be seen in figures 5.1-3 in this chapter and figures A.1-6 in Appendix 2. All the mind maps should be considered in conjunction with tables 5.2.1-3.

	Sub category	Colour code
Mind maps – approach to completing maps	Student views each objective separately	1
	Student views objectives collectively and then completes mind map	2

Table 5.2.1: categories identified from mind map data, denoting approach to completing map

	Sub category	Colour code
Mind maps – working from objectives	Student relates course objectives to other things in curriculum	1
	Student relates course objectives to previous experiences	2
	Student relates objectives to what they think will/ should happen	3

Table 5.2.2: categories identified from mind map data, denoting relationships between objectives as identified by students

	<b>Sub category</b>	<b>Colour code</b>
<b>Mind maps – use of word and expressions by students</b>	Activity/ exercises	1
	Helping/ guiding	2
	Teams/ groups	3
	Getting information and knowing how to use it	4
	Understanding problems and concepts	5
	Basic knowledge and skills	6
	Use of experience and practice	7
	Improvement/ development of particular transferable skills	8
	Good practice in certain areas	9
	Building relationships	10
	Collective responsibility/ participation	11
	Related to employment	12

**Table 5.2.3: categories identified from mind map data, denoting expressions and words used by students**

## **5.2 Categories Developed for Observed Teaching Session Data**

All three courses from Institution 1 were observed. Tables 5.2.4-6 denote the main and sub categories developed from observing teaching sessions and their associated coding. Sample data from observed taught sessions that have undergone analysis are presented in table A4 in Appendix 2 of this thesis. Table A4 should be considered in conjunction with tables 5.2.4-6.

	Sub category	Colour code
<b>Observation – attitudes (of lecturer/ student)</b>	Keen/ enthusiastic	1
	Attentive	2
	Bored	3
	Inspired	4
	Confident	5
	Hesitant	6
	Relaxed	7
	Humorous	8
	Cautious	9

**Table 5.2.4: categories identified from observation data, denoting attitude of lecturer and students**

	Sub category	Colour code
<b>Observation – impressions</b>	Lecturer/ students focus more on process than content	1
	Lecturer focuses on a particular idea/ aspect	2
	Lots of focused questions are asked	3
	Views and ideas are freely expressed	4
	Lecturer leads students in their learning	5
	Lecturer and students learn together	6
	Students work more in groups than individually	7
	Students expected to be creative with their problem solving	8
	Students positively responsive to lecturer irrespective of material	9
	Indication of differences in learning approach, influenced by gender or culture.	10

**Table 5.2.5 – categories identified from observation data denoting impression created**



	Sub category	Colour code
<b>Observation – environment</b>	Learning is student centred	1
	Group interactive sessions	2
	Classroom-based lectures	3
	Onus on developing transferable skills	4
	Both technical and transferable skills being taught	5
	Technical skills teaching is active, transferable skills teaching is passive	6
	Peer learning	7

**Table 5.2.6: categories identified from observation data denoting teaching-learning environment**

### **5.3 Sample data and analysis: level 1, Institution 1**

**Background to course:** The course investigated at level 1 was 12 weeks long, entitled ‘Chemical Process Technology’. The teaching approach used for developing transferable skills was one in which skills were not explicitly referred to.

The course provider was interviewed at the start of the course and identified the following teaching methods and ideas currently being used in developing student transferable skills: individual report writing, internet-based communication, student assessment, student examination questions, external input and student teams. Students were placed in a number of teams in which members were specifically interchanged so they were given opportunities to work with others. Teams were required to carry out a number of tasks related to the process industries, and these were carried out using various resources, including the Internet. Towards the end of the course, students participated in a number of workshops and presented case studies in teams; the teams were pre-selected by the course provider, (on selected process industries).

The team presenting the information was required to assess other teams on their solutions to the case study problem. As part of the final examination for this module, students prepared questions for their peer group to answer. Students were not allowed to answer questions which they themselves composed; all questions were pre-checked by the course tutor in order to maintain the appropriate standard of exam questions.

**Sample data from course:** Box 5.1 shows a sample of responses from a level 1 participant, 'Cara', which also includes comments from members of her peer group obtained through focus group responses. Cara was seen as a representative member of the sample group from which data was gathered as most of her responses were mirrored by the majority of the others in the group. The students selected to make up the sample groups were representative of the class as a whole on the basis of academic ability, gender, ethnicity, nationality and age.

The mind map in Figure 5.1 shows that the participant makes some reference to working in teams and “organising role each member of group will play” which suggests that even though this course is embedded there is an appreciation of the development of certain transferable skills. The participant has also made reference to building their knowledge base and familiarising themselves with using external resources by “us[ing] the internet, contact[ing] relevant companies”. When interviewed about the completed mind map, Cara was not able to reflect on the teamwork in any great depth. The transcript excerpt given below should be viewed in conjunction with table 5.2.7 which shows the sub categories and codes which I have identified from the theme, ‘approach to learning’ which emerged from follow-up interviews.

Cara, level 1

“Well we’ve done some teamwork stuff, some arguments but we got a good mark for that” *assessment seems significant* “and we’ve done some stuff with a candle. I don’t know what else we’ll do – we haven’t been told” *doesn’t take ownership of learning* “so I can’t think what else to say”.

1, 6

	Sub category	Colour codes
Follow-up interview – approach to learning	Reference made to what students have been told	1
	Reference made to what students have been allowed to learn	2
	Whether students have guided their own learning	3
	What students have been made aware of in their learning	4
	Reference made to revising or using knowledge (one situation to another)	5
	Assessment seems more significant than outcomes	6
	Process seems more significant than outcomes	7

Table 5.2.7: Categories identified from follow up interviews, denoting student approach to learning

**Box 5.1: Samples of categorised and analysed data for Cara and representatives from her peer group**

The following two examples are focus group responses for level 1 students and should be considered in conjunction with the sub categories I developed for some focus group data, displayed in tables 5.2.8 and 5.2.9 respectively.

**Focus group question: how are you going to judge the success of the material taught?**

Level 1 response:

“And just make sure that everyone in the group actually understands, as sometimes you do get some people that stay in the background... they’re not actually understanding” *understanding of problem seems very important* “and they can’t answer a question and it shows a communication problem within the group... it may also affect our mark.” *Success measured through assessment.*

1, 2

Table 5.2.8 denotes the categories and colour codes developed for focus group data, which emerged under the main category ‘evaluation of success criteria’.

	Sub category	Colour codes
Focus groups – evaluation of success criteria	Results and assessment	1
	Gaining in understanding and confidence	2
	Continuing to do things, unaided but competently	3
	Reflection	4

**Table 5.2.8: Categories identified from focus group data, denoting student judgement of success**

**Focus group question: how will you evaluate the course in terms of teaching of transferable skills?**

Level 1 response

“Also maybe quality of the work because if you’re interested in it by the way it’s being taught you’ll put more time in it and more effort in it”. *Important to maintain interest.*

3

Table 5.2.9 denotes further colour codes and categories for focus group data, which emerged from the main category identified ‘fulfilment of teaching criteria’.

**Box 5.1 continued:**

	Sub category	Colour codes
<b>Focus groups – fulfilment of teaching criteria</b>	Guidance given but student is also independent	1
	Guidelines, lecturer available to answer problems should they arise	2
	Interest in approach will motivate students to contribute	3
	Developing of confidence or understanding	4

**Table 5.2.9: Categories identified from focus group data, denoting fulfilment of teaching criteria**

From the above examples it can be seen that Cara and students from her peer group seem to take little ownership of their education, for example there is an emphasis on what students are told and allowed to do and upon what they (the students) will be taught. The mind map completed by Cara indicates that although Cara has linked some of the course objectives, she has not established links between all of them which is indicative of viewing the objectives as separate components of the course, not substantially related to one another. There is inconsistency in how she has considered relationships or links between the course objectives. Assessment seems important for Cara in determining whether course objectives were achieved, although the group does not elaborate upon this view. The group's view of the lecturer seems to be of someone who can make the course or subject interesting for the student, which implies that the personality of the lecturer influences students' abilities to pay attention. Cara is also unable to see the relevance of the course outside of the curriculum at level 1 as can be seen from there being no mention of experience or further learning in relation to her current level of study. The implication is that her approach to learning transferable skills is at a very surface level.

**Box 5.1 continued:**

Be able to develop a systematic approach to chemical process analysis, gather and prioritise process information

3

Chemical Process Technology, level 1

A series of lecture based on each set of process technology. Systematically run through each of them using video image diagrams and notes, poster presentation maybe.

Understand the role of chemistry and chemical technology in process applications, where to find relevant information

3.4

Use the internet, contact relevant companies for literature, use books then find information to produce a study that is relevant to that process. This will be carried out in team

2

Have developed basic teamwork and communication skills

Know the chemistry of selected processes and its relationship to process configuration, how to process and transfer relevant information

Organising role each member of group will play. I produce the end product section that involves responding to other people's questions and answers.

Figure 5.1, mind map produced by Cara, Institution 1

3

Boxes A.1-3 and figures A1-3 in Appendix 2 show examples of categorised and analysed data collected from Lewis (Institution 2), Rachel (Institution 3) and Scott (Institution 4). All three of these students are also at level 1 of their undergraduate degree course and their views are mostly representative of others I have spoken to from my research groups. The following transcript excerpt is of a focus group which was organised for students at level 1, Institution 2. The codes shown should be considered in conjunction with tables 5.2.15 and 5.2.16 which are located inside Box 5.3.

- 2 “I think it’s all about teamwork, you could be playing football anyways.  
So yes, that’s what they’re getting at, make us stop and look at the way we work.”  
*Teamwork seems very important and there is general agreement*  
“Set down times, you know and control and manage, hand the work in on time and giving responsibilities to everybody in the group.  
Going away from the book and getting into real life, getting into interpersonal relations and things”
- 5 “Yeah, but something like, I think they’re [going to] give us something that you can’t solve, I mean that one person can’t solve. I mean that sometimes what happens is that they give us, it has happened here, a problem or a coursework for the team and two people do it out of four”.  
*Students aware of exposure to a number of problems used to practice skills*
- 7 “So I think that they’re going to give us something that you can’t solve by yourself in that amount of time. Everyone must be involved and you must work together.”

Both the focus group comments shown and questionnaire responses from level 1 students at Institution 2, which can be seen in table A1, Appendix 2, indicate the majority of views from the sample group at level 1 are similar in meaning. The views of Lewis, (Box A.1), are mostly representative of the group. Most group members feel that they are mainly learning teamwork skills, and that the learning occurs through practice, but very little reference is made to the significance of review or reflection. Although a couple of students from the sample group will judge the success of the course as being able to develop their skills, the majority would like to achieve a good grade and feel that that is a measure of their success. From Lewis’s mind map, Figure A1, it can be seen that Lewis does not seem to perceive relationships between the

course objectives from the course, although is aware of learning activities used to achieve the objectives. He makes no reference to peer review or reflection and the relevance of learning transferable skills within a team-based environment even though he makes much reference to team work. The implication is that Lewis has not appreciated the relevance of the review sessions throughout the course which were primarily aimed at reviewing the process of developing skills.

The questionnaire results obtained from students at level 1, Institution 3, shown as table A2 indicate that the majority of those who completed questionnaires, recognised that they were developing skills, namely teamwork through a number of activities which accommodated this development. Table A2 should be considered alongside tables 5.2.11-14, located inside Box 5.3, which denote the codes developed for questionnaire categories. There was less coherence, however, amongst students about the significance of the course and how it might be useful to them.

The following examples are excerpt transcripts from a focus group session, level 1, Institution 4. The representative codes should be considered in conjunction with tables 5.2.15 and 5.2.8.

- 2 “Learning how to cope with the most difficult people that you could ever meet, who want to do everything all the time and won’t let you do anything...” *recognition of team roles and attitudes seems important*
- 3 “When you do things again and carry on doing them, only then will you know if you’ve got better”. *Success through improvement*

Box and figure A3 which show samples of data obtained from Scott suggest that he has not really recognised a development of transferable skills in this course as there is very little mention of this development. He also reflects upon skills development as being momentary as opposed to a more progressive development throughout the curriculum. His course mark and ability to “pass the test” seem important, (Box A3),



which is demonstrative of a more superficial approach to learning. Some reference is made (from focus group sessions) to experience and how experience will be used in the future, but it is unclear which experience is being referred to.

#### **5.4 Sample data and Analysis: level 2, Institution 2**

**Background to course:** At level 2, a 2-week long intensive course entitled Study Week was studied. The course was taught using an integrated approach to teaching transferable skills. At the start of the course, the course provider was interviewed and the following teaching methods and ideas identified as developing transferable skills: the use of student teams, creating a challenging environment, and solving practical discipline related problems. Students were organised into self-selecting teams to carry out technical problems. Each team presented their solutions and these were discussed amongst the peer group.

**Sample data from course:** Box 5.2 shows a sample of data, which have been categorised and coded for Timothy, a level 2 student at Institution 2. .

The mind map completed by Timothy from level 2, Figure 5.2, shows that he has made several connections between the objectives and can identify several interrelationship. When viewing Figure 5.2, reference needs to be made to tables 5.2.1, 5.2.2 and 5.2.3 which show the sub categories developed for coding mind map data. The following excerpt was taken from part of a follow-up interview Timothy gave. The codes accommodating the transcript should be considered in conjunction with tables 5.2.7 and 5.2.10 which show the categories and sub categories which developed from follow-up interview data.

Timothy, level 2

“This especially helped me developing strategies and team working skills especially during the gams project, [where] we spent a lot of time learning the process and communication skills as well as leadership skills and team working skills. And we’re given simple managerial roles during that project, which we are assigned to tackle a specific problem which I think will help us in our career”. *Relationship to employment is important.* “I think that these are transferable skills which are needed for all career types”.

3, 5      7

	Sub category	Colour code
<b>Follow-up interview – method involved in learning</b>	Building information database and using parts of that knowledge	1
	Interaction with lecturer or responding to particular lecturer/ supervision	2
	Developing an appreciation of skills alongside the technical work done	3
	Using trial and error to judge learning	4
	Using examples of how things should be done	5
	Using constructive criticism /feedback to guide learning	6
	Making and sticking to assumptions with respect to learning	7

**Table 5.2.10: categories identified from follow-up interview data, denoting method of learning**

In the above example, Timothy’s comments reflect upon his desire to associate his learning with employment. He also seems able to appreciate the relevance of learning both transferable and technical skills alongside one another.

**Box 5.2: Samples of categorised and analysed data for Timothy and representatives from his peer group**

Timothy also provided data through a questionnaire. The following example is an excerpt taken from one of his questionnaire responses. The code which correlates to the response should be viewed in conjunction with table 5.2.11, which denotes some sub-categories and associated codes for questionnaire data, developed from the main questionnaire category of 'identification of a skills structure'.

**Questionnaire question: do you think that this course contributes to the learning of transferable skills?**

Timothy's response

"60% yes; group projects and presentations, and getting a chance to comment upon other groups" *reflects upon importance of feedback* "and have them comment upon you has been invaluable".

4, 6

	Sub category	Colour codes
<b>Questionnaire identifying a structure of development activities</b>	Learning is related to core technical components	1
	Building awareness	2
	Growing in confidence	3
	Developing in certain areas and learning new aspects	4
	Recognising the usefulness of the course	5
	Feedback/ review	6

**Table 5.2.11: Categories identified from questionnaire data, denoting structure of skills development**

The following excerpt is taken from a focus group response and should be considered in conjunction with table 5.2.9.

