THE Ph.D. AS A LEARNING PROCESS

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ABSTRACT

The main question being addressed by this research was 'how do postgraduate research students experience the process of doing a Ph.D.?' The way this question was investigated was to discover how the students involved solved the problems which confronted them when doing a research degree.

Seven case studies of Ph.D. students and their supervisors are reported. The student and supervisor pairs came from different disciplines and two universities. The case studies were conducted through interviews and the repertory grid was used as a tool throughout the three years of field work. Additional methods used included rating forms and free writing. The focus of the study was the postgraduates' changing perceptions of their Ph.D.

The topics investigated in order to monitor these changes included:
1) The students' relationship with their supervisors
2) The difference between what they expected to accomplish in a given time and what they actually did accomplish
3) Writing up the results of their work.

Results indicated that the process was similar in these respects for Arts and Science students. It was found that:
a - it was necessary for students to develop an ability to evaluate their own work. The rate of this development appeared to be related to the degree to which the students were allowed to remain dependent on their supervisors. It is suggested that some kind of 'weaning' process should be introduced into the student and supervisor relationship as the postgraduates develop the self-confidence to monitor their own work.
b - The students' ability to estimate accurately what work they could accomplish in a given period of time did not improve over the three years. The observed discrepancies between what the students expected to achieve and what they actually did achieve are used as the basis for describing a hypothetical mechanism by which plans are revised as goals and time limits are adjusted.
c - Writing helped to clarify thinking but was seen by the postgraduates as a difficult activity and of minor importance. This was because it served specific functions. At the ideas generating stage of the work writing helped the students to think more creatively and at the presentation of results stage it helped to organize their work into a coherent whole.
d - Their enthusiasm for their Ph.D. diminished due to the length of time they had to spend working on a single problem. The postgraduates' perceptions changed from seeing the Ph.D. as something special and unique to seeing it as a job of work that had to be completed. Throughout this thesis, the students' changing perceptions of their Ph.D.s are presented as vital to completion of the higher degree course.

All these points taken together are presented as important in developing the skills needed to engage in professional research. They are suggested to be significant aspects of the Ph.D. as a learning process.

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To my parents, Betty and Ralph Phillips, for whom this is all too late ...

ACKNOWLEDGEMENTS

PREFACE

This thesis is concerned with the psychological phenomena involved in doing a Ph.D. The aim of the research was to produce an accurate and comprehensive description of the experiences of a group of postgraduates as they went through the process of learning to do research.

In order to investigate the development of research skills repertory grids, free writing and rating forms were used in conjunction with interviews. By these means case studies of seven postgraduate research students and their supervisors, from two universities, were undertaken. The students were interviewed at monthly intervals over the three year period of their postgraduate registration. Their supervisors were interviewed twice a year over the same three years.

Throughout this thesis pseudonyms have been used for those participating in the study and the two universities have not been identified. These measures to disguise the students and supervisors have been taken in order to preserve confidentiality and anonymity. Without giving assurances of this kind the research would not have been possible.

The pseudonyms used for the seven pairs are:

Postgraduate		Supervisor
Adam	-	Professor Andrews
Bradley	-	Mrs Briggs
Charles	-	Dr Chadwick
Diana	-	Professor Dymond
Ewan	-	Dr Eustace
Freddy	-	Professor Forsdike
Greg	-	Dr Green

Further information, including their subject areas, is given on page 68 of this thesis.

By combining the results of all the methods the seven case studies

were built up. The way that the measures interrelate is described on page 94, but primarily the grids and paragraphs provided more detailed information on topics introduced in the interviews, while the rating forms provided some quantifiable data. The different methods combined to give a holistic picture of what was happening to the students as they learned to do research.

Personal Construct Psychology provides the structure for a study where the focus is on the students' point of view. The repertory grid helps to identify personal criteria for students as they monitor their own learning and the meaning of what is happening is described by the students in detail. The repertory grid technique also provides information on changes over time. For these reasons it was decided that using personal construct theory as a conceptual framework from which to view the question of how postgraduate students experience the process of doing a Ph.D. would provide one way to talk about differences in perception. Using repertory grids, rooted in the theory of personal constructs, would provide a useful methodological device for monitoring individuals' perceptions of their situation, and any changes in such perceptions that occurred as time passed. These models of man as a scientist are used in order to help explain what happens when people learn how to do research.

The study described here is exploratory and provides a descriptive analysis of the processes being investigated. It is not intended to be a hypothetico-deductive or experimental piece of research. Nevertheless it is not a purely inductive investigation as the author did start the research with certain expectations and assumptions. The basic assumption was that the Ph.D., as a learning process, is designed to teach students to become autonomous researchers. The definition of 'autonomous' in this context is: being able to interpret the results of one's own actions

without having to rely on another person's assessment of one's work. It is intricately bound up with the second assumption, concerning the role of feedback in learning to do research. The assumption here is that feedback, from whatever source and in whatever form, is vital to the progress of the students' work. These two assumptions are relevant to all the research described in this thesis.

The expectations, with one important exception, were found to be false during the first year of this study. The false expectations were

1) all new research students would go into the situation with some idea of what they would be doing over the three years. The evidence did not support this hypothesis. Even those postgraduates, who thought they knew the area on which they would be working, changed their minds after starting work on it.

2) The research problem would evolve and become more clear as a result of working on it. This did not appear to happen but, as suggested on page 24, it may be that the question was not correctly researched.

3) Any discrepancy between expectation and achievement, in the students' estimates of the work they could manage in a given period of time, would lessen as they progressed through their course. This too, was not corroborated. Reasons for this lack of learning are discussed in relation to planning work and writing it up in chapter 7.

4) Writing the thesis would follow a similar process to conducting the research. Once again this expectation was found not to have any relation to the information obtained from the students.

The one exception to this list of unsupported hypotheses was the major one that there would be general principles which could be extracted from

the experiences of postgraduate research students regardless of whether they were in the Arts or the Sciences, or a traditional, or 'red-brick' university. Some of these general principles are now given in summary form so that the reader may have some conception of what is to follow.