**Focus group question: how will you evaluate the course in terms of teaching of transferable skills?**

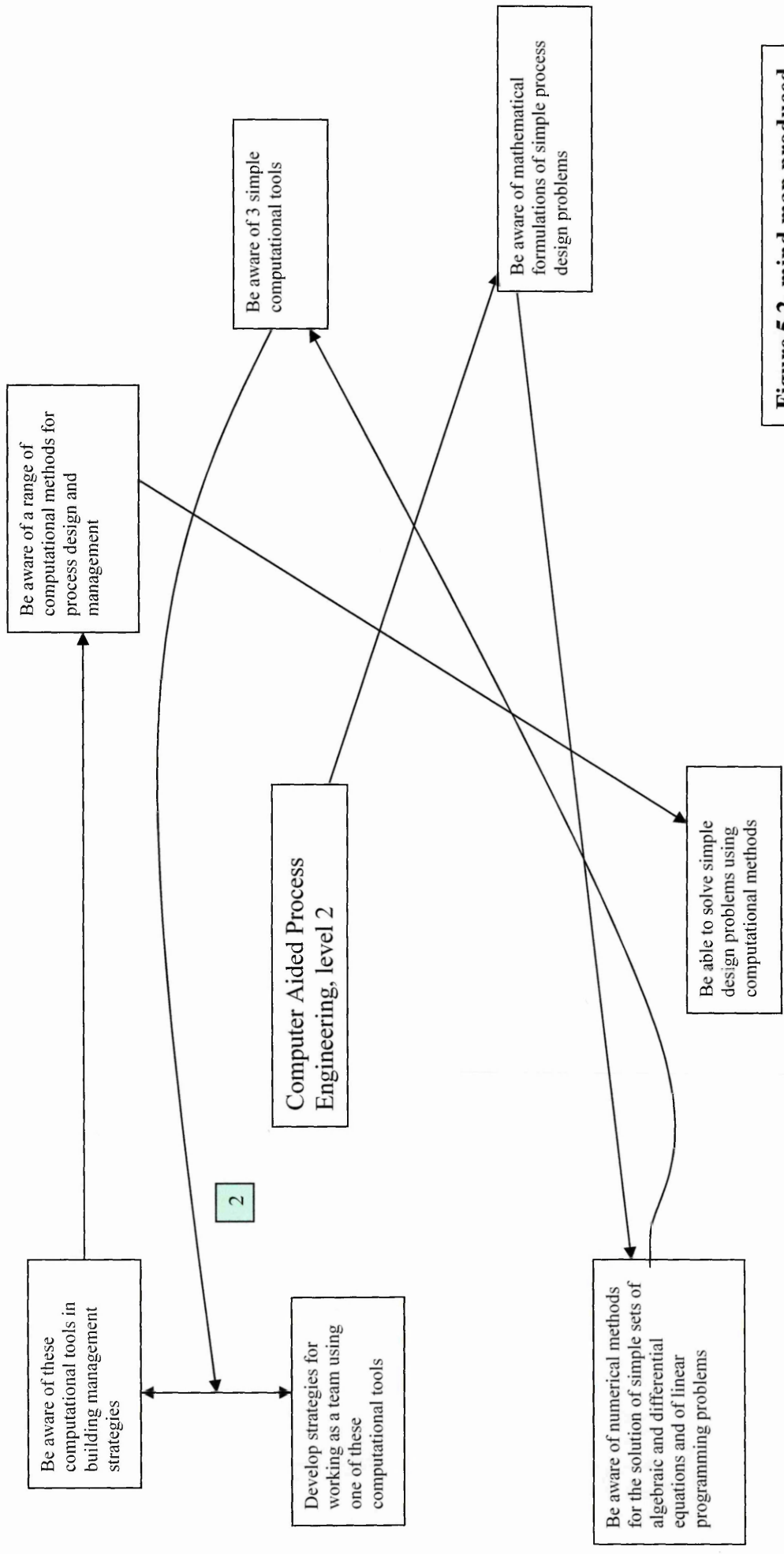
Focus group response

"If you fully understand the course then I assume it's good teaching... whether you are then able to have understood enough to use the knowledge is another matter" *uses the teaching-learning environment to promote understanding.*

4

Timothy expresses an appreciation of the relationships between objectives and the future significance of his transferable skills education. He has been able to internalise his understanding of skills and identify its applicability within a professional context. The approach is representative of someone who is looking to understand the relevance of something, not just pass a test on it. Timothy's mind map, figure 5.2 suggests that he was able to formulate a (rather integrated) relationship between the teaching objectives.

**Box 5.2 continued:**



**Figure 5.2, mind map produced by Timothy, Institution 2**

Box and figure A4 show samples of data obtained from Mohammed. From figure A4 it is suggested that Mohammed was able to demonstrate the relationship between course objectives as a cycle in which one continues to learn. He was also aware that his transferable-skills development is relevant to him outside of the curriculum. The following examples are excerpt transcripts from focus group data collected from level 2 students at Institution 2, and should be viewed in conjunction with tables 5.2.8 and 5.2.16.

4 “The most interesting thing we did was go back and ask questions to find out how we got through the tasks”. *Suggests learning through review.*

4 “I think that the people who were helping us through the review were very good, they did it in such a way that we ended up talking to one another. They became irrelevant, but we wouldn’t have got to that stage without them”. *Recognise role of limited facilitation in developing skills.*

The samples of data shown suggest the relevance of taught review in developing skills.

## 5.5 Sample Data and Analysis: level 3-4, Institution 4

**Background to course:** At level 3-4, the course investigated was ten weeks long, entitled ‘Research Methodology and Management of Experimental Data.’ The teaching approach used in this course was to embed the transferable skills component. At the start of the course, the course provider identified the following teaching methods and ideas as being used to enhance the development of transferable skills: students solving design based problems in teams, applying inter-discipline communication, relating the degree programme and the industrial placement year to the course, and presenting project findings as poster presentations. Students were placed in pre-selected inter-disciplinary groups and asked to design a process plant for a particular process using their previous experiences and knowledge. As part of the final assessment, students prepared and presented a written report and a poster on

which they were asked questions by their course tutors, other academics and their peer group.

**Sample data from course:** Box 5.3 shows sample data with analysis for Niall, a level 3-4 student from Institution 4.

Figure 5.3, is a mind map produced by Niall, Institution 4 and should be viewed in conjunction with tables 5.2.1, 5.2.2 and 5.2.3. In completing his mind map, Niall has taken a holistic approach and has attempted to identify relationships between the course objectives through applying knowledge, skills and experience. Niall has placed much emphasis on “previous reports and experiences” which implies that he is attempting to internalise his knowledge and apply his understanding to a related, though different situation. He also mentions the support from “supervisor guidance and outside help”. In order to understand the following transcript excerpt, reference should be made to tables 5.2.7 and 5.2.10, denoting the codes associated with sub categories developed from follow-up interviews.

Niall’s response

“Similarly with research methodology, I’d expect some supervisor guidance in the sense that if I’m doing something completely wrong, hopefully my supervisor will point it out”. *Keen to develop own abilities and knowledge with supervisor support.*

2

“In a similar way, lecturer outlines will have so far outlined some of the concepts you can use to go about research and handling data”. *Keen to use concepts previously covered and understood.*

5

On at least two occasions, Niall also completed questionnaires. The following excerpt is taken from one of his responses to a questionnaire questions. The sub categories and codes identified through the data he provided are shown in table 5.2.12, which fall under the main category of ‘identification of course aims and objectives’.

**Questionnaire question: what are the aims and objectives of this course in terms of developing transferable skills?**

Niall’s response

“It should also allow us to pick up skills that will aid us in the research we do now and as an employee we should be more employable after we have done it”. *Aware of preparation for employment*

2, 3

**Box 5.3: Samples of categorised and analysed data for Niall and representatives from his peer group**

	Sub category	Colour code
Questionnaires – identification of transferable skills	Understanding	1
	Looking at the big picture/ employment	2
	Communication	3
	Finding things out for yourself	4
	Team development	5
	Developing confidence	6
	Assessing own development	7
	Leadership	8

**Table 5.2.12: categories identified for questionnaire data, denoting skills identified**

More of Niall’s responses to questionnaire questions are shown in the following examples. The sub categories and codes identified from the responses should be viewed in conjunction with tables 5.2.13, and 5.2.14 which shows the sub categories and codes developed from the questionnaire responses of ‘identifying aims and objectives’ and ‘judging success criteria’.

**Questionnaire question: how do you think this learning will occur?**

Niall’s response

“I would like to think that the majority of this learning will occur by actually trying to do the things I am taught about”. *Judging success by being able to internalise knowledge and apply to different situation.* “Being told how to do something is never the same as doing it yourself as a hands on experience”.

1

	Sub category	Colour code
Questionnaires – identification of learning methods	Experiential learning	1
	Lectures	2
	Practice – through trial and error	3
	Examples (direct learning)	4
	Team working methods	5
	Through assessment and feedback	6

**Table 5.2.13: categories identified for questionnaire data, denoting learning methods**

**Questionnaire question: how will you judge the success of the course?**

Niall's response:

"If I can communicate the things I have done in my research project back to people who have little or no understanding of the area then I will feel that I have been successful. I would also like to think that I will be able to spot areas that require improvement". *Seeking understanding for application seems more important*

1

	Sub category	Colour code
Questionnaire – judging success criteria	Building confidence and understanding	1
	Recognising an improvement in using transferable skills	2
	Assessment criteria	3

**Table 5.2.14: Categories identified from questionnaire data, denoting judging success**

Focus group comments were also obtained from students at level 3-4. The samples of transcript shown should be considered with tables 5.2.15 and 5.2.16 which indicates sub categories developed from focus groups.

**Focus group question: what do you think the aims and objectives of this course are?**

Level 3-4 response:

"We're not gonna do this, use the same techniques that we're going to be using now so it's a question of how much we've built and can use from our experience". *Experience is key.* "Try to work out for ourselves what it's like – at least we've got some support here".

7

**Box 5.3 continued:**



	Sub category	Colour code
<b>Focus groups – identification of aims and objectives</b>	Getting the best out of you and improving on other aspects	1
	Show that you achieve more working together	2
	Ensure that students are at the same level	3
	Get to know one another and the facilities available	4
	Become better at focusing upon and developing certain skills	5
	Useful for employment	6
	Using experiences to look at new problems	7
	Provide the opportunities to use mentors from the year above	8
	To give students an education	9

**Table 5.2.15: Categories identified for focus group data, denoting student identification of course aims and objectives**

**Focus group question: how do you think these aims and objectives are going to be achieved throughout this course?**

Level 3-4 response:

“We’ve used the skills that they [former students and people in industry] picked up and are learning between ourselves” *learning as a team and reflecting on experiences* “and then we’ve had opportunities to try them out in the first and second years, working in groups and so on”.

2, 5, 7

	Sub category	Colour code
<b>Focus groups – methods of achieving aims and objectives</b>	Dependent on lecturer and their teaching method/ lectures	1
	Experience and trial and error	2
	Pooling together different skills and qualities	3
	Letting students take responsibility for their own learning	4
	Opportunities for solving problems and learning from those	5
	Feedback and constructive criticism	6
	Learning together and with each other	7

**Table 5.2.16: Categories identified from focus group data, identification of course aims**

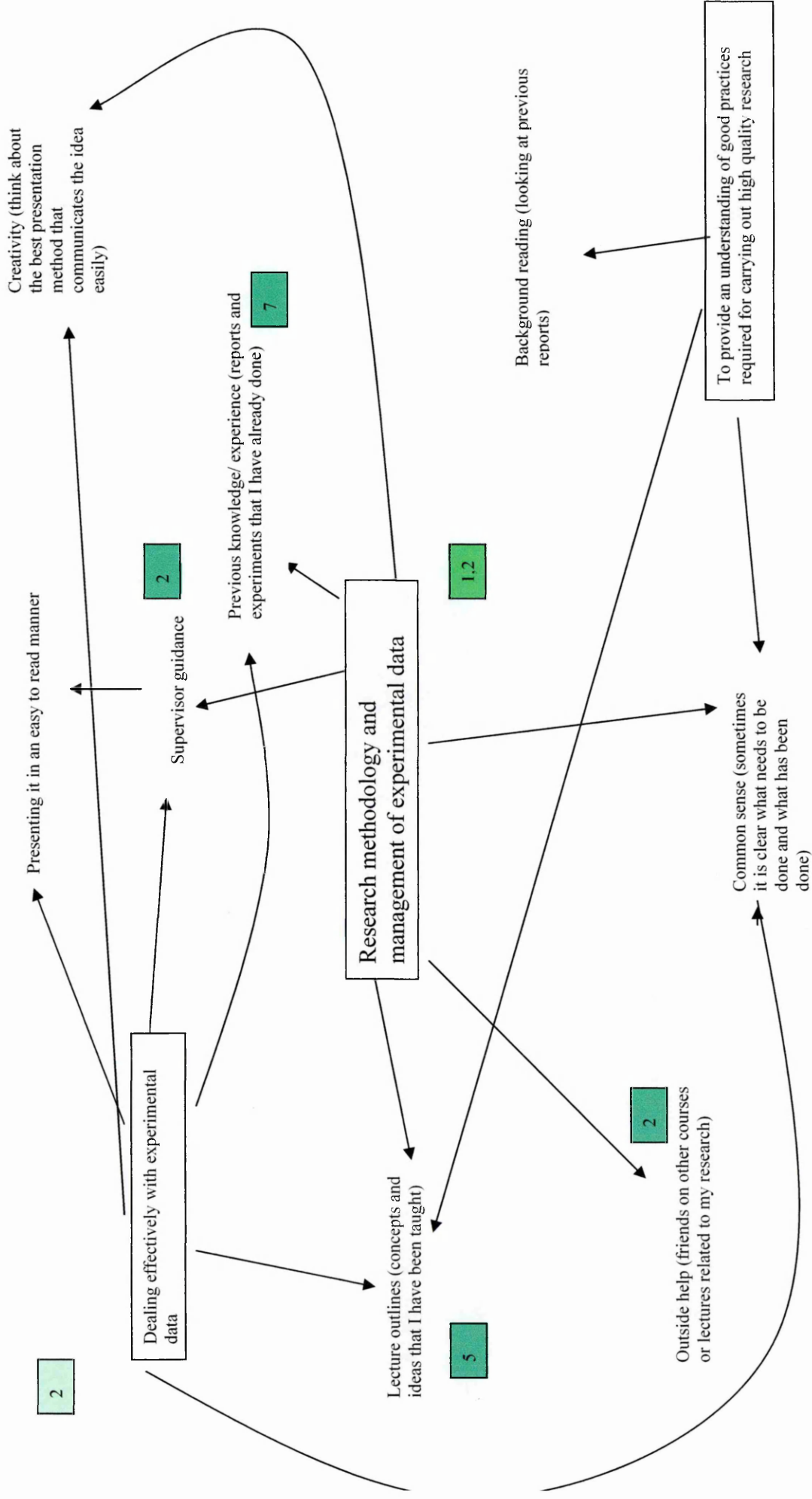
**Box 5.3 continued:**

Students from level 3-4, at Institution 4 feel that they are mostly developing their communication skills mainly through practice. They feel that this course will develop their confidence, that it is using both their technical and more transferable skills and that eventually they will become independent learners. They also seem very aware of previous experiences in which they have enhanced their technical and transferable skills knowledge and which they are building upon at a more advanced level. These views are also reflected through additional focus group comments.

Niall's approach to completing his mind map, figure 5.3 was holistic with relationships identified between objectives. He also recognised the impact of experience on his current development and how it might influence his future development within a professional environment. His reference to developing transferable skills was not as significant as towards developing technical skills, but his views relate very much to understanding, indicative of adopting a deep approach to learning. The majority of views communicated by level 3-4 students are similar to those expressed by Niall.

**Box 5.3 continued:**

**Figure 5.3, mind map produced by Niall, Institution 4**



The questionnaire responses from level 3-4 students, at Institution 1, which can be located in table A3, Appendix 2, indicate the majority of students recognise a wide range of skills being developed during the course, especially teamwork, communication and leadership, (implying that they are beginning to appreciate the different roles within a team). Most students also reflected upon developing skills through actually “having a go” and by being given opportunities to practice. They also appreciate that the course is designed to prepare them for the world of work and boost their confidence rather than being significant in terms of assessment. This perception is also made clear from the students’ final focus group session. The following examples of transcript should be viewed alongside tables 5.2.15 and 5.2.9.

- 6 “I think that you need both the theoretical and practical parts in any module, obviously it works better for some modules than others, it definitely helped me understand safety issues better”. *Related to industrial issues* “I think that I can do that in theory and practice now, which I couldn’t before.” *Developing confidence*
- 4 “But some things were emphasised more than other aspects”.
- 2 “I think that it was more about working together and meeting the deadlines” *working as a team is important...* “Well, it was both really wasn’t it, but all the technical stuff we did before, the last week was definitely more about working together and collective responsibility...”

A sample of analysed data obtained from Roger, a level 3-4 student, has been shown as Box A6. Roger seems to appreciate the value of transferable skills within a professional context, and is able to internalise his understanding of transferable-skills education. He is also looking to take more ownership of his development.

## 5.6 Summary

Overall, analysis of the data suggests that the level of undergraduate study has a greater impact upon students’ perceptions of learning than the approaches used to teach skills. For example, students seem to develop greater awareness of the relevance of transferable skills as they progress throughout the curriculum. Further implications,

from having analysed the data, are presented and expanded upon in Chapter 6. These are discussed in terms of how well they enabled me to address the research questions (Chapter 3).

## Chapter 6

### Discussion and Conclusions

The discussion in this chapter is focused upon what the students themselves have said about their learning and development i.e. what the data suggests. Analysis of data has required me to make 'judgements' which I have done so in relation to how grounded theory has been applied throughout this thesis, (c-f Section 4.1) and in relation to the conceptual framework that I have used, (c-f Chapter 1). Some of the findings were unexpected, contradicting my own assumptions about skills development, especially in terms of how students perceive their learning.

Based on the data gathered and their subsequent analysis/interpretation, a model of curriculum development which supports transferable skills teaching in Higher Education is suggested. The model is presented as Figure 6.3 in this thesis. The model was developed from an understanding of skills development in the context of chemical engineering education at undergraduate level.

Within a grounded theory approach, the quality of data analysis depends upon saturation of categories, which in turn depends upon the nature of categories formulated and the questions asked initially. The questions asked using case study tools have been addressed in chapter 4. In retrospect, it could be suggested that those questions asked of students were not probing enough, in terms of variety of questions asked because they could have provided greater breadth, although a number of tools were applied and the data obtained provided an in-depth picture of skills development. The findings reflect a number of strategies and approaches used by students to

develop their transferable skills. The data have yielded a number of interesting findings which have enabled me to address the research questions proposed in Chapter 3. Reflection is offered upon how comprehensively these questions have been answered in the following sections.

## **6.1 Answering sub-question 1**

*What constitutes effective development of transferable skills amongst students?*

To answer this question, it is important to re-visit the definition of transferable skills, (Chapter 2). It is argued that they are ‘employment-based skills’. Therefore effective development of transferable skills would, to some degree be indicative of students appreciating the value of skills training in their professional environment. Analysis of the data shows that the majority of students consider effectiveness differently at different levels of their undergraduate studies and do not relate effectiveness with professional development until towards the completion of their undergraduate degrees. For example, level 1 students mainly judge their success in terms of assessment criteria and passing exams. An example of this can be seen in Box 5.1, Chapter 5 which shows samples of data obtained from representative comments in the sample group. They also demonstrate an atomistic approach to their learning, course objectives are perceived as individual units which do not relate with one another. Figures 5.1 and figures A.1-3 show how few are the links between objectives in the mind maps completed by Cara, Lewis, Rachel and Scott. Reference is also made to what students have “been told”, and “are allowed to do” which implies a teacher-centred approach, which in turn might suggest an inexperienced approach to teaching (Willcoxon, 1998). Examples of this perception are in Boxes 5.1 (Chapter 5) and A3 (Appendix 2) which show samples of data collected for Cara and Scott.

In the later years of their education students seem to learn more through experience, (e.g. Box 5.3 and Figure 5.3, chapter 5). Niall has repeatedly mentioned experience as a factor in supporting his learning. There is a strong implication that students at this level contextualise their learning in terms of personal meaning. They do not, however, begin this way. As can be seen from Box A1 and Figure A1, (Appendix 2), Lewis does not mention experience as a contributory factor in supporting his learning.

## **6.2 Answering sub-question 2**

*What are the underlying factors that account for student perception?*

There appear to be two main factors influencing student perceptions: mode of assessment and student motivation. Assessment seems particularly important during the first part of the students' education - during which the majority indicate that they measure success in terms of assessment and exam marks. Students seem to be dependent learners at this stage which is a finding recently reflected in a report produced by the National Audit Office, (2002). The findings from the report suggest that:

In the current environment of school and college tables, students tend to be 'spoon-fed' for longer, and are less equipped with individual and self-learning skills

NAO, 2002, p.15

Towards the end of their undergraduate degree course, students are less concerned with assessment and more concerned with understanding through application and personal development; they show signs of being considerably more autonomous in their learning. It can be argued that students are also more motivated to learn by their final year as their focus shifts to their future employment. They seem to have a better comprehension of what it means to develop skills and why such development is

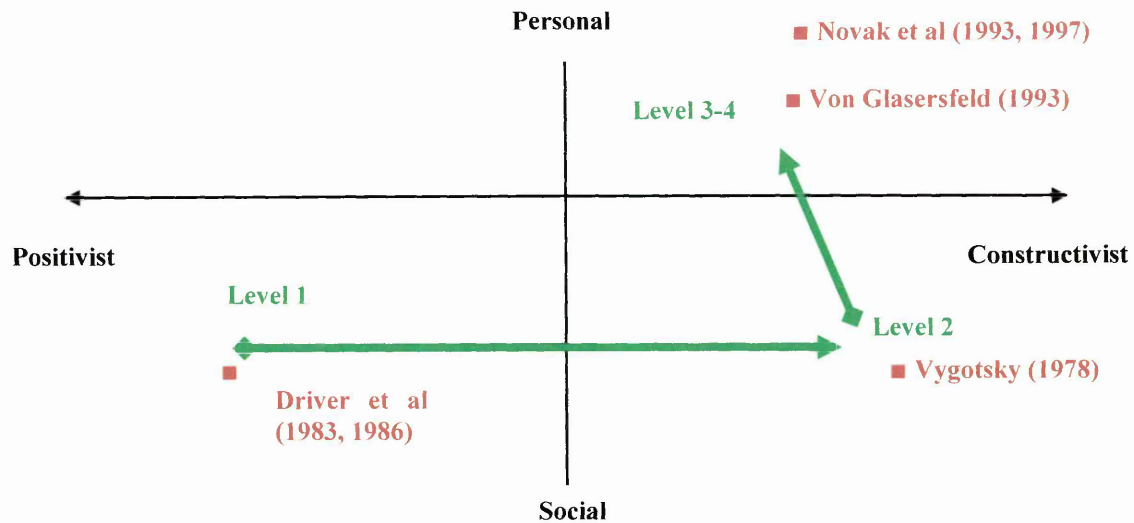


relevant, whereas students at lower levels of their undergraduate studies were unable to appreciate and articulate their development of skills and its relevance. Seifert (2004) suggests that the development of understanding in learning is proportional to the development of motivation. Final-year students are able to relate their development very specifically to employment and the appropriate application of the skills for achieving personal and professional goals. Although an implicit relation between meaning and motivation is suggested, with further research it may be possible to establish the exact nature of this connection. Students were not asked specific questions about motivation in learning as the assumption was made that they would have found such questions too difficult to answer in the time they were given.

### **6.3 Answering sub-question 3**

*To what extent does a constructivist learning theory enable me to understand the process through which students develop transferable skills?*

The results indicate that students develop their transferable skills by constructing meaning and by personalising their development within context. Hence, the majority of views expressed by students are supportive of a constructivist framework of learning. It is acknowledged that there are different forms of constructivist learning theory. Part of the concern was in defining exactly where my interpretation of constructivist theories lie in relation to the learning approaches and perspectives of students. Such concerns are not uncommon, (Matthews, 1997; Geelan, 1997). Figure 6.1 depicts the influence of a constructivist theory of learning upon students' development of transferable skills, as interpreted from the data.



**Figure 6.1: Schematic representation of students' learning patterns in relation to constructivist learning theory**

**Level 1:** students position themselves in a positivist-social domain at this stage of their undergraduate study. Students seem to have an 'expectation' with respect to their learning, that there are answers which they will be led towards by trusting the lecturer. Students at level 1 perceive their learning as group based and there is an awareness of social interaction in supporting learning. Geelan (1997) suggests that Driver's work in the early 1980s falls into this domain, Driver et al (Driver and Erickson, 1983; Driver and Oldham, 1986). It is suggested that Driver et al argue in favour of a seemingly constructivist curriculum based on learning through social interaction. Their research was concerned with science education, although their perspectives suggest an acceptance of science knowledge rather than construction of understanding.

First, we accept the conventional wisdom that the formal learning of science in schools ought to involve not only gaining an acquaintance with the phenomena of the natural world; it should also involve learning about the theoretical entities which have become accepted within the scientific community.

Driver and Erickson, 1983, p.37

**Level 2:** transferable skills development tends to fall into a more constructivist-social domain at this stage, governed by ‘Vygotskian traditions’ of learning. The shift in the role of the learner is better understood through reference to Vygotsky’s zone of proximal development (Vygotsky, 1978; Wertsch, 1985, Hedegaard, 1996) which “characterises mental development prospectively” (Vygotsky, 1978). He defines the zone of proximal development as:

The distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers  
Vygotsky, 1978, p. 86

Wertsch’s (1985) suggestion that the zone of proximal development is jointly determined by the learner’s level of development and the form of instruction involved is particularly significant. The implication of a relation between development and instruction has been corroborated through findings presented here, (for example, see section 5.4). The notion of peer tutoring is alluded to by Mohammed, via the comments made on “people helping us”. It is a level of ‘instruction’ which comes from both the teacher and peers.

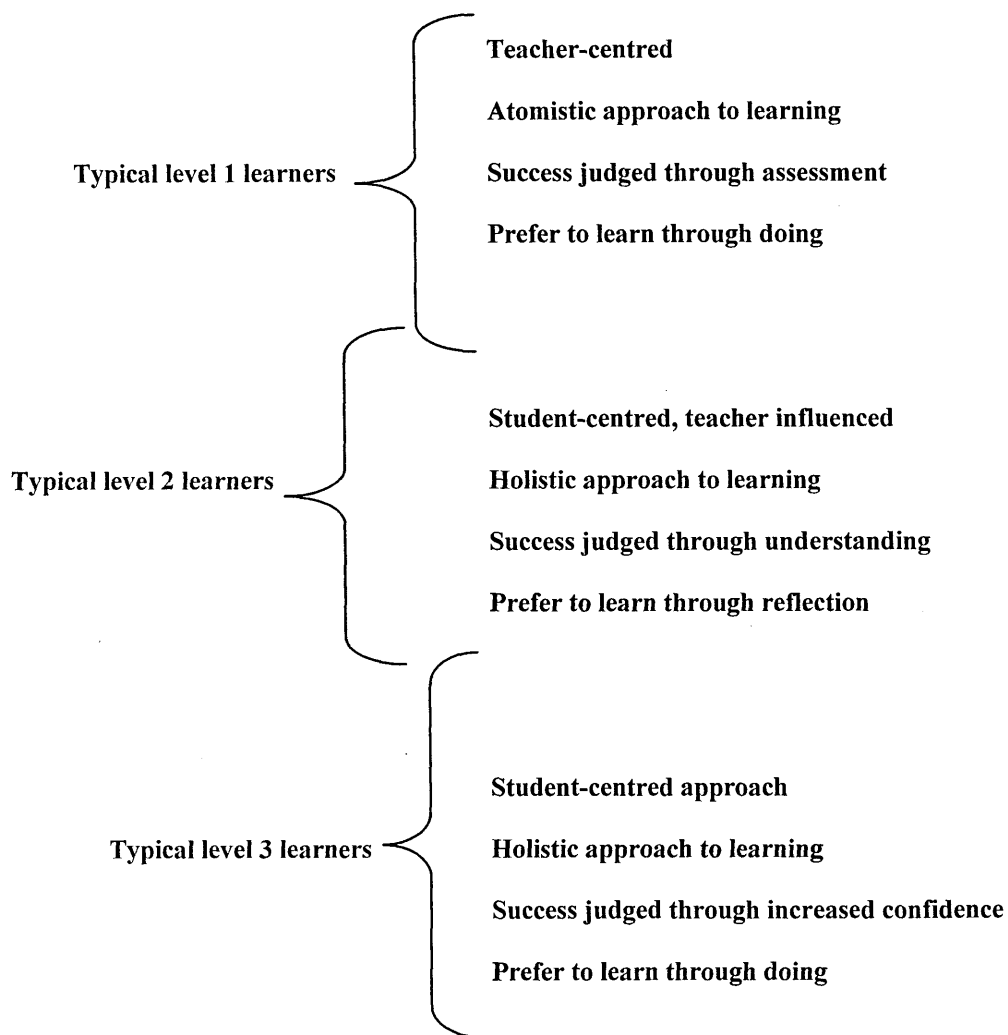
**Level 3-4:** the last phase of Figure 6.1 leads to a more personal view of learning in which students ‘measure’ their development against personal criteria and work from their own experiences. At this juncture, findings from research data suggest that student learning behaviour is typically somewhere between radical constructivism (von Glasersfeld, 1993; Bettencourt, 1993) and human constructivism (Novak, 1993; Mintzes, Wandersee and Novak, 1997). The ability of students to develop transferable skills through reflection becomes almost ingrained and there is little indication of

facilitated reflection anymore. For example, table A3 indicates the majority of students comment upon “use of experience” as a learning method, without adding “reflection on experience”. Students seem to use their experiences and contextualise their learning on the basis that they are responsible for their learning, (human constructivism). At the same time as deriving meaning in this way, students make their learning entirely their own (radical constructivism). Both these constructivist traditions support social interaction as a way of fostering conceptual change, encouraging but not directing the learner.

#### **6.4 Answering the Central Research Question**

*What is the pattern through which students develop transferable skills?*

Analysis of the data suggests that there is a considerable change between levels 1 and levels 3-4 during which students shift from a teacher-centred approach (what they are told, allowed to do) to a more student-centred one (responsible for their own learning). The shift has been identified by Trigwell and Prosser, (1996) and Trigwell and Shale, (2004) whose work reflects a changing need in academia to accommodate a more student-centred teaching approach. It is perhaps interesting to note that a huge discrepancy between first and third year responses was also found by Haigh and Kilmartin (1999) in their studies of geography students. It might therefore be possible to argue that level of study has a greater influence on students’ learning patterns than discipline, though further research would be needed to establish the strength of this assertion. Figure 6.2 is a schematic representation of students’ learning patterns identified from the data.

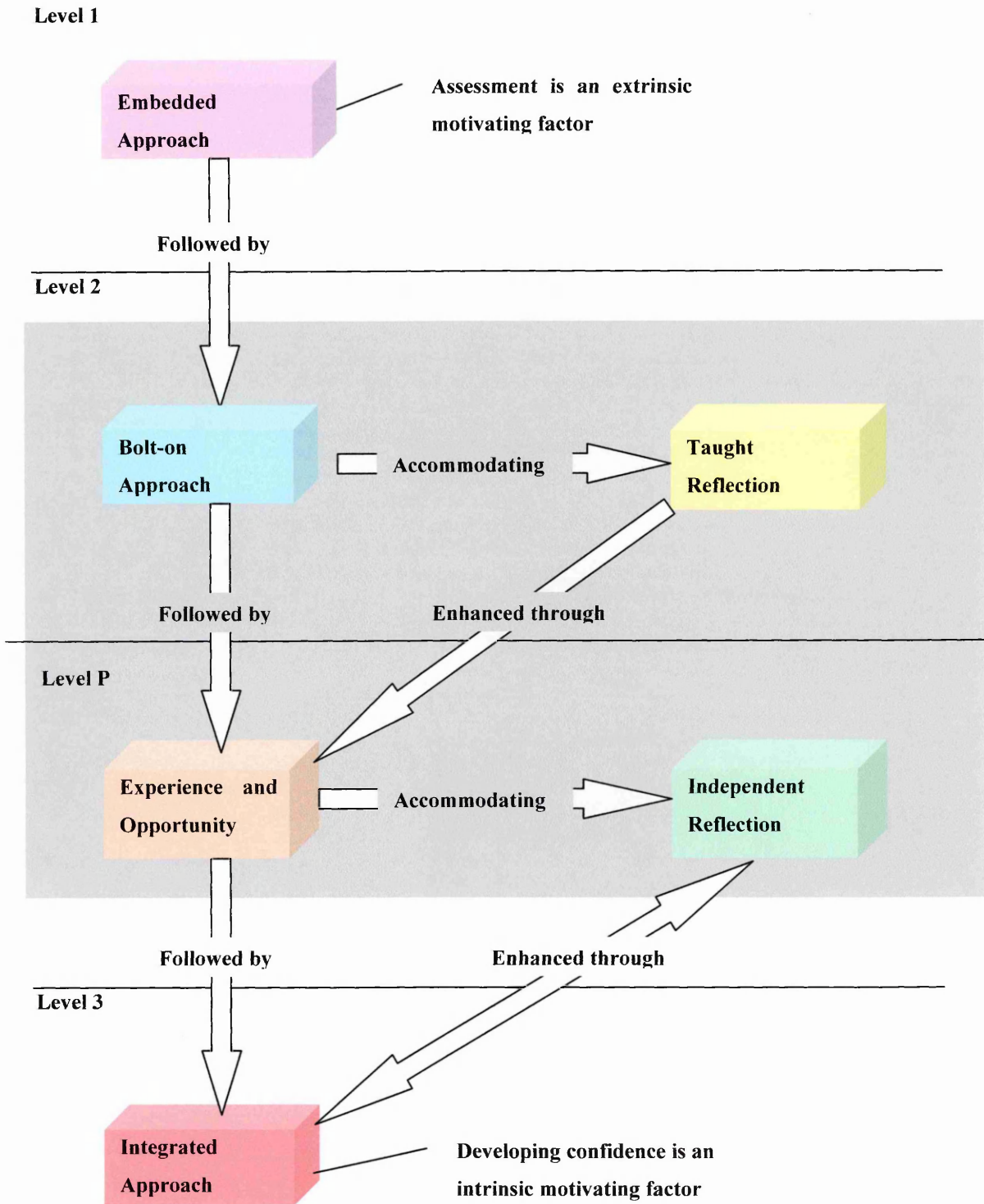


**Figure 6.2: Schematic representation of students' learning patterns in relation to levels of undergraduate study**

Figure 6.2 suggests that both typical level 1 and typical level 3 learners prefer to learn through doing. This is an interesting finding and may be related to the teaching approaches used at level 1 which were mostly bolt-on for teaching transferable skills. It should also be pointed out that the level 1 course from Institution 1 used in this research, although embedded in its approach, encourages a culture of discovery learning.

## **6.5 A Model of Teaching Skills to Undergraduate Engineering Students**

Having addressed the research questions, and developed my understanding of students' strategies for developing transferable skills I propose a model to accommodate the various learning strategies described. The model proposed is presented as Figure 6.3. Data suggest that students' learning experiences are more influenced by their current levels of undergraduate study than by the teaching strategies used. As such, the model is suggestive of a cause and effect scenario; it reflects the notion that changes in level of undergraduate study are directly proportional to changes in learning strategies and therefore should influence teaching strategies.



**Figure 6.3: Model for Teaching Transferable Skills to Undergraduate Engineering Students**

Level P – placement year  
 Boxes – main considerations in model  
 Area shaded grey – most significant stage of student changes

### 6.5.1 Explaining the Model

The model shown as Figure 6.3 represents an idealised teaching approach, based upon student perceptions of development, for developing transferable skills in students in Higher Education. The model is based on interpretation of the approaches and strategies which students themselves have identified as contributory to their learning. I have investigated students' perceptions of learning (rather than teacher perceptions of teaching) to construct a model which should be more informative than one derived exclusively from teaching perspectives. Research conducted by Case and Gunstone (2003) in engineering education highlighted the advantage of investigating the students' perception as it both "described differences in students' experiences for explaining differences in learning outcomes, and for suggesting constructive teaching methods". The model (c-f page 6-10) highlights the explicit approaches to optimise teaching of transferable skills throughout an undergraduate engineering curriculum.