The main finding to come out of the research was that the length of time that it took for the postgraduate students to become autonomous researchers was determined by the relationship they had with their supervisors. The ability of the students to evaluate their own work appeared to be a function of the length of time that the students were allowed to remain dependent on their supervisors. At first the supervisors were the mediators between the students' work and the information it contained regarding their progress.
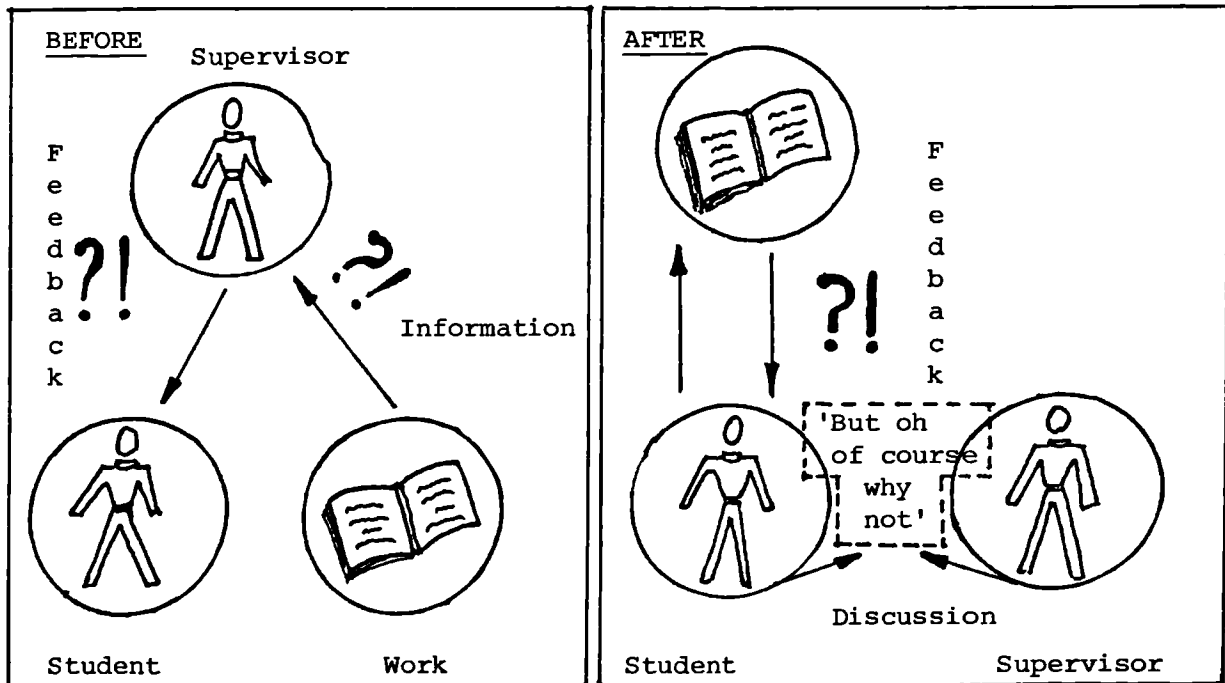
Student and supervisor interact through the student's work.

Student and work are autonomous while the student's relationship with the supervisor has become more egalitarian.

As the postgraduates settled into their research programme they gradually developed the skill to interpret the information contained in their own work together with the self-confidence necessary to base their subsequent actions on that information.

It appeared too, that planning over time was more difficult to do for written than for practical work such as computing or experimenting. Further, that writing seemed to serve two functions; initially it was a creative activity similar to thinking but later it was more of an organizational activity that helped to clarify thought and fuse disparate aspects of the research. For these reasons it was one of the most difficult activities undertaken by the postgraduates. It was also the activity that was perceived by them as being of relatively minor importance.

The postgraduates' enthusiasm for their Ph.D. diminished due to the length of time they had to spend working on a single problem, but this had an important effect on the development of their work. At first they had seen the Ph.D. as very special and people with doctorates as different from others because they had all made a unique contribution to the development of knowledge. Later they realized that the thesis was just another job that had to be finished and the 'special' qualities needed were those of persistence, determination and hard work.

The stages of disillusion and pain had not been expected but neither was the finding reported on page 112 that the students tended to underestimate their own progress. On the whole what follows is a report that, had it set out only to test and support the original hypotheses, given as expectation on pages 13 and 14, might never have been written!

CHAPTER ONE

INTRODUCTION

Many thousands of postgraduate students learn how to do research by spending a minimum of three years in a university registered for a Ph.D. degree; yet very little is known about the process of learning to do research. This thesis is the result of an attempt to study how a few people tried to do research for the first time. It is concerned with how people solve the problems which confront them when they are doing a research degree.

Both Medawar (1964) and Sacks (1978) have pointed out that the scientific literature often creates the erroneous impression that research proceeds logically and with pre-ordained inevitability. Sacks says 'Perhaps what is happening is that the reconstructed logic of the process comes to stand for the process itself' (p.49). It is the aim of this thesis to examine the truth of this view. First, a historical account of the development of this study up to the formulation of its questions is given.

The Pilot Study

The decision to undertake this study arose from an earlier interest in the role of feedback in problem solving. Prior to the main study, I conducted a small experimental study in which postgraduate students were asked to solve a deceptively easy problem. The problem was a variation of the 2, 4, 6 task devised by Wason (1960). This problem involves the subjects in generating a series of hypotheses in order to arrive at a general rule. In the small pilot study the subjects were told either that they would be receiving no feedback from the experimenter or that they would be given information about their progress after each trial. Both groups were given identical instructions about the problem at the start. All subjects were timed. Beginning, completing and rewriting times were

noted together with subjective estimates of time taken. The trials each took between 15 and 30 minutes.

The result of this experiment showed significant differences between the two groups (p = < .05). The subjects in the 'no feedback' condition waited 0.98 minutes before beginning to write their first trial series of numbers and hypotheses. This was significantly longer than their counterparts in the 'feedback' group who waited only 0.412 mins. They also took significantly longer (12.43 mins) to complete the problem and announce a rule than the 'feedback' group (7.25 mins). This was regardless of whether or not the solution finally offered was correct. The 'no feedback' group also overestimated the time it had taken them to complete the task significantly more than the 'feedback' group. The differences here were:

No feedback group - 7.81 mins more)
) than actual time taken.
Feedback group   - 0.98 mins less)

The subjects taking part in this experiment were all asked to rewrite the instructions before and after completing the problem. They all took much longer to rewrite the instructions after they had completed the problem regardless of group and irrespective of whether or not the solution they offered was correct.[*]

Some of the questions raised by these results were:

1 - Why did people take longer to start work on a problem when they were not expecting information regarding their progress even though they had the same amount of information about the problem when they started?

2 - Why did the 'no feedback' group overestimate the time spent working on the problem?

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[*] The results of the rewriting of instructions were highly significant (p = 0.0005 Binomial test).