It is important to mention the stage students are at in their learning when they enter Higher Education. Although the data do not account for their position prior to tertiary education: literature suggests that there are gaps between secondary and tertiary education. Hacker and Rowe's (1997) work suggests that teachers in secondary education use informational instruction strategies rather than those which are more inquiry based. They view this as a growing concern as it ill-prepares the student to develop responsibility for their learning in Higher Education. Pargetter et al (1999) also identify a significant leap in the transition from secondary to tertiary education. They argue that transition facilitation is necessary and even though their research is based on the Australian education system, it also appears to be applicable to UK



education as there is also a perceived gap between secondary and tertiary education, (Kinchin, 2005).

Figure 6.3 shows an embedded approach is suggested as the starting point, for students attending level 1 of their undergraduate degree course. Students seem to value assessment as a criterion for judging success at this stage; therefore it is suggested that there is little need for making them aware of the skills agenda since it is not related to assessment criteria. Fieldhouse's (1998) suggestions that implicit teaching techniques which develop skills are useful for enhancing the teaching-learning environment by forging learning links and developing a broad range of skills are of interest here as they form a framework. Students are still capable of developing skills, even though this development may not be explicit and therefore it is important that an embedded approach be considered at this stage.

The most significant stages in the model are those shaded grey as they represent where the greatest changes in students 'attitudes and behaviours' occur. The inclusion of a bolt-on component is a 'high priority' in this model because it enables students to develop awareness with respect to their learning. It also echoes the suggestion of Drummond, Nixon and Wiltshire, (1998) that this approach enables the value of skills development to be made explicit in addition to providing a varied learning experience for the students. It is the explicit nature of this development which is identified here as significant. Analysis of data suggests that this approach to teaching incorporates developing reflective practice in the students. The notion of taught reflection and its influence on the development of transferable skills is highlighted by the sample of data made available by Mohammed, (Box A4, figure A4). The other necessary

component of the model is inclusion of a work-based placement, (represented in figure 6.3 as level P), as being ideal for providing an opportunity for students to build a portfolio of experiences. The impact of the placement year can be established from responses of students at level 3 of undergraduate study. All the students at level 3 from institutions 1 and 4, that took part in this research, completed professional placements, as did three students from Institution 3.

Teaching skills using an integrative approach is seen as an accepted strategy within skills education, (Kemp and Seagraves, 1995; Atlay and Harris, 2000). De la Harpe and Radloff (2000) suggest that transferable skills are more likely to be developed when they are integrated into regular course work and taught by the subject teacher. The emphasis on developing skills through an integrative approach is also present during placement opportunities, (Humphreys, Greenan and McIlveen, 1997). By building upon this strategy in the final year, the findings from my data suggest that students contextualise their skills and develop awareness of the significance of transferable skills. Again, reflection forms a significant part of the teaching framework, but students at this stage are increasingly seen as self-taught. There is a cyclic relationship between the integrated approach and independent reflection in which students take responsibility for their learning and through reflection, opportunity and experience, continue developing their skills.

### **6.5.2 Issues of the Model**

The model produced may not be applicable to other academic disciplines on the basis that the findings which inform the model are very context specific. The focus of this research has been exclusively upon engineering, more specifically chemical

engineering. It is not possible to extrapolate to the teaching approach one would need to take in other subject areas and disciplines. The model does not attempt to understand transferable skills development during work-based placement. Although a number of students refer to it as an integral part of their development, the research did not go so far as to establish why it was so successful or what specific difference it made. Smith and Wilson (1992) also suggest that students themselves consider a work-based placement as the singular most important learning experience for developing skills, although their findings were based upon students undertaking business management degrees. There is however, substantial literature available on the benefits and shortfalls of such an experience (Smith, Wolstencroft and Southern, 1989; Humphreys, Greenan and McIlveen, 1997; Bennett, 2002). It may be advisable to establish the exact benefit of the placement year as an area for further study.

It is important to recognise and respond to the limitations of this model. As Fallows and Steven (2000) claim repeatedly

There is no universal skills development model that suits the entirety of Higher Education, or even the entirety of UK Higher Education. The sector is populated by independent institutions with individual identities and inspirations.

Fallows and Steven, 2000, p.11

Their argument centres upon the different contexts in which skills are considered (c-f Chapter 2) and the individual differences between institutions and disciplines in Higher Education. Although there are limitations, some of which are mentioned, there was substantial collaboration in obtaining the data.

### **6.5.3 Using the Model: the Role of the Academic Practitioner**

Assessment has previously been highlighted as problematic in the development of transferable skills (c-f Chapter 2). It is an important criterion to consider in terms of the model which has been produced. Students' views of assessing their skills seem to change throughout the curriculum; assessment of skills becomes more about 'self-realisation' especially towards students completion of their undergraduate studies. Assessment therefore should incorporate evaluation and reflection - as opposed to grades and pass marks - for it to be useful in developing individual meaning of transferable skills for students. Work carried out previously by Davis, McCarty, Shaw and Sidani-Tabbaa, (1993) suggests that appropriate modes of assessment present a concern for teaching which supports a constructivist learning framework. Tynjälä's (1999) research on comparing traditional with constructivist learning environments in Higher Education concurs with this notion of changes in assessment as one of the most fundamental required in accommodating a shift from one learning environment (traditional) to the other (constructivist). The model, Figure 6.3, may be considered as actively supporting Biggs' (1996) argument for constructive alignment. The implication is that assessment criteria needs to be re-considered, as students progress throughout the curriculum in line with adopting different teaching strategies (bolt-on, integrated, embedded). Biggs' central position is that academic practitioners need to be more student-centred in their teaching-learning activities and more authentic in their assessments. The model, Figure 6.3, implies that the academic practitioner needs to incorporate an assessment framework which eventually allows critical self evaluation by the students.

The changing role of the academic practitioner also requires consideration within the context of the model, (Figure 6.3). If students perceive a shift from a more teacher-centred to student-centred approach to learning, (c-f figure 6.2) then measures need to be taken to accommodate this change, (Davis, McCarty, Shaw and Sidani-Tabbaa, 1993). The role of the educator can become pivotal to the learning process and requires definition as it influences the role of the learner (Watts and Zofili, 1998). Seifert (2004) also argues that to increase motivation for student learning (developing meaning), the changing role of the educator is a contributory factor.

Teachers who are perceived as being nurturing, supportive and helpful will be developing in students a sense of confidence and self-determination which will be translated into the learning-orientated behaviours of the intrinsically motivated student.

Seifert, 2004, p.148

Recognising and responding to the learner in this way is also seen as moving towards supporting a constructivist paradigm of learning in which the student is seen as constructing their understanding.

## **6.6 Recommendations and Future Work**

Even though the proposed model, (Figure 6.3) is context specific, (c-f section 6.5.2), it is simple, highlighting the main concepts and their relationship to one another without using technical jargon. It is therefore possible that it could be tested in other discipline areas. It would be interesting to extend this research by testing the model within different discipline areas in Higher Education: e.g. nursing, dentistry and medicine as they are all vocational disciplines. It would also be interesting to see if the model could be adapted to suit requirements in other less vocational disciplines. One should also consider what happens when graduates gain employment, and whether the pattern of development continues or changes is also a matter that requires further

investigation. It is argued by Bennett, Dunne and Carré (2000) that there is a mismatch between the skills new graduates believe they have and those employers believe they have this result in job dissatisfaction due to insufficient developmental opportunities. It would be useful to investigate such a claim and whether there are still gaps between what Higher Education achieves and the expectations of employers. As was previously argued (c-f Chapter 2) the responsibility for students developing transferable skills lies increasingly with Higher Education. Is it still the responsibility of Higher Education to establish the exact nature of the gap between industry and themselves in terms of skills and address that gap, or should industry take responsibility for moulding new recruits to further develop the skills they have gained from Higher Education?

As previously argued (c-f Chapter 2) implementing transferable-skills teaching in the curriculum is highly problematic for the academic practitioner. De la Harpe and Radloff (2000) have argued that the attitudes and beliefs of academic staff about their roles and responsibilities and general conceptions of teaching and learning are at the heart of effective change, though proximal goals (actions) may need to be the initial focus of change before distal goals (beliefs) may be challenged (Guskey, 2002). It is important to be aware of these current perceptions. I aim to evaluate the impact of the work I have conducted within Higher Education and especially the response of those who teach in this arena. Does it truly make a difference and if so how much of a difference? The question posed is also an important one in light of more recent Government instigated changes which will have a significant impact upon Higher Education, (DfES, 2003b). Lomas (2004) suggests that the proposed changes may result in this notion of “the student as a customer” and that the academic community

may witness a shift in balance of power between themselves and the undergraduate community. Research suggests that the numbers, socio-economic status, cultural background, experiences, needs and aspirations of students are undergoing change with the shift to mass Higher Education systems, (Gordon, 2002). The Dearing Report (Dearing, 1997) also highlighted this emergence of “the student as a customer”, although it is argued that if lecturers treated students as customers and provided what they wanted, then this would often fail to provide students with the necessary learning experiences, (Lipsett, 2004). The perceived shift may help or hinder the agenda for developing transferable skills. It is difficult to determine at this early stage, but one thing which can be said with confidence is that the skills debate is here to stay.

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# Appendices

## **Appendix 1:**

Sample material produced by the TRANSEND Project

## **Appendix 2:**

Samples of Data

## **Appendix 3:**

Samples of Raw Data

## **Appendix 4:**

Code used for Observation Data

## **Appendix 1:**

Sample material produced by the TRANSEND Project

## Example of building in Communication Skills

### Discussion Groups

#### Brief Description

Students undertake structured discussions of specific issues under staff guidance.

#### Skills Developed

Compromise  
Consensus  
Listening  
Stating own view

#### Words of Wisdom

Train your facilitators.

Involve everyone in the discussion.

Ensure that criticisms are expressed positively.

Be clear in your objectives.

For examples of **Communication skills** as an element of good practice,



### Application of Discussion Groups

#### Modules in which this element of good practice is employed

Level 2: Leadership, Teamwork & Communication Skills  
Personal Skills Development

- 1 -

#### Personal Skills Development

Description: students are provided with a framework in which to discuss

## Example of Experiential Learning technique

### Challenging Environment

#### Brief Description

Students undertake activities/tasks that are designed to test skills already acquired under more extreme conditions allowing them to develop these skills further.

#### Skills Developed

Learning through doing  
Learning through experience  
Working under pressure

#### Words of Wisdom

Ensure that you have clearly defined learning aims and objectives.

Remember that what is challenging to one individual is easy for another and impossible for the next.

For examples of **External input** as an element of good practice,




### Application of Challenging Environment

#### Modules in which this element of good practice is employed


Level 2: Effective Teamwork Through Projects  
Leadership, Teamwork & Communication Skills  
Level 3: Process Engineering Operations & Management

- 15 -

	<b>Postgraduate Tutoring</b>	28
		29
	<b>Example of using Peer Tutoring</b>	30
		31
	<b>Debriefing</b>	32
	<b>Material on Questions</b>	33
<b>Brief Description</b>	<b>Words of Wisdom</b>	
Students/staff tutors chair structured discussions which review performance with respect to specific activities/tasks, highlight strengths and weaknesses and determine further learning objectives.	Provide training for student tutors.  Team student tutors with experienced tutors who can provide advice and guidance.  Emphasise the need to make debriefs constructive and their importance in the learning process.	
<b>Skills Developed</b>		
Assessing capability of others Facilitating discussion Summarising discussion	Ensure all debriefs are summarised – that key learning issues are identified and that areas for further development are highlighted.	
		For examples of <b>Peer tutoring</b> as an element of good practice, 
	- 25 -	

**Application of Debriefing**

Modules in which this element of good practice is employed

	<b>Design Project Teams</b>	44
	<b>Design Project Teams</b>	45
		46
	<b>Example of using Student Teams</b>	47
	<b>IS</b>	48
	<b>Teams</b>	49
		50
		51
		52
<b>Case Study Teams</b>	<b>Words of Wisdom</b>	
<b>Brief Description</b>	See comments relating to <b>Changing Teams/Single Teams</b> as appropriate.  Ensure that the case study provider has a solution to the case study problem regardless of whether the case study was manufactured or based on an actual problem or event.	
Student teams are presented with a case study problem that they have to solve. This may be part of a workshop, an industrial presentation or a conventional lecture. Case studies should be examples of 'real' problems for which the students are given background information and for which they should develop a potential solution. Ideally the case study should be based on an actual problem or event.		
<b>Skills Developed</b>		
Creative thinking Problem solving Teamworking		
		For examples of <b>Student teams</b> as an element of good practice, 
	- 40 -	

**Application of Case Study Teams**

Modules in which this element of good practice is employed

## **Appendix 2:**

### **Samples of Data**

## **Appendix 2**

### **A2.1 Sample Data and Analysis: level 1, Institution 2**

**Background to course:** At level one, a 2-week intensive course entitled Computer Aided Process Engineering was studied. A teaching approach initially focused upon the exclusive development of students' transferable skills and was followed by the completion of a project which relied upon integrating both technical and transferable skills. During interview the course provider identified the following teaching methods and ideas currently being used to enhance the development of transferable skills: a systematic approach to problem solving, using large groups for teamwork training, regular reviewing of skills development by individuals and groups, experiential learning, and sharing experiences. Initially students were divided into teams of eight to build the team dynamics and to develop teamwork skills, the teams were then divided into groups of four for the actual project work. Students carried out tasks in which they were given opportunities to develop their presentation, charting, planning, and timekeeping skills and then shared experiences with the remainder of the peer group. Having identified the skills development after training, students assessed their own performance and how well they were working in their teams during debriefing and reviewing sessions.

**Sample data from course:** Box A1 represents views obtained from Lewis at level 1, Institution 2.



From the mind map completed by Lewis, Figure A1, it can be seen that although he was able to comment upon each of the objectives, he was unable to make connections between them on his mind map. There is a visible absence of lines between objectives on the mind map. The following example is an excerpt taken from a follow-up interview conducted by Lewis. The categories and associated codes identified should be viewed in relation to table 5.2.1.

Lewis level1

“I think that the emphasis is on the team and how good we are at developing our teamwork, and presentation skills. I think that the project is just a way of getting us to develop these skills, it’s not really that important.” *Aware that course is about developing skills.*

4

The following example is a questionnaire question which Lewis answered. The categories and codes which emerged from data collected from questionnaires are shown in table 5.3.4.

**Questionnaire question: do you think that this course contributes to the learning of transferable skills?**

Lewis’s response

“Yes because there are lots of teamwork projects, but not much teamwork as yet”. *Recognises the importance of developing the skills.* “I think it helped us understand corporate ways of working.” *Becoming aware of the importance of teams.*

2, 5

### Box A.1: Samples of data gathered for Lewis

The comments made by Lewis in the follow-up interview session, reflective of *being more aware of the teamwork process* are also seen in similar comments he has made when completing a questionnaire. The two subcategories have been applicable to Lewis’s comments even though they are very similar.

4

Tool – interview

Category – approach to learning

Sub category - what students have been made aware of in their learning

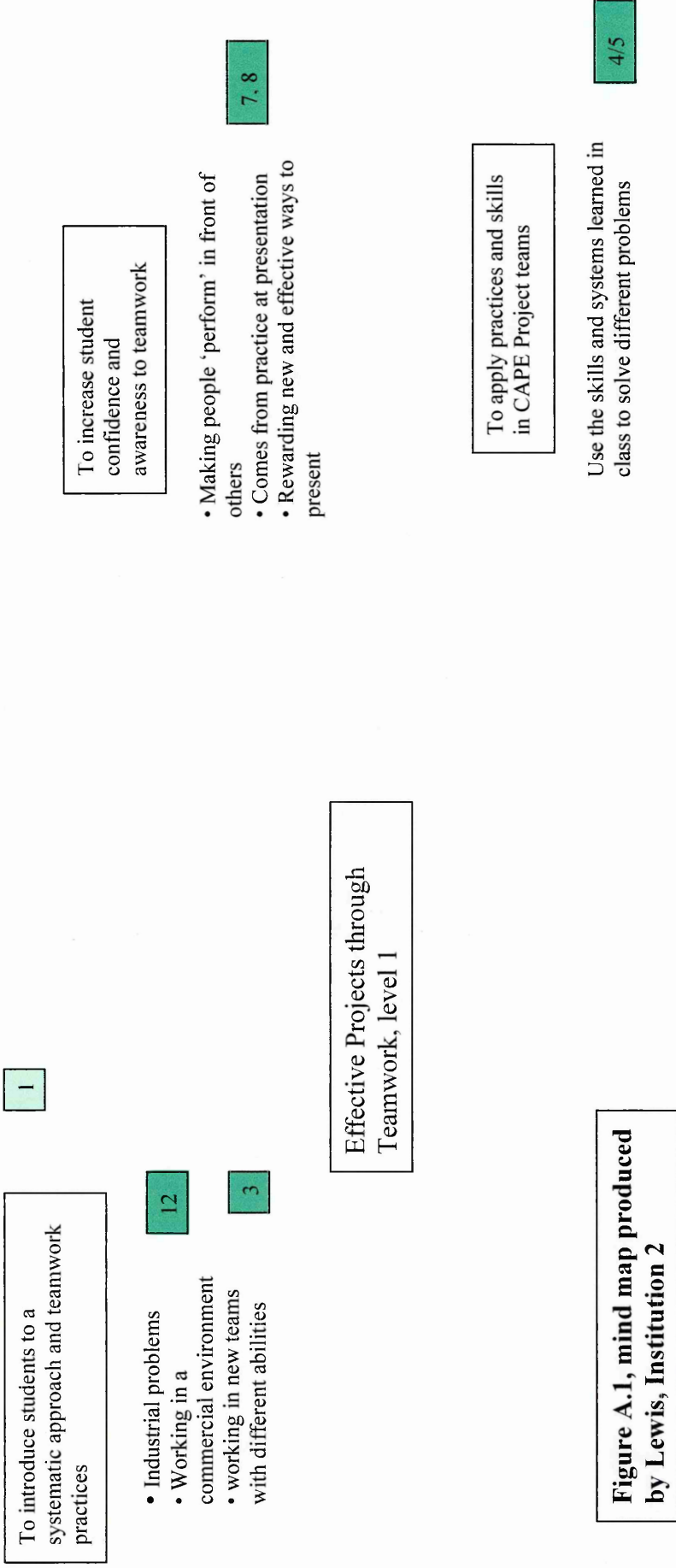
2

Tool – questionnaire

Category - identifying whether skills teaching is present in course

Sub category – building awareness

The cross over between sub categories would be expected as it provides corroboration of views irrespective of tools used and represents a good example of triangulation.