3 - Why was the time needed to rewrite instructions for a familiar prob-

   lem more than the time needed for a novel problem?

Answers to these questions can be suggested within the framework of

Ornstein's (1969) theory of cognitive organization and duration experi-

ence. Ornstein says that subjective experience of time changes according

to the amount of information being stored mentally. His theory suggests

that at first the cognitive load is great and therefore time is perceived

as passing relatively slowly. Once the information is efficiently processed

and organized into a cohesive system it makes up a smaller load and time is

perceived as passing more quickly.

In the pilot experiment people took longer to act on the problem when

they were not expecting external information. This could be because they

were trying to organize the information they already had into a manageable

form. However, this would not be the best strategy to adopt for those who

were expecting help from outside. In this case the sooner they acted the

sooner they would be given more information. For these reasons behaviour

was affected by the anticipation of feedback.

The people in the 'feedback' group knew that once they had taken

some action based on their initial knowledge they would receive further

information to help them towards solution. The additional knowledge

would at first extend the cognitive load, according to Ornstein's theory,

but gradually it would help to integrate the discrete pieces of informa-

tion into a form that made sense. When this happened, storage space

would automatically be reduced and this in turn would shorten the duration

experience.

If this is true then the people who have been given feedback will

ultimately experience the time spent solving the problem as less than

those who had to manipulate large amounts of separate information. Such an explanation provides possible answers to questions (1) and (2). Namely, that people who are not expecting feedback take longer to act on a problem because they are trying to organize the information they do have internally. This, together with the additional information they deduce from operating on the problem, takes up more cognitive space and consequently time is perceived as passing slowly or, to use Ornstein's terminology, duration experience is lengthened.

Question (3) concerning the additional time needed for both groups to rewrite instructions after completing the problem could be related to this explanation. Writing about a recent experience and presenting the relevant information involves people in running through the process in their mind. After the experiment both groups had more to think about than prior to the experiment. This meant that (i) it took longer to run through the process (ii) the duration experience, or perception of the passage of time, was longer after completion than prior to commencement and (iii) the overall cognitive load was greater, therefore it took longer to express instructions for the problem in writing after having experienced it.

The theory relating organization of cognitive load to subjective duration experience was developed by Ornstein from experiments designed to accommodate very short time intervals i.e. not more than 60 seconds. The problem solving experiment used as a pilot in this study was concerned with longer time intervals of from 15 to 30 minutes. The results which showed that anticipated, as well as actual, feedback was an important influence on problem solving behaviour, permitted interpretation based on this theory. That this should be so was both exciting and convenient,

but promising though Ornstein's approach may be, it must be used with caution when explaining any results based on time intervals of more than one minute.

The Present Study

About this time in the evolution of the present study the Social Science Research Council sent out a letter to supervisors questioning the present system of research degree education and asking whether an alternative form of training might not be preferable. The juxtaposition of the early problem solving experiment and the concern regarding postgraduate education led to the conception of the present study.

Real life problem solving in the form of doing research was to be the topic addressed and the role of feedback was to be the principal focus. Rewriting instructions was to become writing paragraphs about work intended to be undertaken before it was attempted and work completed after it had been done. The extended time period of formulating and then bringing a research problem to fruition would make it easy to monitor the changing organization of a postgraduate's thinking as the problem became more familiar. It would also be possible to investigate how time was experienced by following estimations of time needed for parts of the work and then comparing them with the time taken.

In the Ph.D. training programme the most important source of feedback is the supervisor, so student and supervisor pairs were to be recruited for the study and attention paid to the techniques used by the supervisors in giving information about their progress to the postgraduates. Records could be kept of the supervisors' assessment and comparison made with the self-evaluations of their students. How feedback from the supervisors af-

fected the work of the students and how the postgraduates' perception of their Ph.D. changed as a result of their progress, could all be investigated using clinical methods.

The expectation of the author at the start of this study of postgraduates was that their research problems would come into focus as a result of working in the area, rather as a photograph gradually emerges and sharpens as it is first immersed in developing fluid and then left to dry.

Other expectations were concerned with the students themselves. These were influenced by a small amount of personal experience, hearsay from other postgraduates and articles in the national press. The prevalent picture of postgraduates at this time was of a bright and enthusiastic group of people. They had done well in examinations, knew more or less what they were going to do, and planned their work in a logical manner. Finally, the original picture of the typical postgraduate was confounded by tales of isolation, lack of structure and sometimes disinterested supervisors. The last is important as it was from the missing feedback during periods of disinterest on the part of supervisors that the effects of 'feedback' and 'no feedback' was to be observed.

The research question investigated during the course of the author's Ph.D. programme, and hence the topic being addressed by this thesis is 'How do postgraduates experience the process of doing a Ph.D.?'

Subsumed under this, the questions originally being addressed were:

(1) What is the effect of feedback on the postgraduates' progress? This was to be investigated by involving the supervisors in the research.

(2) How accurate are the students in assessing their own progress? Record sheets were designed to monitor this.

(3) Do postgraduates use short term goals to help them solve research

problems? Writing paragraphs before and after attempting parts of their work would help clarify this while also giving some insight into their subjective experience of time.

(4) How does perception of the Ph.D. change as a result of having worked on it for three years? Repertory grids would be used to give some idea of how cognitive structures changed over time. ('Cognitive structures' here is used to describe the way in which postgraduates group aspects of their thinking about their work.)

It was with this formulation that an attempt was made to discover how it felt to the postgraduates to go through the process of learning to do research by registering for a Ph.D. degree.

The overall question of students' perceptions of the process of doing a Ph.D. did not change during the study. However, the research problem of the author gradually came into focus as a result of working in the area. The question being considered underwent subtle changes during the three years of conducting the research. This was because it was established quite early in the research that the earlier questions were not the most helpful for supplying information that would provide a solution to the superordinate question concerning the process of doing a Ph.D. The important questions eventually turned out to be:

(1) What is the effect of the student and supervisor relationship on the outcome?

(2) How do postgraduates plan their work?

(3) What is the role of writing in learning to do research and to report it?

It is evident how these questions evolved from the earlier ones. The student and supervisor relationship is integrally related to the questions

of feedback and the ability to monitor one's own progress. The analysis of how time was experienced through the difference between expectation and achievement of short term goals developed directly into the planning of work. 'Planning' is defined here as a strategy designed by an individual to achieve a specific goal in a given period of time.