	Identification of skills	Learning methods	Structure of skills development	Judging success
Ify	To be able to work with others patiently and accept other people's ideas <i>Teamwork mentioned</i> 5	In practicals, labs and by doing <i>Experiential learning</i> 1	I think it is different from the undergraduate teaching because we normally work alone than in groups 2	By the mark I achieve in the project. 3
Costas	Develop teamwork 5	Not through the outward bound event, teamwork will develop over the years <i>Development progressive</i>	It is one small step. It was an interesting alternative to lectures	If we get a good grade at Cape 3, we are successful 3 <i>Assessment criteria</i>
Sana	To make everyone taking the course gain presentation skills, confidence to speak their ideas, people skills 3, 5 <i>Communication and teamwork</i>	Through different situations where we all have to use and improve them 1	Yes, it will definitely reflect our attitude to all further interactions with curriculum and extra curricular activities 6	My overall improvement in skill and problem management. 2
Juan	The aims of the course we did were to learn techniques to work, communicate and to always have a say in any teamwork 3, 5	By doing many projects and to look back at what we did on the programme <i>Reflection important</i>	Yes, but not this year. For third year would be very important when we do the research project. 5	When anything that I do as a course work in teams gets a good qualification and the group is pleased with the final product will look. 3
Roberto	The aims is to show us that teamwork is not easy and to provide us with tools to improve our teamwork. These skills, we should be able to use them everywhere 5	By assigning us tasks in which we have to apply teamwork skills 1 <i>Experiential learning</i>	Yes, it does fit	Very good, even though I didn't agree with everything that was said, I did learn many useful skills. 2
Lewis	Team working, aims quad 5	Practice 1	Lots of teamwork projects, but not much teamwork as yet. I think it helped us understand corporate ways of working 2, 5	The CAPE 3 Project 3

**Table A1: questionnaire responses which have been categorised and codes as part of my analysis for level 1 students from Institution 2**

### **Sample Data and Analysis: level 1, Institution 3**

**Background to course:** The level 1 course was twelve weeks long and entitled 'Teamwork and Communication'. The approach used to teach transferable skills was to focus exclusively on the development of the skills. The following teaching methods and ideas were identified by the course provider as currently being used to enhance the development of transferable skills in this module: working in a tutor group, giving students problems to solve which required them to determine the scope of the problem (which did not produce a single answer) for themselves, and self analysis. Initially, students were put into tutor groups to carry out some exercises. The groups analysed themselves prior to carrying out the exercises in the course to establish their working patterns and their contribution to a team. Debriefing sessions followed the completion of each problem. A review was conducted at the end of the course, to ensure the module fulfilled its objectives.

**Sample data from course:** Box A.2 shows a sample of data collected and analysed for Rachel, a level 1 student from Institution 3

Figure A.2 represents the mind map completed by a student attending a bolt-on skills development course at Institution 3. The participant, Rachel, has taken an atomistic approach to completing her mind map and has not formed relationships between the objectives of the course. Reference should be made to tables 5.2.1, 5.2.2 and 5.3.3 to view the sub categories of relevance to mind map data.

Rachel, follow-up interview response

“I looked at all the different boxes and what sort of skills we need to deal with in each box” *considers each objective separately* “and how they could teach it to us”. *Not prepared to take ownership of learning.* “So I broke it down and that’s how I dealt with it.”

1

1

**Questionnaire question: do you think that this course contributes to the learning of transferable skills?**

Rachel’s response:

The aim of the course is to attain skills that can be used in any situation, showing that different activities require the same skills *building an awareness.*

2

Rachel also gave the following response to a questionnaire question on judging success. The following excerpt should be viewed in conjunction with table 5.2.14.

**Questionnaire question: how will you judge the success of the course?**

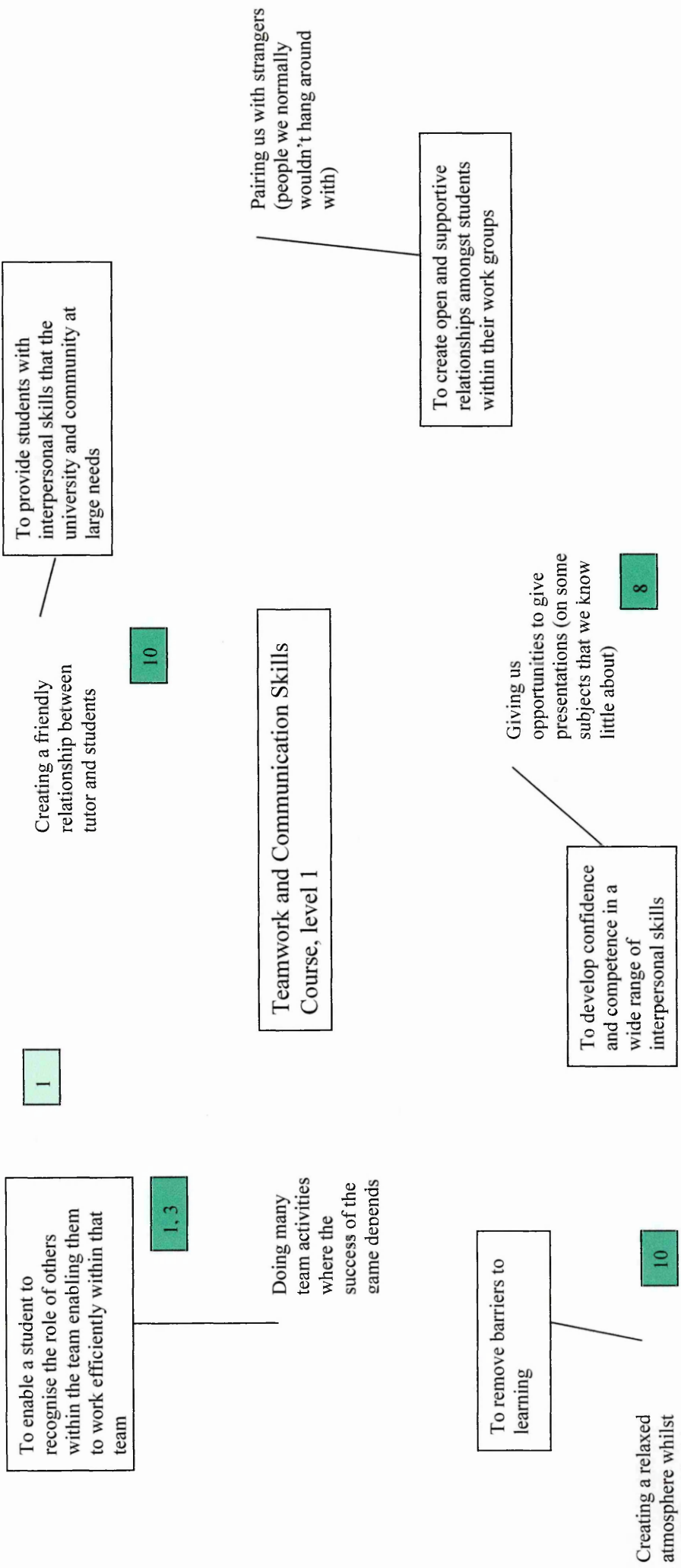
Rachel’s response:

“Improvement of group work, how effectively we can all work together”. *Teamwork seems especially important.* “How successful my final group was as compared to my first group.”

2

Rachel’s response shows that she appreciates that the course is designed to help her develop her transferable skills in such a way that there is no/ minimal assessment associated with it

## **Box A2: Samples of data gathered for Rachel**



**Figure A.2, mind map produced by Rachel, Institution 3**

	Identification of skills	Learning methods	Structure of skills development	Judging success
Mike	To build up confidence within each person so they can use their skills more freely and easily. <span style="border: 1px solid black; padding: 2px;">6</span>	Through communication skills and tutorials. Having a go! <span style="border: 1px solid black; padding: 2px;">1</span>	Yes.	If I can take any part of any module and use it in different contexts easily. <span style="border: 1px solid black; padding: 2px;">1</span>
Gareth	To teach us how to work in a group under stressful and time-limited conditions. <span style="border: 1px solid black; padding: 2px;">5</span>	Splitting us into groups and getting us to undertake tasks, <i>practice</i> and then getting us to evaluate our team skills. <span style="border: 1px solid black; padding: 2px;">1, 5, 6</span>	When working in groups during tutorials, I find myself thinking about what I have learnt. <span style="border: 1px solid black; padding: 2px;">5</span>	If I undertake the final task and by using these skills get a better evaluation. <i>Both final evaluation and skills important</i> <span style="border: 1px solid black; padding: 2px;">2, 3</span>
Rachel	Develop skills of working together as a team. Understand what is required of you when working in a team. <span style="border: 1px solid black; padding: 2px;">1, 5</span>	Lots of team tasks, repetition. <i>Practice</i> <span style="border: 1px solid black; padding: 2px;">1, 5</span>	Yes, because it's more practical than lectures etc. Team working skills learnt.	How successful my final group mark was as compared to my first group. <i>Marks are significant.</i> <span style="border: 1px solid black; padding: 2px;">3</span>
Dipesh	The objectives of this module are to improve the communication skills of the students, to help students assess themselves in terms of what they can achieve as far as working individually and within a team. <i>Evaluation within team seems significant.</i> <span style="border: 1px solid black; padding: 2px;">3,5,7</span>	By completing the tasks given to us by the lecturers. These tasks are designed to enhance teamwork as well as individual progress. Also in the form of some lectures e.g. how to make presentations, body language. <i>Learning within both formal and less formal environments</i> <span style="border: 1px solid black; padding: 2px;">1,2</span>	It has helped us acquire skills that may not be useful now, but will be very useful as we progress in our curriculum. <i>Appreciates significance of skills</i> <span style="border: 1px solid black; padding: 2px;">5</span>	The judgement of the success of the course has to be done personally on an individual basis because no 2 individuals will react in the same way to the same module. But if you feel there has been a change in your behaviour and skills in a positive way after completing the module, then that can be counted as success. <i>Assessment not significant</i> <span style="border: 1px solid black; padding: 2px;">2</span>

**Table A2: questionnaire responses which have been categorised and codes as part of my analysis for level 1 students from Institution 3**

### **Sample Data and Analysis: level 1, Institution 4**

**Background to course:** The course investigated at level 1 was twelve weeks long, entitled An Introduction to Process Design, and was taught using an integrated approach to developing transferable skills. The course provider identified the following teaching methods and ideas currently being used to enhance the development of transferable skills: team based learning, use of relevant examples to teach students about technical problem solving and assessment through a group oral presentation. Students were divided into random groups of four or five to both carry out a design project and present their project findings. In their groups, students were asked to design three sections of a process plant. Part of the assessment procedure was carried out as a technical presentation assessed by the course tutor.

**Sample data from course:** Box A3 shows a sample of data collected from Scott, a level 1 student attending Institution 4. /the data has been categorised, coded and partly analysed.



From the mind map in Figure A3, it can be seen that the participant, level 1 student Scott, makes a lot of reference to his basic knowledge and skills and refers to *knowledge being forgotten* which implies that he considers his education at this level as more refresher than progressive and looks to this course as establishing familiarity with tertiary education. He also repeatedly mentions what *he is allowed to do* which implies that he is not taking much responsibility for directing his own learning in this course and that his ability to learn is contained within certain boundaries. Reference should be made to tables 5.2.1, 5.2.2 and 5.2.3 to identify the sub categories identified and colour codes associated with them. The following excerpt is taken from a follow-up interview and should be viewed alongside table 5.2.7.

Scott's response from follow-up interview:

"...we've been allowed" *indicative of student not being responsible for directing learning* "to know certain things that we need to know in order to help ourselves do this project and we haven't been given anything too serious to deal with. We've been given a certain amount of knowledge that will allow us to pass the test" *assessment very prominent* "and do some real research for ourselves."

1/2

Similarly, questionnaire responses from Scott (level 1) can be seen in the excerpts given below. Reference should be made to tables 5.2.12 and 5.2.13 which show the coding system used to identify a number of questionnaire sub categories.

**Questionnaire question: what do you think the aims and objective are of this course in terms of developing transferable skills?**

Scott's response

"They are aiming to build our communication skills through the design project and our report writing skills are being developed in classes based solely on report writing". *Is not looking at the applicability of skills in another context.*

1, 3

**Questionnaire question: how do you think this learning will occur?**

Scott's response

"Through assignments" *judging success from course grade and feedback* "and presentations"

6

Focus group data was also obtained from students at level 1. The following two excerpts of transcript are taken from focus groups involving level 1 students at Institution 4. They should be viewed alongside tables 5.2.15 and 5.2.16.

**Focus group question: what do you think the aims and objectives of this course are?**

Level 1 response:

"The aims are basically to get us together to interact in the group and be able to express our ideas". *Seen very much as a team developing exercise* "It's very vague, it isn't that important to our course so the aim of the project is to get us all involved".

2, 5

### Box A3: Samples of data gathered for Scott

**Focus group question: how do you think these aims and objectives are going to be achieved throughout this course?**

Level 1 response:

“I think the important thing is realising that everyone does have different kinds of skills and everyone is good in different kinds of areas and especially in a group, you bring all these different ideas”. *Learning as a team.*

3, 7

### **Box A3 continued**

If the sub categories developed for Scott's responses were viewed, (Box A3) it can be seen that there is some overlap (similarities) between some sub categories. For example,

6

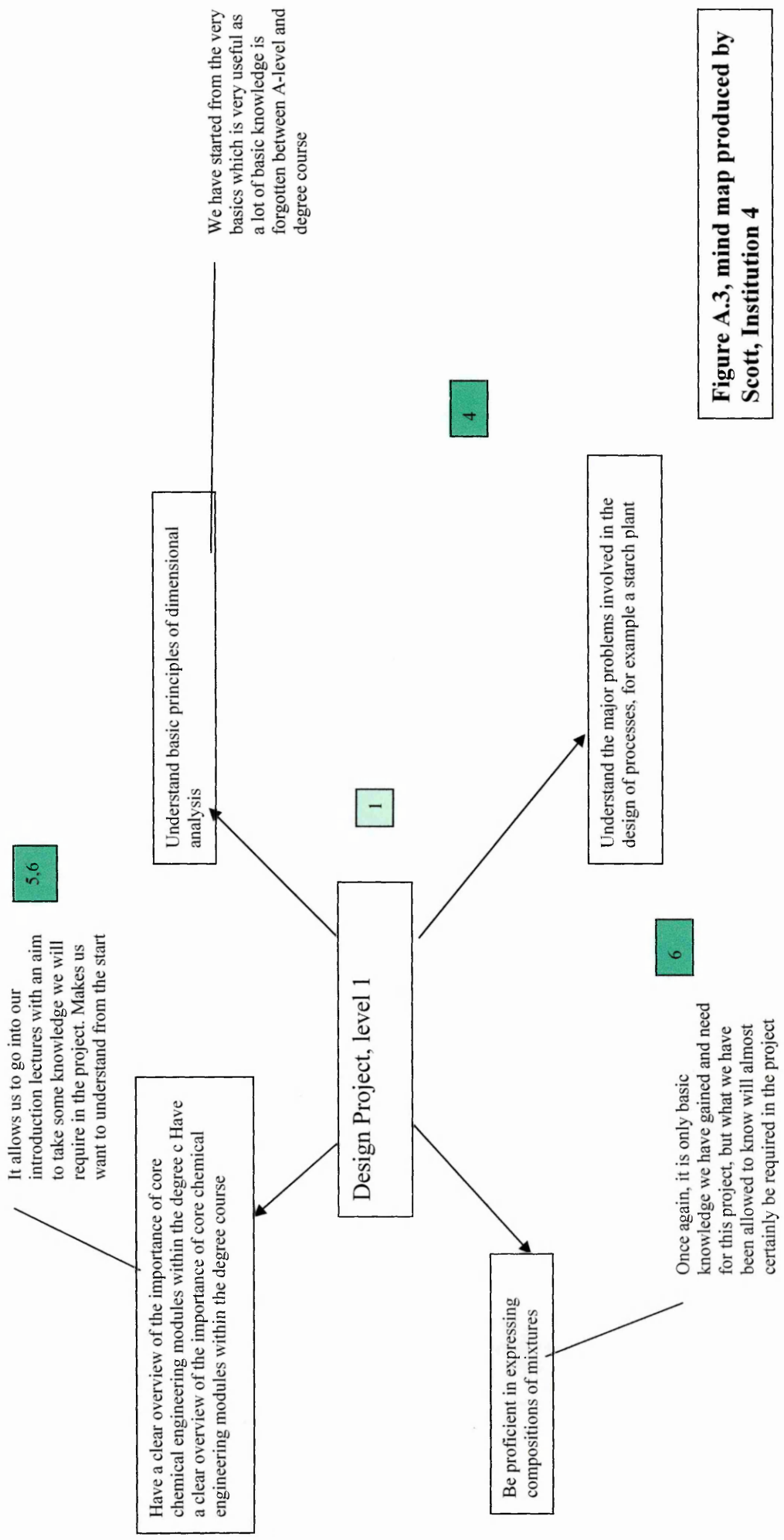
Tool – follow up interview  
Category – approach to learning  
Sub category – assessment is significant

6

Tool – questionnaire  
Category – evaluation of success criteria  
Sub category – learning through assessment

In identifying these categories which are similar, but have been found using different case study tools, triangulation of data can be seen, reflecting the consistency of the data irrespective of the tools used to gather it.

Other students who completed mind maps from this course, at this level of undergraduate study also demonstrated similar capacities for being led in their learning and not identifying relationships between the course objectives.



## **A2.2 Sample Data and Analysis: level 2, Institution 1**

**Background of course:** The course investigated at level 2 was ten-weeks long and entitled Personal Skills Development. A teaching approach which focused exclusively on the development of transferable skills was adopted. The course provider identified the following teaching methods and ideas used to enhance the development of transferable skills in this course: experiential learning techniques, placing students in teams, peer review and peer feedback of presentations, competitive team-based debates and technical based problem solving. Students were put into teams in which they remained throughout the module. Whilst in these teams, the students conducted technical problem-solving exercises and outdoor communication exercises. Towards the end of the course, the teams were also required to participate in two or three debates with another team. Each student in the year group gave critical feedback on the presentations given and also assessed the debates they were not personally involved with, through a written assessment.

**Sample data from course:** Box A4 shows a sample of data obtained for 'Mohammed', a level 2 student from Institution 1.

Figure A.4, the mind map completed by Mohammed from level 2 indicates that he views his learning of transferable skills (through a bolt-on approach) in a cyclic, progressive manner. Reference is made to “practice and real life situations” indicating that the student views experiential learning as an important process through which transferable skills are developed. All the course objectives are interrelated in this participant’s mind map. The following transcripts have been taken from a follow-up interview given by Mohammed, including comments from his level 2 colleagues via focus groups. The comments should be viewed in conjunction with tables 5.2.7, 5.2.8 and 5.2.9.

Response to follow-up interview:

“Well, all of these objectives – they’re significant to real life” *able to relate it to development outside the course objectives* “and how you assess yourself. It’s a cycle I think, and basically you have to understand that one follows that other”, *awareness of relationship between objectives* “you see the cycle’s drawn like that”.

5

**Focus group question: how would you judge the success of this course?**

Focus group response by students, level 2:

You’ll be doing things like debates and be able to get your point across and as you go on the industrial placement you should develop more confidence. .. I think if you review your progress before you start, in the middle and then at the end you can see certain areas of development. *Reference made to both gaining confidence and review of learning*

2, 4

**Focus group question: how would you evaluate this course in terms of teaching skills?**

Focus group response by students, level 2:

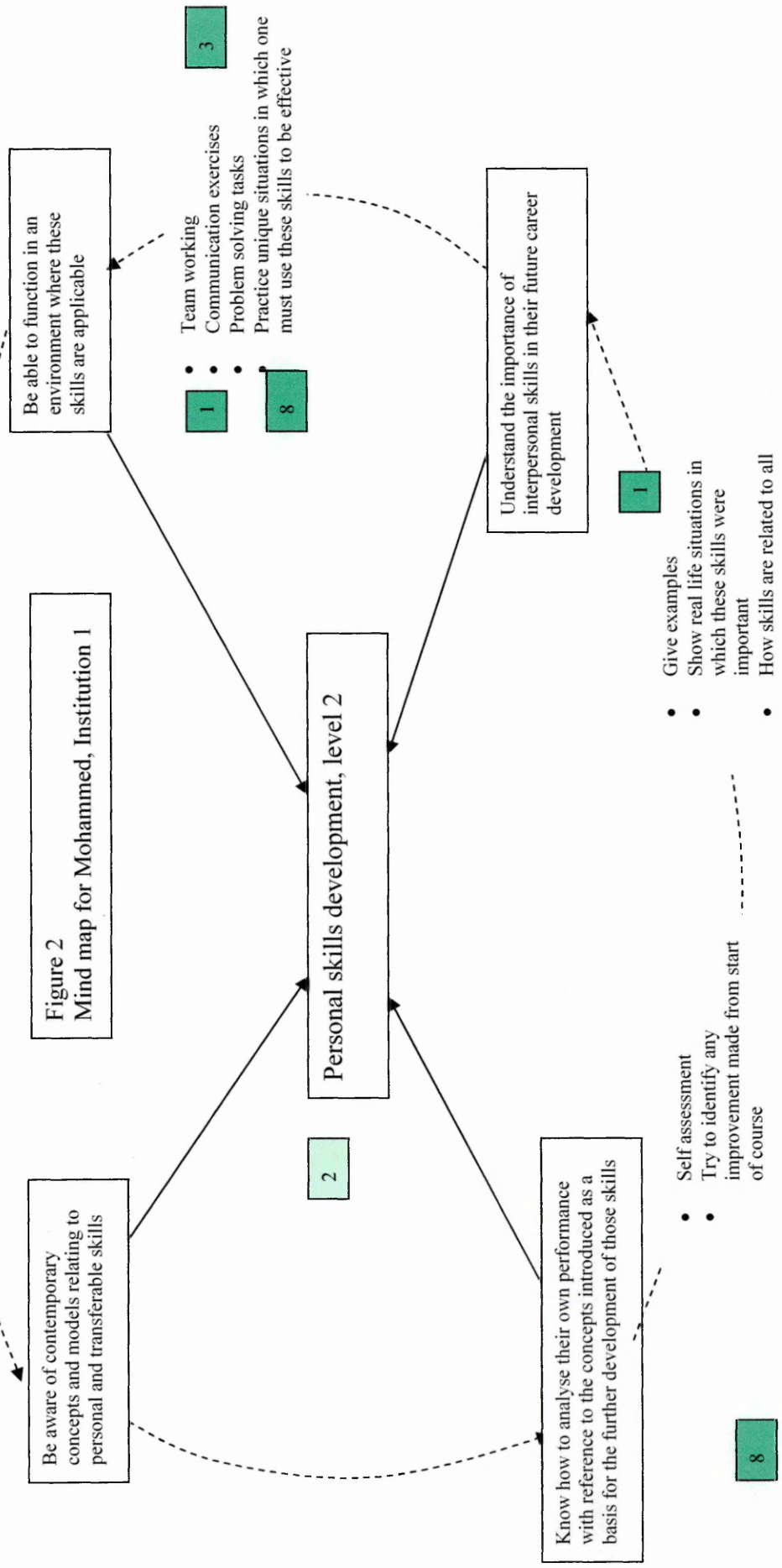
I think by being confident at using the skills. *looking towards applying the learning* If the lecturer has instilled a sense of belief that we can do this then that’s pretty good I’d say.

4

#### **Box A4: Samples of data gathered for Mohammed**

**Figure A.4, mind map produced by Mohammed, Institution 1**

2



### **A2.3 Sample Data and Analysis: level 3-4, Institution 3**

**Background to course:** The course investigated at level 3-4 was a twelve week long multi-disciplinary design project taught using a strategy which integrated both transferable and technical skills. The following teaching methods and ideas were identified as currently used to enhance the development of transferable skills in this course: competitive team working in mixed disciplines, marked difference in the approach to problem solving, the end presentation is not merely technical, video conferencing is introduced. Students were placed in multi-disciplinary groups and required to produce a fully scheduled and costed civil and process engineering design which was creative, functional and durable. Part of the final assessment was based on a presentation of the groups' findings which was assessed by peer groups and senior academics.

**Sample data from course:** Box A5 shows samples of data obtained from James, a level 3-4 student at Institution 3.

Figure A5 shows the mind map completed by James, a level 3-4 student. The mind map should be viewed in conjunction with tables 5.2.1, 5.2.2 and 5.2.3 which denote criteria for mind map data. James has identified links between course objectives and mentions the importance of employment in his mind map.

James's response, follow-up interview:

"..I think that our management skills have improved quite a lot such as prioritising, meeting deadlines and delegating... this project enhanced the basic skills we already had, we just synthesised them better". *Awareness of application and putting everything together*

4 3

It was also possible to obtain questionnaire responses from James. The following excerpts are taken from a questionnaire James completed and should be viewed in conjunction with tables 5.2.11 and 5.2.13.

**Questionnaire question: do you think that this course contributes to the learning of transferable skills?**

2

James's response:

"Well yes, it's a bit of both. If we used our transferable skills and no technical knowledge we wouldn't be able to complete the project and vice versa"

**Questionnaire question: how do you think this learning will occur?**

James's response:

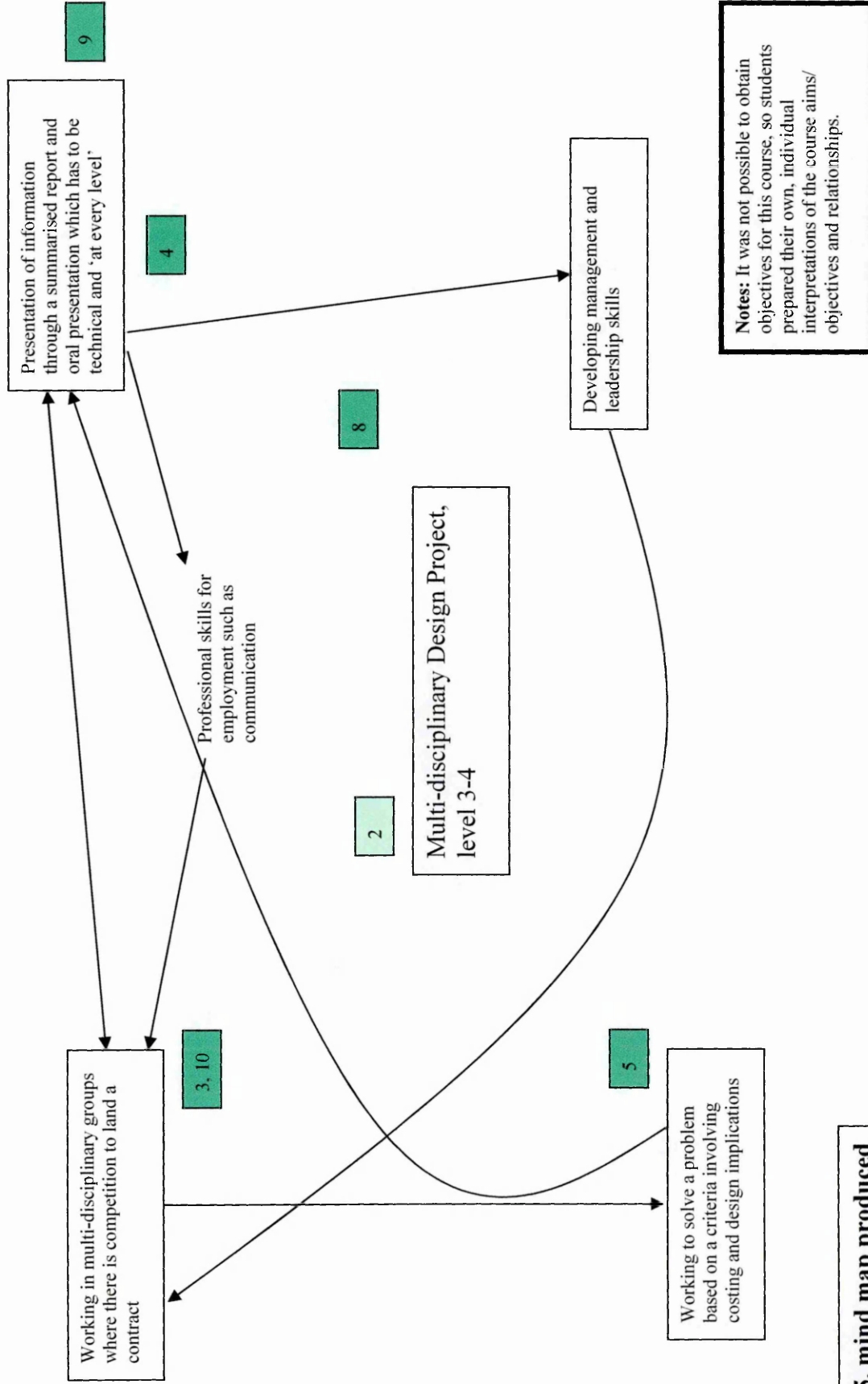
"Working with people from other disciplines mainly, we help them, they help us".  
*Suggests learning from one another.*

5

Data obtained from James suggests that an effective team based environment promotes learning and that skills development is as transparent as technical development.

### **Box A5: Samples of data gathered for James**





**Figure A.5, mind map produced by James, Institution 3**

### **Sample Data and analysis: level 3-4, Institution 1**

'Process Operations and Management' is a ten-week course, used to investigate skills development at level 3-4. An integrated teaching approach was used to teach transferable skills. The following teaching methods and ideas were identified as being used to enhance the development of transferable skills: case studies given by industrial representatives, working under pressure, company involvement, hands-on experience, relating the degree programme and the industrial placement year to the course. An industrial working environment was created for students in which to use and develop their transferable skills. Experienced industrial representatives provided relevant case studies to students, and passed on their relevant operational experience. Students were also given opportunities to complete hazard and operability studies, risk assessments, standard operating procedures on a pilot scale process plant and actually run the unit in teams. They were required to work together under simulated, industrial conditions to a deadline, during a number of process runs towards the end of the course as would be expected of them in industrial situations.

**Sample data from course:** Box A6 denotes the data collected for ‘Roger’, a level 3-4 student.

The mind map completed by Roger, Figure A6, shows that he makes much reference to “experience and hands-on learning” which implies that this is a key method through which he is understanding the course material, but he has also thought about “trying it out in a real (industrial) environment”. The mind map should be considered with tables 5.2.1, 5.2.2 and 5.2.3. The following excerpt is taken from a follow-up interview given by Roger and should be considered alongside table 5.2.7.

Roger, level 3

“I think with this though, it is important to show a variety of companies and how good practice is established within different environments within engineering, lots of different people have different ways of doing things and by these things. You have to work out what works best for you, it’s about your professional development, not just what works out best overall”.

7

The following two excerpts are taken from focus group data obtained from level 3-4 students, which should be considered alongside tables 5.2.8 and 5.2.9.

**Focus group question: how would you judge the success of this course?**

Level 3 focus group response:

“It’s about the students having an equal input and ultimately taking responsibility” *ownership of learning*. “Come next semester and you’re not combining all the different subjects and using them all together. Whereas maybe with this, you’re combining all the different aspects of the different courses and using everyone’s” *.can see how core technical knowledge fits*

2, 3

**Focus group question: how would you evaluate this course in terms of teaching skills?**

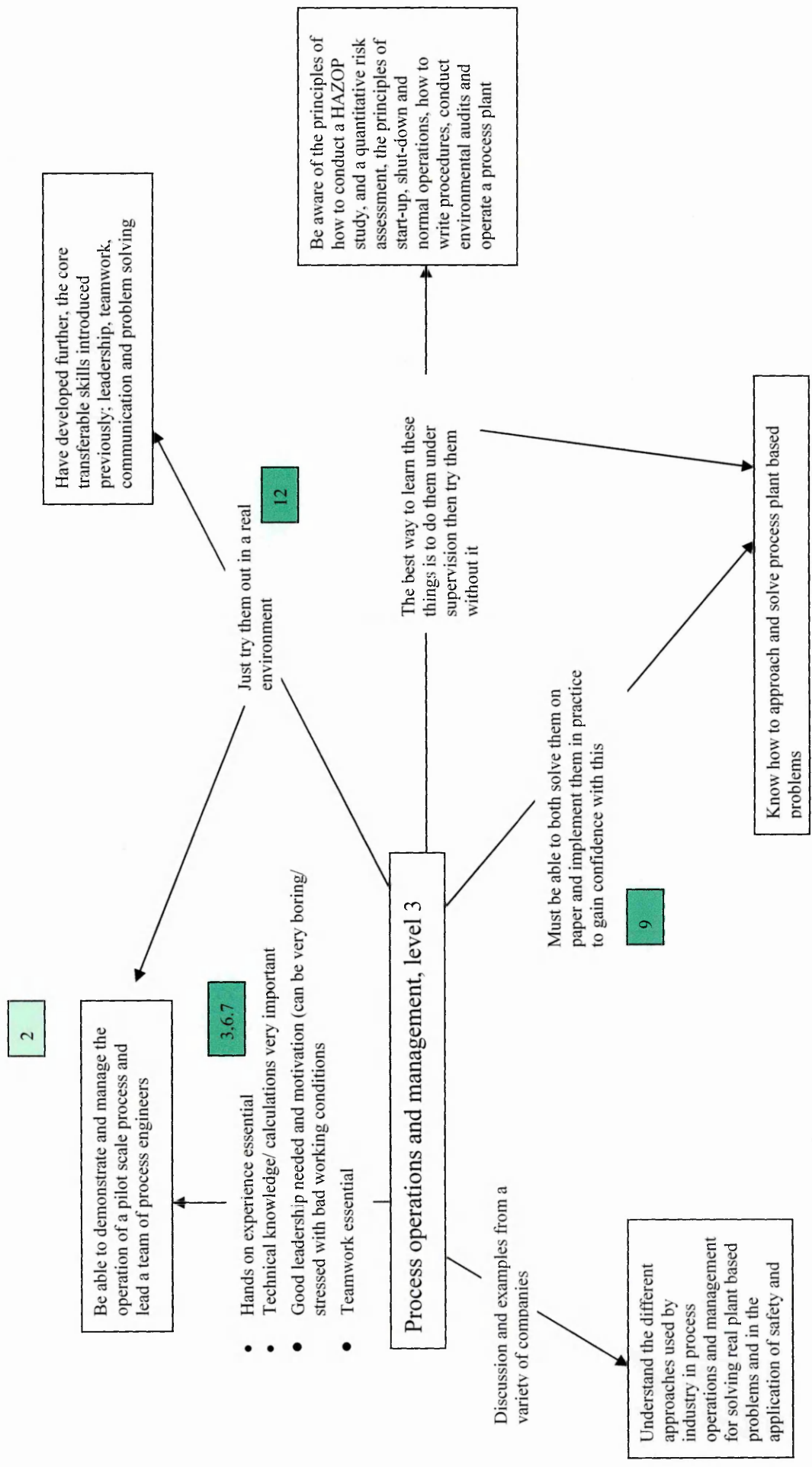
Level 3 focus group response:

“It’s whether you can visualise what you’re actually doing and do it on your own to some degree” *looking to become independent learners*. “We’ve all been on a placement year so this shouldn’t be anything more than refreshing and using our knowledge and skills collectively. When we go on the Hess rig, [the lecturer] should have confidence in us”.