'Perception of the Ph.D.' turned out to be an ambiguous question. At first it was thought that the grids would be sensitive to changes in the way the postgraduates thought about their research problems. In the event what the grids showed were the changes in the way the postgraduates thought about doing a Ph.D. This was probably due to the elements elicited for the grids which were primarily concerned with the author's research problem - not the research problem of the postgraduates being researched!

The only question which developed directly from the study as it proceeded, rather than from any question that was originally being considered but which changed over time, was that concerned with writing. Writing emerged quite early as a significant aspect of the work and became increasingly important as the research progressed.

CHAPTER 2

SETTING THE SCENE

Introduction

This chapter is divided into six sections. The first merely describes an attempt to locate relevant literature through the use of a computerized search. The next three sections are concerned with questions which aim to establish what is currently known about research students and their training. The last two sections are directly concerned with the questions being addressed in this thesis. They aim to further understanding of how postgraduate research students experience the process of learning to do research through studying for a Ph.D. The questions address planning work and writing the thesis, and are concerned with the general question regarding perception of the Ph.D.

The literature review spans the period from 1955 to 1981. In 1955 Kelly published his theory of personal constructs and McClelland published his theory of the need to achieve. Both are relevant to the present study even though neither are specific to postgraduates. In fact several related, or relevant, studies appeared in different parts of the psychological literature during this period although they have not been collected together before within the framework of learning to do research. Certain questions have been formulated in order to try to present a logical context within which to place this study. These questions, which form the headings of the sections, are included purely to facilitate the organization of the chapter into a coherent form and are intended to help the reader follow the information in respect of the research questions as it develops.

1. Computerized search

At first it seemed a good idea to use modern technology as a means of

identifying literature from a variety of disciplines and specialist areas in order to draw them together for the purpose of this thesis.

In order to discover what was known about postgraduate research students and to identify who had investigated this area of higher education a literature search was carried out using the Lockhead Palo Alto computer (DIALOG system). The strategy adopted was to identify studies which included in their titles or descriptions the key words 'supervision', 'postgraduate', 'Ph.D. thesis', in combination with 'research', 'higher degrees', 'education' and 'teaching'. The data bases searched were the Social Science Citation Index, Comprehensive Dissertation Abstracts, and Educational Research Information Centre. The search yielded a total of 18 titles.

However, an examination of the detail of these references did not reveal the existence of any study which addressed itself to the questions investigated in this thesis. In fact, the references indicated that there is little in existence which has any direct relevance to the current investigation.

Only one abstract 'On supervising student research' (Seeman, 1973) suggested any similarity to the topic of the present study. A detailed examination of this paper showed that it was an account of how one supervisor had thought about the problem of teaching research skills and the recommendations that he had made as a result of his experiences with postgraduate students. Seeman's observations were based on introspection and an awareness of the demands made upon supervisors, from the point of view of somebody who had not yet forgotten what it was like to be a postgraduate student. His comments arose from the system in the United States, which is different in several ways from the British system. Nevertheless, they are of interest to the present study.

The main point that he makes is that the present student and supervisor (adviser-advisee) relationship is a symbiotic one that needs to be changed into a relationship with clearly differentiated boundaries. He says that the way to do this is for supervisors to encourage their students to value and trust their own experiences. The advantage of using their own experience to further the research task would be that the new knowledge created during the process of 'becoming a scientist' would in turn, help the students to become more autonomous. This occurs merely by the student's recognition of the inevitable link between the experiences of the knower and the generation of new knowledge. Such an approach places the knower at the centre of the development of knowledge. Polanyi (1958; 1969) was concerned with the knowing process and stressed the importance of tacit, or personal knowledge. Seeman acknowledges this subjective element in research and so urges supervisors to help their students become independent by accepting a two-stage approach to supervision. During the first stage the supervisor has the responsibility of deciding whether the proposed work is of the required standard and if the student has the necessary potential to carry it through. He sees this difficult decision as seeking a minimal, rather than an optimal, point on which to base future discussions with the student. The second stage begins when he adopts a colleague-consultant role which places responsibility for their work firmly onto the students themselves. This planned procedure differs from a laissez-faire approach by having clearly defined structure and accountability. It also has a devolvement of power from the supervisor into a more symmetrical, give and take kind of relationship with the student.

2. What has been written about research students?

Despite the disappointing results of the computerized search, several

relevant studies were discovered by more conventional means. Academics

in Britain who have their Ph.D.s in psychology and are now in the posi-

tion of being supervisors to research students have questioned the process

that leads to the award of the Ph.D. (as Seeman had done in the United

States).

Wason (1974) referred to

(1) the lack of a regular work schedule,

(2) the difficulty of finding a problem on which to work,

(3) the problems he had encountered during supervision,

(4) the confusion experienced by the new postgraduate.

He also commented on the difficulties the students encountered when

writing the thesis, which he assumed to be done after the research had

been completed. These are factors which have been explored in some depth

in the present study.

Baddeley (1979) was more critical in his analysis and asked whether

the Ph.D. degree in psychology was becoming devalued. He referred to

(1) the narrowness of a training that concentrates on a single topic,

(2) the narrowness of the thesis that results from it,

(3) the training and whether it has any relevance at all to either an

       academic or an industrial career.

He concluded that the present system failed to provide adequate research

training for many postgraduate students.

His main interpretation of the problem was that the non-directive

tradition in Britain means that the supervisor may do very little during

the early years of a research student's work, due to the difficulty of

steering an adequate line between laissez-faire and firm direction. He also referred to the relative uselessness of thesis writing as a training to communicate research findings.

The thesis is a problem for research students and their supervisors which has also been identified by Frances (1976), a professor of hydraulics, working in the area of civil and mechanical engineering. He was particularly concerned about the ambiguity present in guidelines for students, supervisors and examiners. He points out that within the context of the Ph.D. thesis, originality has never been defined. He lists a number of ways in which the students being examined may be considered to have shown originality. These are by:

(1) setting down a major piece of new information in writing for the first time,

(2) giving a good exposition of another's idea,

(3) continuing a previously original piece of work,

(4) carrying out original work designed by the supervisor,

(5) providing a single original technique, observation, or result in an otherwise unoriginal but competent piece of research,

(6) having followed instructions and understood the original concepts,

(7) having many original ideas, method and interpretations all performed by others under the direction of the postgraduate,

(8) showing originality in testing somebody else's idea.

He concludes that the examiner's interpretation of this ambiguity is an important component in the decision whether or not to award the Ph.D. degree.

These three approaches are similar in that the supervisors all express concern about the system of learning to do research for the Ph.D. degree.