1

Level 3 students’ comments suggest they are taking responsibility for their education and not being dependent upon the lecturer. The students’ comments also reflect upon their desire to have learnt from previous experience and develop knowledge in different situations. Roger’s individual comments also imply that the personal style of an individual is important, that knowledge is interpreted (and subsequently applied) independently not universally.

**Box A6: Samples of data gathered for Roger**



**Figure A.6, mind map produced by Roger, Institution 1**

	Identification of skills	Learning methods	Structure of skills development	Judging success
Wale	Developing communication, teamwork and leadership 3, 5, 8 <i>Aware of developing a no. of skills</i>	From hands on experience, working on the pilot plant. 1/3	It builds on everything we've done before, from 1 <sup>st</sup> year until now. 2	From knowing how to deal with problems encountered during real life process operations. 1
Rizwan	Team working, communication, leadership 3, 5, 8	Through working with others under deadline conditions, under pressure. 1, 5	It fits into my experience in industrial placement when I was operating (as part of the team) on plant. Develops theory learnt by putting it into practice. 2	Judge success when I start working in industry under similar circumstances. 2
Anna	To further develop team working etc. but with a more practical orientation 2, 5 <i>Relevant to employment</i>	Through practice. <i>Opportunity to practice.</i> 1	It's an integrated part of the course as it should be. <i>Formative part of curriculum.</i> 1	On how confident I feel working in the teams and how well I do in group exercises at assessment centres. <i>Confidence important</i> 1
Roger	To develop a practical understanding of process operations and management. 1/2	By doing it. <i>Experiential learning significant.</i> 3	We're sort of building on things we did during placement. <i>Recognition of development.</i> 4	If I can do them better than before. <i>Developing abilities.</i> 2
Stewart	When working on the rig we will develop team working skills and leadership. 5, 8	When we are in our groups we will have to work as a team to achieve the best possible outcome, to do this we will have to work well together. 5	When we work in groups we indirectly improve our transferable skills. 4	I will judge my success depending on whether I use any new skills I develop. <i>Considering wider implications.</i> 2
Lola	To practice team working and problem solving. Basically learn and practice transferable skills, like communication, leadership etc. 3, 4, 5, 8	Through case studies, practicing the skills in various group exercises, practical work on the Pilot plant included 3, 5	I have learned these skills in my second year and continue to apply it this year and further in my career. 4, 5	Being able to pass my assessment course in the search for a job. Being able to finish group projects like the design project and capital cost estimation one. 1

Table A3: questionnaire responses which have been categorised and codes as part of my analysis for level 3-4 students from Institution 1

## A2.4 Sample Observation Data

	Attitudes	Impressions	Environment
<b>Level 1</b>	<p>Students were confident at being able to guide others and lead the workshop session in a team 2</p> <p>Students generally humorous 8</p> <p>Everyone was attentive and asked many questions</p>	<p>Peer-led and peer-tutored session 7.8</p> <p>Students presented solutions in case study teams 3</p> <p>Used a number of resources</p>	<p>Student-led workshops on technical subject 1.2</p> <p>Case study given by presenting team 7</p> <p>Student assessed</p>
<b>Level 2</b>	<p>Students were very argumentative at times, very enthusiastic about their stance 1</p>	<p>Student teams argued for and against cases and then opposed and responded to comments 4</p> <p>Remainder of team took questions from the floor 7.8</p>	<p>Student-led team debates 1</p> <p>Both peer and tutor assessment of debating skills 7</p> <p>Subject of debates was not related to technical components 4</p>
<b>Level 3</b>	<p>Students under pressure to complete task</p> <p>Everyone is involved 2</p>	<p>Lecturer not present for most of the session 6</p> <p>If things go wrong then students are responsible for correcting the mistakes 8</p>	<p>Students running pilot scale process plant 2</p> <p>Work in teams, assuming different engineering roles 5</p>

Table A4: comments from observed teaching sessions for courses observed at levels 1, 2 and 3-4 at Institution 1 (should be considered with tables 5.2.4, 5.2.5 and 5.2.6.

## **Appendix 3:**

### Samples of Raw Data

## Sample Data from Institution 2, level 1 – CAPE Project

### Focus group transcript

“The objective of the course is to familiarise us with practices in industry and some sort of project or course work, which we must do and in order to solve this project we must use skills used in the industry like proven techniques and methods, which in the end – I mean they help us do something like that”.

“I think it’s probably less about that and more about teamwork and working together and actual real practical abilities that you get in business rather than all the technical stuff like putting together equations and boring stuff like that. It’s actually more like working with people, managing people, managing actual ways in which your company wants to go, and earning profit. It’s actually trying to get us away from the academic ‘this is how’ scenario”.

“I don’t think so. The guy said...”

“Yeah I know.”

“The guy said we’re going to use games”.

“Yeah, well you have to do a little bit”.

Yeah, but we’re going to be using games for the rest of our lives”.

“But what you said about people, learning to work with the people”.

“Yes, exactly”.

“I think it’s all about teamwork, you could be playing football anyways”.

“So yes, that’s what they’re getting at, making us stop and look at the way we work”.

“Set down times you know, and control and manage, hand the work in on time and giving responsibilities to everybody in the group”.

“Going away from the book and getting into real life, getting into interpersonal relations and things”.

“I think it’s mostly about teamwork and we’ll be doing a project I think. And that will count towards our coursework I think. I think that this project we’re doing, they’ll give us a lot of project work in the second and third year, so I think they’re gonna be doing a really large project and it would be things like teamwork and how to manage your time effectively”.

“That’s true, definitely”.

“I think they’ll put us in groups”.

“They’ll probably also... it’s all about practice and being forward and confident and saying what you think in front of people. That’s probably one of the key skills they’ll try to teach us



and the only way to do that is just practice, practice, practice. And give us loads of excuses to do loads of displays and fun things and interesting new ideas, I think to like put forward our work”.

“Yeah”.

“That’s quite true”.

“They’re going to make us do things together and see if we can actually get something done on time”.

“Compared to the rest of the Uni we always get our work in on time, we always have that. I think they’re going to give us, not hard but complicated, more complicated, yes”.

“It won’t be complicated, it’ll be open so you can go in different ways”.

“Yeah, but something like, I think they’re gonna give us something that you can’t solve, I mean that one person can’t solve. I mean that sometimes, what happens is that they give us, it has happened here, a problem or a course work for the team and two people do it out of four. So I think that yeah, they’re going to give us something that you can’t solve by yourself in that amount of time and you need, you need, you must work together”.

“It would be difficult otherwise”.

“I bet they’ll put us into their own groups, otherwise yeah”.

“It’s pretty hard to judge isn’t it”.

“Basically if we do well in the project, it’s an...”

“No”.

“Just when you get to your new teamwork, see how you develop, how you work better, how you apply”.

“How it works, if it works better working as a team, then you’ll see if it has worked or not. You don’t have to wait, you pretty much know if you’re satisfied or not. For example we, for the project we have to do a presentation, and you know, you have a feeling of how you did and how your group is doing. If you know that during the group, your part is really crap, but everyone else is better, you know then that you feel bad and you say well this is what I’ve done this time. It won’t happen again and you know that that’s one way that you know”.

“I think it’s also about the mark, but no-one’s saying it”.

“Yes, the mark. That’s the most obvious thing, that’s the point”.

“Yeah, but that’s not how you judge how much you’ve learnt”.

“That’s what you’re trying to find”.

“If our group did get a good mark, but I knew that I put input into that group and I’d be proud of my mark. I think it matters”.

“Yes, but even if you don’t get a good mark, you should be proud as well. You should be sad but proud”.

“You can’t really judge it”.

“I think it depends with the group and the people you’re kept with”.

To introduce students to a systematic approach and teamwork practices.

By introducing practices used in industry every day.

To increase student confidence and awareness to teamwork

Confidence increases through teamwork and cooperation, and such skills can only be taught via teamwork leading to the completion of a project

Effective Projects through Teamwork, level 1

To apply practices and skills in CAPE Project teams

To introduce students to a systematic approach and teamwork practices.

By giving us problems that are present in industry and setting us in teams so we can solve the problem together.

To increase student confidence and awareness to teamwork

This is very hard to do.

I think we are going to be giving questions/problems that cannot be solved by a single person. Therefore everyone will have to worry about an aspect of the problem. In that way the student must be confident in what he is doing and be aware that what he does affect everybody in the group

**Effective Projects through Teamwork, level 1**

By Giving us industry problems that can't be solved by manual method: because of a great number of variables.

Therefore.

To apply practices and skills in CAPE Project teams

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**Sample Data from Institution 3, level 1 – Communication and Teamwork Skills Course**  
**Focus group Transcript**

“It’s to make sure that we get the best out of what we do, the best of what we’re good at and to work on what we’re not so good at. Like in my case, I’m not so good at physics, but I’m a lot better at maths, that is what that exam was at the start. I suppose it’s the same with skills, it’s about using your strengths to balance the weaknesses”.

“I think it’s more about showing you that you can’t do tasks all on your own, you have to ask for support so that you can work through them in groups”.

“It’s to show the value of working with others as opposed to by yourself”.

“We’re learning how to work to people’s strengths and organise teams to get the maximum out of them”.

“Learning from experience really, what works well and what doesn’t work so well”.

“When we went to Coniston, I think we were dropped in the deep end a bit because you’re put in groups and you didn’t know anyone else in the group. You had to build a team and you had to get along with people”.

“Learning how to cope with the most difficult people that you could ever meet, who want to do everything all the time and won’t let you do anything”.

“Exam results”.

“I don’t think so. I think it’s more about when you do things and carry on doing them, only then will you know if you’ve got better”.

“With the communication skills course, if we did the same task again, like if we did the first task again, and then you can see how much you’ve improved and how much you’ve bettered yourself, to what degree”.

“I don’t think we’re far enough through with the course to make that kind of distinction yet”.

“We just really started it recently and some people didn’t go to Coniston so we can’t judge it”.

“Feedback from the group members as to how you’ve done”.

“Success with the tasks I think is also an indication of the successful teaching”.

Mind map for Institution 3

To enable a student to recognise the role of others within a team enabling them to work efficiently within that team

Team exercises like lego building and discussions

To provide students with interpersonal skills that the university and community at large needs

fundraises and excursions to get to know all yrs in engineering

~~Coniston Course, levels 1 & 4~~

Communication & Teamwork Skills course, level 1.

To remove barriers to learning

To create open and supportive relationships amongst students within their work groups

First name basis with professors like Thayer. Getting to know professors outside lectures

To develop confidence and competence in a wide range of interpersonal skills

Getting students to give oral demonstrations where they can learn A3-11

Mind map for Institution 3

To enable a student to recognise the role of others within a team enabling them to work efficiently within that team

Involving students in exciting team building exercises.

To provide students with interpersonal skills that the university and community at large needs

Initiating community projects within the department.

Coniston Course, levels 1 & 4

Communication & Teamwork Skills Course, level 1

To remove barriers to learning

encouraging friendly relationships with the lecturers

To create open and supportive relationships amongst students within their work groups

Holding discussions within the work groups on how best to complete various tasks.

To develop confidence and competence in a wide range of interpersonal skills

Ask the students to examine their personalities & helping them improve



## **Sample Data from Institution 4, level 1 – Introduction to Design Project**

### **Focus group transcript**

“Definitely communication with the actual presentation when the project and group skills as well. We’re gonna have to work together and make sure that it all comes out at the end. I think that’s far more important in what the aims are, the aims are basically to get us together to interact in the group and be able to express our ideas. It is very vague, the whole idea of a starch plant – it isn’t that important to our course so the aim of the project is to get us all involved”.

“The course is to help us to become better speakers to a group or just to one person, interact with a few people, just to help us develop skills to talk to the media or whatever and to do presentations”.

“It makes it part of the job when we work in a design company, it will be an integral part of the job, it’s very useful for us later on”.

“It also gives you confidence in expressing your opinion and things like that”.

“Chemical Engineering is an industry at the end of the day and if your skills are poor then the people buying from you are always going to – as long as you sell yourself properly they’ll see the confidence inside you. They’ll be confident about buying that product, if you’re not confident about selling that product, they’ll see straight through that and your product does have to be of a standard, yes, but selling it is the main thing”.

“Let us go out by ourselves actually. We have to work by ourselves, people we don’t really know we have to make friends with and make sure we get along so that we can end up with a decent marking, that’s what we need. If we don’t get along by ourselves, we can’t communicate to the person marking us”.

“I think the important thing is realising that everyone does have different kinds of skills and everyone is good in different kinds of areas and especially in a group. You bring all these different ideas to one person and that one person speaks for the other members. They’re trying to show us how important it is, it’s all about team gain and the importance of team gain”.

“In doing the presentations, to begin with, they’re showing us what Chemical Engineering is really about. They’re giving us a simple project to prepare for what we’re going to be doing later on in the degree course”.

“It’s also about people skills, it’s an industry and industry is all about people and money, people skills”.

“It’s all about looking at the audience and the audience reaction and see how they think you’re doing and they will judge whether you were good or bad”.

“Looking at it in terms of success depends on how well we do in the next presentation on that, see how well we’ve actually improved on the next presentation and see how well our design went, how we go about it in the next one”.

“A good point I think, is in terms of success, is to look at what knowledge you’ve got out and how you use it in the future”.

“In the end, if we manage to get our ideas across, even if they’re wrong as long as we manage to get hem across”.

“It can be a bit of the stress the presentation”.

“It’s a big group as well so we’re gonna have to split the responsibilities and tasks so everyone gets a decent part in the whole project”.

“Well what they’ve done so far is give us guidelines, how to research certain things so far and how to go about the whole situation. We can do our own thing, but at the same time we’ve had to go out and do the research, had to build on what they’ve said”.

“Even if we get stuck, even if the material they give us is not enough, we can go and see someone to help us. There’s always someone there who’ll speak to you, everyone’s really helpful, really open”.

“They’re here to teach us at the end of the day – it’s what they get paid for”.

Mind map for Institution 4

the core Chem. Eng. modules are extremely important within the course as ~~the~~ skills

Have a clear overview of the importance of core chemical engineering modules within the degree course

and understanding is needed from all modules to design a process properly, as in heat exchangers, safety, environment and material + energy balances.

## Design Project, level 1

Be proficient in expressing compositions of mixtures

Understand the major problems involved in the design of processes, for example a starch plant

the Design Project has outlined the problems involved in designing a process plant as in avoiding dangerous procedures and recycling materials and energy

it has been made aware that the dimensions of equipment is important, as to withstand ~~the~~ pressure and speed procedures

Understand basic principles of dimensional analysis

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## **Interview Data: A sample of 2 interviews with students from level 2, Institution 1 – Personal Skills Development Course**

### **Rachel**

“Right, the being aware of contemporary concepts, it’s very much going to be demonstrated by the lecturers. You know, given examples in class, not just by staff as well, but by other media. With the analysis of your own performance, you have private analysis sessions as well as one on one going over specifically what you’ve done, how you did, how you can improve and also group analysis would be your peers looking on and saying how you could improve. Being able to function in the environment, you’re put on the spot and it’s like right, show us what you’ve learnt. That’s all about that. And the understanding of the importance of interpersonal skills, it’s very similar to learning the contemporary concepts, it’s a lot of examples given in the lecture.”

### **Alex**

“Basically, I think what it is, is being aware of the concepts, is basically given talks, presentations, notes, etc. examples of how the different ways of how to present yourself and the situations and different ways you can react to situations i.e. given a presentation without any notes in front of your mates etc. from the lecturers and other members of the department and then being put in those situations yourself and how you react to those situations. You’ll be able to understand how important these skills are because you’re starting of with no skills or a bare minimum of skills and building them up so you can see how important it is to have them. But also being in that position and practicing then you’ll be able to function in that environment better. Also analysing your performance from watching other people, you can see their good points, bad points, where they should improve and where not, if they’re very good. You can then look at yourself in that respect and then compare that with feedback you’re getting from everybody else.”

**Focus group Data: A sample of focus group data obtained from level 2 students, Institution 1**

**What do you think the aims and objectives of this course or module is in terms of teaching transferable skills?**

“Build up confidence primarily.”

“Yeah, it’s primarily for confidence boosting”.

“To make us more professional at communicating”

“Learning that there are different types of communicating. Giving us the tools and then letting us come up with the skills and using them for employment in companies”

**How do you think that you are learning transferable skills throughout the duration of this course or module?**

“Showing what other people do, seeing how other peoples’ presentations are run and then see how our own are run and then they’ll tell us how it went”

“So making mistakes and then learning from the mistakes”

“Giving us examples of presentations, for example without aids and then doing them ad things like leaving a gap at the end so you understand that you have to use the time. And the next thing we’re doing is visual aids so I think at some point we’ll be expected to use visual aids then. So we’ll watch and learn about how to use visual aids so the next time that we have to use visual aids it becomes easier and we learn about the good points, so we watch our peers and you say, I’m going to use that idea.”

“That’s a very good point, yeah”

**How are you going to judge the success of the material taught?**

“On a scale of 1 to 10”

“Maybe initially when we started out it was a bit wrong, we were not very good at using the skills and then at the end, it depends on how you’re able to express yourself. If you’re able to put your point across with confidence and clarity”

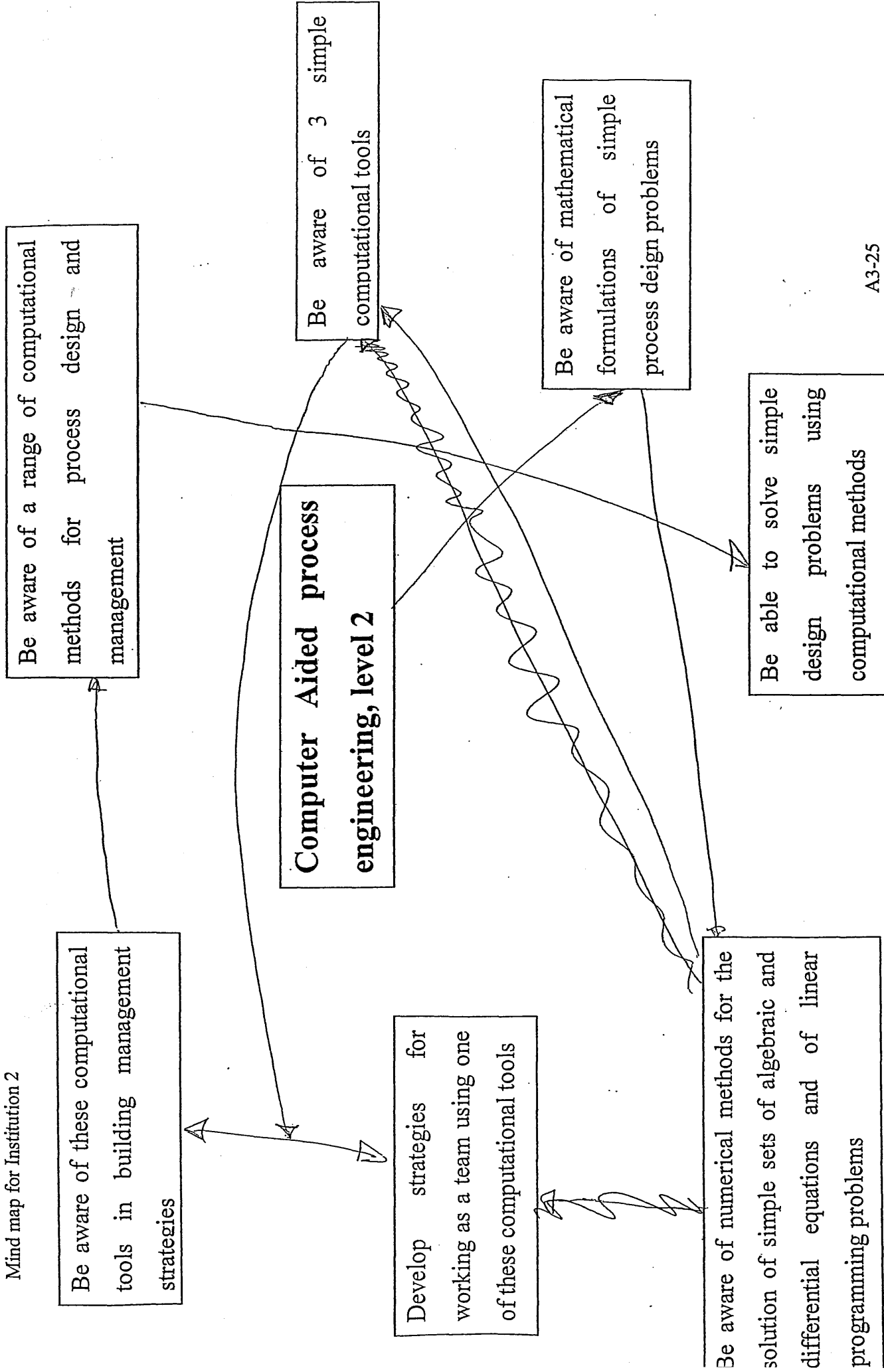
“I think we will only know if we’ve succeeded once the course has finished and you’re actually put in that situation for real like a job or whatever next year and you can say, yeah I learnt something”

“Or use your teaching then – apply it”

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10/10/10

Mind map for Institution 2





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## Sample Data from Institution 1, level 3 - Process Operations and Management

### Focus group transcript

“Well, I think that the aim of this course, seeing as it’s specifically for the M.Eng people was to foremost to give us an introduction to, first of all, process operations, how a chemical plant is designed, and that’s why we’re working on the HESS rig, things like that because after that we will be better Chemical Engineers than people who hadn’t done that”.

“In that way, it’s good and it also gives us a chance to practice the transferable skills which we learnt. Even in the first year we started learning them. Just to practice them in the environment of the process plant, that’s what I think it’s all about”.

“It’s not just the process plant as well because we are going to be interacting with engineers, like civil, mechanical engineers which especially with our M.Eng, we’ll have even more of a need to get on with people – we’ll need skills like teamwork”.

“Yes”.

“Um, I think most of it, you learn by doing it, that’s what we’ve done basically”.

“Yes, that’s what I was going to say especially as we’ve talked about it. To come in and do it properly you have to do this, this and this and then you can do it”.

“Yeah, so working in a team, to a deadline, that we’ll be put under more pressure, that we need more elaborate communication skills to get on with dealing with it. Because everything we do is on a deadline, cos even the HESS rig, we’ve only got 2 hours for each sift so we have to run the plant, even in the workshop we’ve got deadlines”.

“Yes, so we can say that in the course it gives us exposure to the practical side”.

“I think maybe when we start running the HESS rig, maybe we’ll see everything we learnt before running the HESS rig and it will help us in running the HESS rig”.

“It’s very difficult to make a judgement at this stage”.

“Yes, I think eventually when it comes down to it, it’d be how well I do at my assessment centre, going to interviews because these are the skills that you look at. It’s like if you can demonstrate it well then you can get a job, then I’ve done well and this has come in handy”.

“Getting a job will consolidate the success of this course basically”.

“At the moment, we don’t understand too much about it, but through the lectures, doing the coursework, we’ve looked at the theoretical problems of the plant”.

“I think the more we get exposed to these problems and the HESS rig stuff, then the more we are aware of it when we come out into industry. So I guess this will be a way to compare things when we get out into real life and that situation, you can relate it”.

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- 11/15/16/18/20/22/24/26/28/30/32/34/36/38/40/42/44/46/48/50/52/54/56/58/60/62/64/66/68/70/72/74/76/78/80/82/84/86/88/90/92/94/96/98/100

### Mind map for Institution 1

Be able to operate and manage the operation of a pilot scale process and lead a team of process engineers.

Not done yet but will do

### Process Operations and Management, level 3

Have done HAZOP and QRA, will do the exercise on HESS RIG in wk 10 to fully appreciate process operations.

Understand the different approaches used by industry in process operations and management for solving real plant based problems and in the application of safety and environmental policy.

Have developed further the core transferable skills introduced previously, specifically those identified as being important to process engineers; leadership, teamwork, communication and problem solving.

Through team-work on case-studies and group exercises

Be aware of the principles of how to conduct a hazard and operability study and a quantitative risk assessment, the principles of start-up, shut-down and normal operation, how to write procedures, how to conduct an environmental audit, how to operate a process plant and how to conduct plant based trials.

Have done this much

Have completed one coursework on MASS BALANCE on HESS RIG. I have another coursework on recycle calculations

Know how to approach and solve process plant based problems.

Mind map for Institution 1

Be able to operate and manage the operation of a pilot scale process and lead a team of process engineers.

Process Operations and Management, level 3

Understand the different approaches used by industry in process operations and management for solving real plant based problems and in the application of safety and environmental policy.

Have developed further the core transferable skills introduced previously, specifically those identified as being important to process engineers; leadership, teamwork, communication and problem solving.

Be aware of the principles of how to conduct a hazard and operability study and a quantitative risk assessment, the principles of start-up, shut-down and normal operation, how to write procedures, how to conduct an environmental audit, how to operate a process plant and how to conduct plant based trials.

Know how to approach and solve process plant based problems.

*developed skills through work shop*  
*These features*

*to be used in the process plant*  
*to be used in the process plant*

*We are required to solve a recycle problem & under new circumstances and apply the conclusion of the calculation to the operation of the pilot scale process*

*we will be able to solve the problem*  
*we will be able to solve the problem*

**Sample Data from Institution 4, level 3 - Research Methodology and Management of Experimental Data**  
**Individual follow-up interviews**

**Sample 1**

“I’ve done something similar to what I’ve done last time, just brain storming the whole thing and putting lots of lines connecting what I think all the bits and pieces are and I’ve mainly done a main heading for each thing so hopefully you can follow it. Dealing effectively with experimental data, I’ve put one of our lecturer’s down as he’s lectured on it, bioreactor. We’re doing a module which is actually using process data to model a process. I’ve got communication, layout of final report, reading and summarising technical journals, ease of use of experimental equipment, repeatability and how to manage the project better”.

**Sample 2**

“Right, I’ve gone through and looked at everything and looked at how the department can firstly help us deal effectively with experimental data. I said we can borrow experience from people who’ve already done it, people who’ve got PhD’s and stuff like that as well as our own experience. We can make sure we’re taught what is effective dealing with the data so that we can recognise if we’re doing it right or not and we should also be provided with guidance to, like computer programmes or people that can help us deal with the data better. So you know use of a particular programme or a spreadsheet or something you know, and be pushed in the direction of somebody who can identify trends and anomalies with our data. The other thing is, how to provide and understanding of good practices, shows us how to look for these practices within our research, provide adequate resources so that we can do the good quality practices and research and highlight the advantages pf this”.

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show us  
Benefits of effectively  
processing data.

Mind map for Institution 4

Dealing effectively with  
experimental data

Shows us  
what good  
data is.

Highlight ineffective  
ways of dealing with data.

Past examples of  
all processed data.

### Research Methodology and Management of Experimental Data

To provide an understanding of good  
practices required for carrying out  
high quality research

Highlight  
bad practices

Show ways  
of looking out for bad  
practices.

Show  
ways  
of correct  
bad  
practices

Show ways of  
checking the quality  
of our research

A3-35

Give reasons as to

"The university should offer  
us the following so that we can attain  
works in the boxes."

Mention a 'higher level' source as to what  
implications are of the 'lower level' detail  
of good practice methods.

Show who's  
good practices  
are

Shows us  
examples of people  
who are known to  
carry out high quality  
research

To provide an understanding of good  
practices required for carrying out  
high quality research

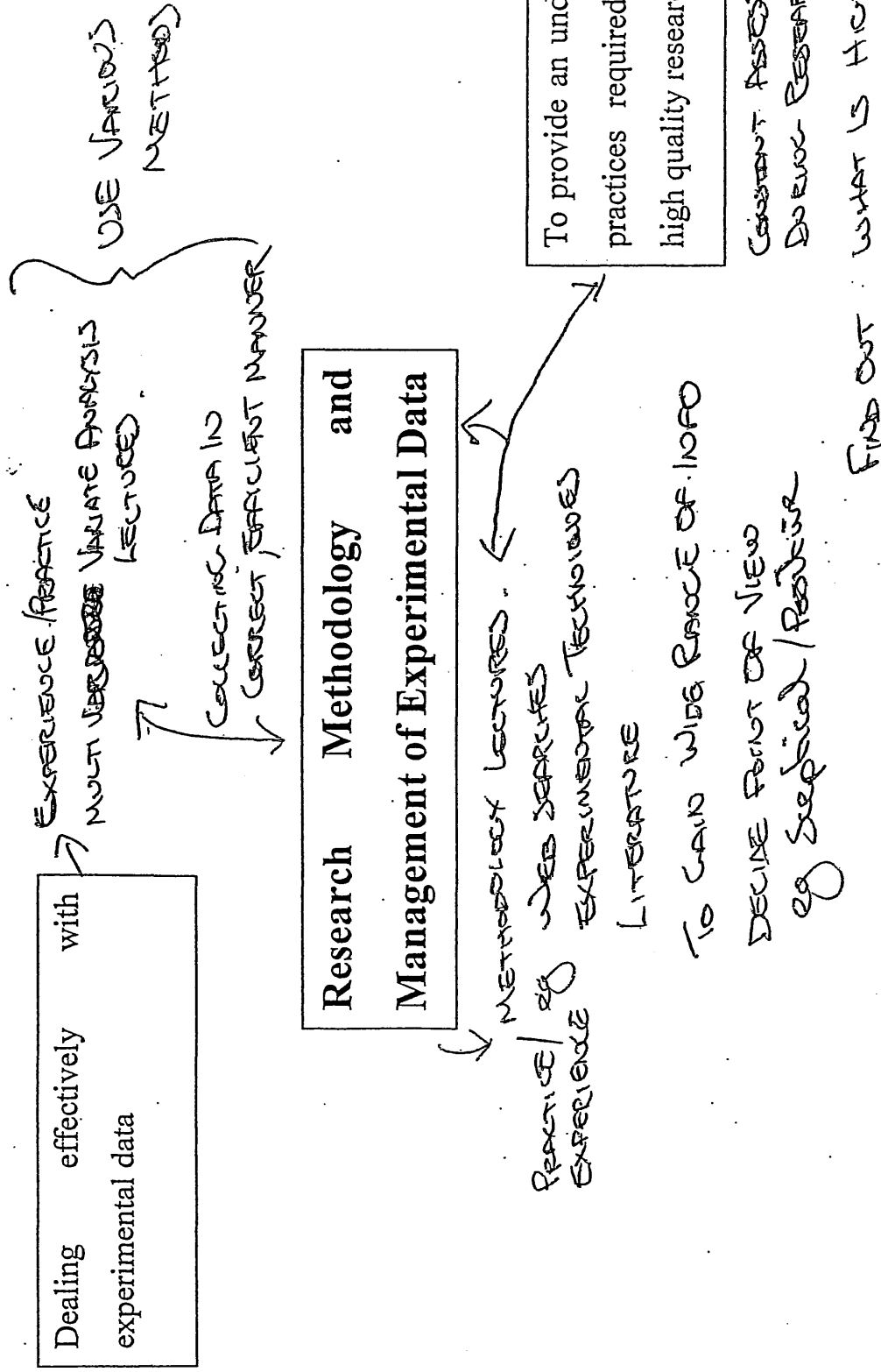
Show  
ways  
of correct  
bad  
practices

Show ways of  
checking the quality  
of our research

A3-35

Give reasons as to

Mind map for Institution 4



## **Appendix 4:**

Code used for Observation Data

The following key is to be used to identify the aspects that are applicable to the observations to be conducted as part of this research:

- A – eye contact is maintained
- B – humour is used
- C – an attempt is made to get feedback
- D – questions are open ended
- E – questions are closed
- F – particular questions are asked of individuals
- G – questions are asked of the group as a whole
- H – a series of problems are set
- I – students are guided through the problems
- J – appropriate examples are given
- K – un-amended OHP notes are used
- L – the white/black board is used
- M – lecturer hands out completed notes
- N – lecturer hands out incomplete notes
- O – questions answered with questions
- P – analogies used
- Q – lecturer tells students the answers
- R – lecturer asks students to find the answers for themselves
- S – discussion is encouraged
- T – provides positive criticism of ideas
- U – lets students explore their own solutions to problems
- V – does not interrupt until speaker has finished
- W – notes are made on responses to questions
- X – annotation is used
- Y – there is no fear in expressing ideas
- Z – confident at expressing own ideas
- AA – confident at asking for further explanations
- AB – comfortable in the company of the lecturer
- AC – focus on lecturer
- AD – students do not look away/fall asleep
- AE – students do not arrive late

**Code used for Observation Data**

Teacher	Initiation	Maintains student attention		
		Asks questions		
		Sets tasks		
		Writes		
		Explains		
	Other			
	Response	Encourages involvement of students		
		Answers questions		
		Listens		
		Explains		
		Discusses ideas		
	Other			
	Student	Initiation	Asks questions	
			Listen	
Write				
Look				
Make comments				
Other				
Response		Show enthusiasm		
		Listen		
		Write		
		Express ideas		
	Discuss			
Other				

**Schedule for Observation Data**