Baum (1979), an academic researcher, summarized the problems currently

inherent in the system as:

(1)   uninterested supervisors

(2)   unhelpful research samples

(3)   frustration

(4)   boredom

(5)   lack of research training

(6)   deadening of enthusiasm.

He also pointed out that even the 'failures' of this system were among

the successes of the initial degree stage. He concluded that it seems

to be the manner in which the present system is operated that is at fault.

Rudd (1975) based his study on the results of interviews with 696

British postgraduate students. He estimated that a quarter of all re-

search students were seriously dissatisfied with the supervision that they

were receiving. He did not, however, attempt to link the supervisors' ex-

periences to those of the students.   Yet it is argued throughout this

thesis that the progress of the research is more likely to be a function

of the relationship between the student and supervisor than the behaviour

of either one of them.

3.   What is known about the training of research students?

As it happens, it was from his experiences in supervising postgraduate

students as well as working with clients (patients) that Kelly (1955)

first introduced personal construct theory. He noted that in his role of

'thesis director' at Ohio State university in America he was engaged in

similar activities to those in which he engaged in his role as therapist.

He describes these as:

helping the person to 'pinpoint the issues, to observe, to become intimate with the problem, to form hypotheses either inductively or deductively, to make some preliminary test runs, to relate his data to his predictions, to control his experiments so that he will know what led to what, to generalize cautiously and to revise his thinking in the light of experience' (Kelly, 1963).

Kelly's approach states that we perceive the world through our own personal pair of goggles. We all bring our own unique history and experiences to situations and this affects how we construe them. He emphasized the individual as the maker of meaning and believed that in order to understand people's behaviour it is necessary to know how they construe their situation. People are neither prisoners of their environment nor victims of their biographies, but active individuals struggling to make sense of their experiences and acting in accordance with the meaning they impose on these experiences.

Other approaches to learning often assume that teacher and learner alike both perceive the learning situation in the same way. The Ph.D. is a learning situation where the students are encouraged to seek out information for themselves and might incorporate the idea of developing the ability to learn from mistakes.

The new postgraduates have spent long years at school receiving knowledge that helped them to pass examinations. It is probable that their undergraduate courses were also based on a model which resulted in the handing out, as opposed to seeking out, of information. Snyder (1967) noted that, at the undergraduate level, very bright students were always asking questions. These students were regarded by the staff as a nuisance.

This means that those qualities most likely to be needed for a researcher, i.e. curiosity and the ability to see different possibilities in a situation, may be discouraged in the population from which research students are drawn. Further, that the very students who would be most suited to research are those who would have had more negative experiences with members of the academic staff. Within the context of this thesis and the questions being considered, it seems that a predisposition for an unsuccessful student and supervisor relationship may be being set up by the university system.

Yet what Snyder observed is merely a continuation of what occurs at an earlier age. De Bono (1973) states that at the end of long years of formal education, there is a deterioration in the thinking ability of children which is reflected in their attempts to solve problems. He shares Bruner's (1972) view that schooling in our society not only makes it unnecessary for the learner to think, but also makes it difficult for the pupil who comes up with an unacceptable, new point of view. He describes the process of the reduction of fantasy, imagination and clever guessing to a minimum. Yet these are precisely the characteristics that are needed to do good research.

In a discussion of what happens to the learner during the process of learning, Thomas (1977) argues that learning criteria are continuously being generated by the learner. These criteria are then used as yardsticks against which the learner subjectively evaluates progress. He says that by considering his or her learning experience from different points in time the individual will perceive it differently. This means that individuals see completed projects quite differently from the way in which they saw them while they were working on them. Thomas suggests that this is be-

cause it is only retrospectively that people can recognize the learning that has occurred. Such recognition is not possible at the time that learning takes place. This idea is relevant to the present study because it goes some way towards explaining why people's perceptions of their Ph.D. change over time.

Abercrombie (1966) speaking of undergraduates, points out that the student sees the teacher as more remote than the teacher sees the student. She stresses the fact that a student's perception of the teaching relationship is more asymmetrical than a teacher's perception. This observation, together with that noted by Wason concerning the effort needed for a new postgraduate to address a member of the academic staff by their first name, is important within the context of the present study. This is because the effects of the student and supervisor relationship on the outcome of the postgraduates' research will be considered in some detail in this thesis. The present state of knowledge is mainly concerned with information on supervising based on introspective accounts of supervisors, and with statistics on non-completion rates based on large scale surveys of postgraduate students.

A repertory grid study was carried out by Runkel and Damrin (1961) who attempted to discover changes that occurred while trainee teachers were studying for their qualification. They found that at the beginning the students were viewing children in terms of many dimensions that were both complex and unhelpful to them as teachers. At a mid-point in training the students were using only a few, simple dimensions and by the time they had completed their course they were viewing the children with the help of more dimensions than they had been using half-way through. During the course they identified aspects of the children in their situation that were use-

ful to them in their work as teachers. This begins to explain how people's

perceptions change.

The following explanation for this phenomenon has been proposed by

Bannister and Mair (1968). 'This suggests that the aim of training might

have been first to beat all the nonsense out of the trainee and get him to

concentrate on one or two "important" things. When the subject had re-

covered from the impact of the focusing, he could again individually

elaborate his construction of the teaching situation' (p.209). Perhaps

the same thing is happening to research students.

In fact, McKnight (1981) has related such a cycle to research projects

and suggests that 'in the early stages of a project one expects construing

to be fairly undifferentiated. He says that the lack of differentiation at

this point can be seen as reflecting a lack of experience. As the project

progresses and experience is gained, so differentiation increases up to

some maximum which probably occurs after all the work is completed and

prior to writing the report'. McKnight's students were working on their

undergraduate projects but it might be that postgraduate research students

too are expected to write a thesis at precisely the time that they are

least able to co-ordinate their findings into an integrated whole, i.e.

before there is a small but organized amount of differentiation.

4.   What research has been done of people engaged in research?

Studies based on large scale survey of wastage rates among postgraduate

students continue the gloomy picture drawn by the academics who have ex-

pressed concern. Taking nine years from registration as their point of

departure, Rudd and Hatch (1968) found a 50 per cent dropout rate among

Arts students and 15 per cent among Science students. The Social Science

Research Council reported in 1980 that less than a third of postgraduates funded by them completed their Ph.D's in four years. Wright (1965) reported that only half of her sample of 61 higher degree students had completed after eleven years. New postgraduates seem to be at a disadvantage when starting their research degree course. Why should this be so?

Welsh (1978) discovered that there was dissatisfaction with supervision due to insufficient contact between the postgraduates and their supervisors. The degree of formality the new graduates have been used to within the educational system, coupled with the effect that the system has had in discouraging original thought have both to be overcome before they can really start to generate ideas and discuss them with their supervisors. She has stressed (1981) the importance for supervisors to communicate to their students the necessity of adopting a structured approach, based on effective planning, if they wish to complete their Ph.D. successfully.

Katz and Hartnett (1976) looked at graduate education in America from the point of view of the contribution it makes to the development of the person by helping to blend the intellectual and the emotional. They point out that little attention has been given to students and what happens to them during their postgraduate careers. A significant point made by them concerns the lack of feedback from supervisors to their students. They recommend that supervisors should become more nurturant even if this nurturance was only to extend to introducing current students to those who had recently received their Ph.D. They are critical of the narrowness of the topics studied and the standard of writing in theses. These inadequacies are attributed to the system and the supervisors' place in it and not to any inherent lack of ability in the postgraduates.

Nordbeck and Maini (1970) stated that what was significant about po-

tential researchers compared to a control group of young graduates, was that they could formulate a greater number of problems in their respective subject areas although these were not necessarily 'better' problems than those formulated by the control group.

Continuing their study of young research workers in Sweden, Maini and Nordbeck (1972) identified five main phases in research: (1) preparatory, (2) planning, (3) data collection, (4) analysis and interpretation of data, and (5) report writing. They stressed the importance of critical moments in the individual research process which can occur at any time during these phases. A critical moment is defined as 'such isolated or recurrent incidents and periods experienced by the researcher as being crucial for the progress and results of his research'.

The five phases noted by the Swedish team are all important aspects of what occurs during the process of research, but the emphasis in this thesis is on process as a continuous development of interconnected activities. These activities include all of those identified by Nordbeck and Maini as phases, but need not necessarily occur in strict linear succession.

Nordbeck and Maini's study of the psychology of the researcher differed from the study of postgraduates learning to do research because new postgraduates are confronted with the confusion noted by Wason (1974) at the same time as they would be entering the preparatory phase of Nordbeck and Maini. In addition, new postgraduates are aiming to complete a research project in three years while also hoping to gain the Ph.D. degree which qualifies them as research workers. In order to achieve this, they have to complete the research and write the report by which they will be assessed. Therefore, although there are overlaps with the Swedish project, the study of postgraduate students learning to do research differs from

the study of research workers doing research, even though their sample included postgraduates as well as post-doctoral researchers. For these reasons, the present investigation aims to look at the whole process of learning to do research rather than concentrate in depth on any single aspect of it.

The next two sections refer more directly to two of the questions being asked in the introduction to this thesis. These are:

How do postgraduates plan their work?

and, What is the role of writing in learning to do research and to report it?

5.   What is known about planning work as a psychological activity?

There is very little that is known about the psychology of planning but, according to Miller, Galanter and Pribram (1960) who are responsible for the seminal work currently available on this topic, planning is 'an indispensable aspect of the human mind' (p.102). They define it as 'any hierarchical process in the organism that can control the order in which a sequence of operations is to be performed' (p.16).

The definition of planning being used in this thesis is: A strategy designed by an individual to achieve a specific goal in a given period of time.   Such definition is more in keeping with Jaques' (1976) notion of time-span and McClelland's (1955) theory of motivation than with Miller, Galanter and Pribram's concept of planning.

Their conception of planning is similar to a program for a computer. They postulate a TOTE model with an inbuilt feedback loop. This unit comprises a Test - Operate - Test - Exit routine and is offered as an explanation of behaviour in general. Their hierarchy of TOTE units assumes that

the planners are able to evaluate their own actions from the feedback con-
tained in the operation before initiating the next sequence. This assumption
is not necessarily correct as it is possible that any discrepancy between
'what is' and 'what should be' at the 'test' phase is not obvious to the
planners.

There are other points in Miller et al.'s conception of planning that
are not in accordance with the idea of planning as it is used in this
thesis. For example, they state that different people plan on different
time scales from each other and that different people fill in more or less
detail of a plan. These differences are put down to stable personality
characteristics of the individual planner.

It is precisely the amount of time and detail in a plan within one
individual that is of particular relevance to the topic of this thesis.
A flexible plan for Miller et al., is one where the parts can be performed
in any order, e.g. writing five letters. A flexible plan within the con-
text of this thesis is one that can be modified as a result of information
received from operating on parts of it, i.e. feedback from an action may
lead the individual to change the plan to some extent. The change could
relate either to time or task, or both. Miller et al. do not insist on a
specific goal and are not interested in precise time scales. They are con-
cerned with the execution rather than the formation of plans (p.69) (original
emphasis). The concern in this study of the postgraduates is with the cog-
nitive structures lying behind the execution of a plan; the execution here
would be the behaviour which results from the plan. Miller et al. make the
assumption that plans are constantly being revised after they have begun to
be executed but do not state how this happens. It is the mechanisms
through which this revision occurs that are the object of interest in this
thesis.

Furthermore the conception of planning employed by Miller et al. is too general for purposes of this thesis. Within their definition of plans they include the notion of cognitive maps (knowing where to find a recipe book), memory (selection and retrieval of metaplans to generate plans), and behaviour (operating on the environment and evaluating feedback). The idea of plans being stored and available for a certain specific time is not really relevant to the idea of plans as an intention to achieve a specific goal in a given time, and does not account for planning on different time scales at the same time.

Borger and Seaborne (1960) also comment on the generality in Miller et al.'s use of the term. They say that both conscious and unconscious processes are included in Miller, Galanter and Pribram's concept of planning, and draw attention to the computer-like and programmed aspect of behaviour using the term plan. This idea in particular is not consistent with the model of man as an actively construing planner, which is the model used in the present study.

Initially, the new postgraduates have to plan a programme of work in conjunction with their supervisors. This may take the form of a general overall plan for the three years, or a series of more detailed, short term plans with specific deadlines, or both.

Planning work is a theme which Jaques (1976) develops on the basis of this theory of time-span. Time-span of discretion is the longest period of time over which an individual can use his own judgement and tolerate uncertainty. The relationship between time-span and planning, according to Jaques (1978), is that the longer ahead the goal, the greater is the amount of information that needs to be organized from the start. The longer the task, the more complex it usually is and therefore the greater

the number of circumstances which need to be anticipated. The amount of
initial information required and the number of sub-categories into which
this information is organized will be determined by an individual according
to his time-span capacity.

This means that different people will require different lengths of
time for planning work and setting short-term goals, and that the amount of
information to be organized at different stages of the plan will also vary
from one person to another. This coincides with the view taken by McClelland
(1955) in his explanation of the need to achieve.

According to McClelland the achievement motive demands that an individu-
al must continually work with more and more complex situations in order to
avoid boredom. His theory is 'hedonistic' in that it is based on the af-
fective, or emotional, component of personality which constantly needs to
be satisfied. He also relates level of intelligence to the need to achieve.
He concludes that, in order for satisfaction to be reached, any of a
numerous and complex variety of methods could be implemented. Because of
this it becomes a highly individual matter.

These two studies, while relevant to the idea of planning work, are
primarily concerned with managing work through time and the need to achieve.
However, they are more consistent with the approach to planning being taken
in the present study, than is the approach taken by Miller, Galanter and
Pribram. Both are concerned with the individual and while Jaques is
primarily interested in time, McClelland places emphasis on goal. In this
study the process of planning at the individual level, will be considered
with particular relevance to the time taken to reach a specific goal -
the Ph.D.

6.   What is known about thesis writing?

The Ph.D. thesis is the product on which assessment of the students' work
is eventually based and the critics of the present system are unanimous
in their comments regarding the difficulties experienced by students at
the 'writing up' stage of their research. Baddeley (1979) discussed prob-
lems of adequate supervision in writing and the training of writing skills,
Wason (1974) described procrastination and incoherence in presenting results
in written form.

Murray (1978) refers to writing as a process of rewriting and explains
that writers read and rewrite to discover what they have to say. He sug-
gests a technique to improve writing skills where students' successive
drafts are examined to see whether the later drafts define and refine
meaning more effectively than did the earlier drafts.

In a study of writing among 170 academic staff members, Lowenthal and
Wason (1977) also found rewriting to be an important factor in the writing
process. They identified two distinct writing types in their survey. They
described these types as:

(1)   those who see writing as a serial process in which the words are

corrected as they are written and who plan their writing in detail

before beginning to write;

(2)   those who can only think as they write and compose a succession of

complete drafts.

They discovered, too, that some people achieved great satisfaction from
the act of writing while others described it as an extremely painful experi-
ence. It would appear that these latter members of the university staff are
similar to postgraduate students with regard to the pains and problems suf-
fered while trying to write.

Commenting on thesis writing from the student's, rather than the supervisor's, point of view McGuinnes (1974) says that points develop as one writes and that thesis writers will not know what their thesis is about until they have written it. She, too, stressed the importance of a series of rewritings. The emphasis on rewriting and learning from what has been written suggests that, at the very least, writing helps to sort out chaotic ideas. At the other extreme, this way of talking about writing a thesis makes it sound as though what has been written controls the writer rather than the other way around.

This is not as unusual as might be imagined. Cohen (1977) suggested that writing played an important part in the process of psychological dis-covery. He postulated a link between writing and creativity and reported that many psychologists said that the only time they think was when they sat down to write.

It may be that the difficulty in writing experienced by so many academics at both the student and staff levels is due to a strong link be-tween written language and thought. This is particularly significant when considering the number of people who discuss their ideas and their work (e.g. at conferences) but cannot write about them easily. Postgraduates, too, can say 'well what I meant to say was ...' but have not managed to write it in such a comprehensible manner. Written language has been refer-red to as 'the means of discovery of new knowledge' (Olson, 1975). If writing leads to discovery and not, as is generally supposed, discoveries merely need to be put into writing, this may in part account for the experi-ence of writing a scientific paper as the most difficult part of the work for some academics. Murray defines writing as 'the process of using language to discover meaning in experience and to communicate it'. He

bases his argument primarily on observations of poets and authors. But the assumption of a link between writing and thinking is supported by the work of both Cohen and Wason with regard to academic and scientific writing. It may well be that the definition used by Murray is also appropriate for the postgraduate involved in thesis writing. In fact, the highly objective language of science may be disguising the important subjective element of discovery which results from experiencing the process of writing.

Certainly writing is important for the postgraduate students who need to get some order out of their research data. The question is whether their period of learning to do research has included acquiring the necessary skills. Pirsig (1974) described his teaching method for people having writing difficulties; it was simply to define the topic as narrowly as possible. The illustration he uses was originally intended as a project on the United States, this narrowed to the main street of the town, then the front of one building and eventually one brick of the building. This exercise was twofold: (1) to force concentration on a well defined area that had not been written about before and (2) to minimize the risk of imitation.

If the skills of writing cannot be defined but can be taught as Pirsig implies, then perhaps they resemble the skills needed to do research which are also never articulated to the students. It is precisely these skills, implicit though they may be, that students are required to learn during their three years as postgraduates. Writing the thesis is known to be a particularly problematic area for Ph.D. students. Difficulties experienced at this time may be due to the amount of thinking that needs to be incorporated into the work of organizing the research into a coherent whole at a time of maximum cognitive differentiation.

Summary

From this particular selection of literature it has been possible to establish that there is a paucity of information regarding postgraduate research degree training. The computerized search yielded only one paper, based on the American system, while the four articles most directly relevant to this study were based on introspective accounts from the point of view of the supervisor. It suggested that new postgraduates experience certain difficulties with regard to supervision and that only a small proportion of them complete their Ph.D.s in four years.

Much of the information relative to the training of research students was extrapolated from information about students at the undergraduate level of our education system. The research on researchers showed a slight tendency to confuse postgraduate and post-doctoral research workers but nevertheless gave some useful information relevant to this study. The ability to generate problems and an awareness of critical moments were identified as significant features of young researchers in Sweden. The Swedish studies also discussed the existence of five main phases during the process of research.

The answer to the question 'what is known about planning work as a psychological activity?' was 'very little'. The most significant contributors to this field used 'planning' in such a way that very little of what they argued could be usefully applied to the postgraduates in this study. However, other theorists, concerned with managing time and with motivation towards a goal could be interpreted in a way applicable to the psychological planning of work.

Although very little is known about thesis writing, rather more is known about writing in general. Writing was referred to as 'a process of

rewriting' (Murray, 1978). It was described as a serial process for some and a succession of complete drafts for others. It could be a source of great satisfaction or an extremely painful process.

The student and supervisor pair as an asymmetrical role relationship has not been formally studied, but personal construct theory provides a conceptual framework from which such a relationship may be viewed.

CHAPTER 3

RELATIONSHIP BETWEEN THE THEORETICAL

FRAMEWORK AND THE METHODS USED

Introduction

This chapter describes the reasons for the methods of data collection and analysis used in the study. The seven case studies were analyzed and interpreted from within the framework of Kelly's Personal Construct Theory.

The format of the chapter is designed to give a rationale for the methodology followed by a brief introduction to the link between Personal Construct Theory and the repertory grid. It concludes with some criticisms of the grid technique as a research tool. The methods themselves are described in more detail in the next chapter.

Rationale for Methodology

As there is very little research or theory existing on the distinctive ways in which postgraduates tend to do research, the main purpose of this study was exploratory rather than confirmatory. An exploratory study requires a discipline no less rigorous than that associated with the methods of data collection involved in the experimental, hypothesis testing and large scale survey models of research. But it deviates in many respects from the more traditional models. The differences arise primarily because the aims of the research are different.

In the exploratory study the aims are:

(1) To research interesting problems which are not susceptible to the requirements of more traditional methods.

Glazer and Strauss (1967) emphasize the contribution that can be made to knowledge by the generation of new ideas and theories to be tested. Once this has been achieved the exploratory research can be complemented by the introduction of experiments and surveys. They also stress the im-

portance of avoiding the traditional approach when to use it would result
in restricting choice of problem to suit a particular method rather than
vice versa.

(2) To generate hypotheses rather than to test them, but to be as
     rigorous as possible while doing so.

The point here is that experimental methods control out extraneous, but
often relevant, variables. In the natural setting such variables are
noted and their effects described as far as possible. Exploration, rather
than experimentation, is the keyword. The next chapter describes the pro-
cedures adopted to fulfil these requirements.

(3) To produce comprehensive findings from the everyday world by using
     systematic techniques to study real-life situations rather than the
     more artificial experiment and laboratory based studies.

Battersby (1981) has pointed out that the type of methodology suited to
studying topics located within their natural environment demands a strin-
gent discipline. Instead of rigorous experimental hypothesis testing,
the case study looks for patterns and structures from which concepts may
be developed for future investigation. It permits individuals to elabor-
ate on their personal interpretation of events. The information obtained
by these means, makes it possible to identify where later, quantitative
studies should be focused. More specific questions may be posed at that
later stage, and any original hypotheses, which may have been derived
from the qualitative data of the earlier, exploratory study, can be tested.
If this work were to be extended at some time in the future, some of the
more traditional techniques could be used. These might take the form of
structured questionnaires, based on topics identified in this study, or a
controlled experiment involving two groups of students and their super-
visors.

The case study involves an intensive investigation of the people involved covering all relevant aspects of the complex process that is being researched. It usually continues over an extended period of time. The data collection for the present study was carried out over the three years that a Ph.D. is supposed to take from inception to completion. This three year period of registration for a higher degree was the same for the author as it was for the postgraduates being studied. The processes involved in working for a higher degree such as defining a specific problem on which to work, researching it and reporting it in writing, are necessarily protracted. Therefore, any patterns that recurred, either over time or between the student and supervisor pairs, could be monitored and recorded. As Wason (1974) has suggested, these processes, undergone while working on an activity, may alter the perception of the activity itself.

In addition to taking account of the longitudinal nature of such processes, the case study approach is well suited to looking for patterns in order to formulate tentative hypotheses. There was no need for a large sample at this stage of exploration where the important thing was to obtain systematic data from a real-life setting. In fact, as it was not at all certain at the start of the research what the important issues were likely to be, it was neither sensible nor practical to engage in experimentation or survey type research. The most appropriate time to introduce experiments and surveys to test any hypotheses that may have been developed, and so build on the discoveries of exploratory research, would be after the exploration has been completed.

The in-depth design was structured so that a wholistic picture of each of the pairs who made up the cases could be gathered by using several data collection techniques.

These were:

1.   individual interviews

2.   repertory grids

3.   feedback interviews, based on computer analyses of the grids

4.   free writing

5.   progress rating forms.

The systematic use of different methods has been mentioned by Webb et al. (1966). They say that there is a possibility of bias occurring in data due to different kinds of error creeping into different methods. Therefore, using a variety of methods is a way of increasing confidence. The advantage of using a number of different methods is that each may provide a differing view of the phenomena in question and hence minimize the risk of a distorted picture which might arise from the use of any one particular method.

The value of following a small number of student and supervisor pairs over the whole period of the students' registration for a higher degree was that the people involved could be studied in their natural setting. In addition, the different stages of their work could be monitored and the meaning to them of what was happening could be explored. The amount of detail required in order to achieve this depth of research was such that a larger number of cases would have been impractical.

In traditional research based on experimentation and/or large samples, individuals are viewed from the point of view of a detached researcher. Extraneous variables are eliminated as far as possible and the motivation of the subjects usually discounted. The aim is to obtain quantitative data that can be compared statistically, and replicated on other occasions, in other places, by other people. Tried and proven, as this 'experimental' method is, it is not suitable for all purposes.

Harré (1977) has argued for an intensive, rather than extensive, study in order to find out how people come to act as they do in a real life setting. He suggested Kelly's (1955) personal construct approach, based on the cognitive resources of the participants, as a model for explanation in psychological science. Harré was concerned to move away from studies of 'independent and dependent variable' treatments. He explains that this is because the extensive study gives rapid results but often tends towards the trivial in terms of what it is that is being investigated. Therefore, in order to use the extensive study in a more effective way it would be sensible to base the decision of what is to be investigated on the results of an earlier problem-defining study.

Harré and Kelly both believe that what people do is conditioned by their conceptions of what is going on in the changing situations in which they place themselves. Thus, the decision to work from a conceptual framework of Personal Construct Psychology (Kelly) was a direct result of the aim of the author to explore a little known area. This theory emphasizes the point of view of the individuals being studied. A somewhat more detailed explanation of it is given in the pages that follow in order to make explicit the links between Kelly's theory and the use of the repertory grid for this research.

A carefully defined in depth study was undertaken of what happens to people as they learn to do research. The repertory grid technique, described in the next chapter (pp.75-80) is a movement towards a marriage of the clinical, projective, qualitative method of research with a slightly more rigorous, structured, quantitative method. The reason for choosing to use the grid, a method that would permit some form of quantification, was in order to ensure that certain valuable information, not available

from the purely qualitative technique, would be revealed. In addition,
it was hoped that a certain amount of organization of the data would
result from the grid and that this organization could be used as an aid
to understanding the information derived from the more informal methods.

The Repertory Grid and its Relationship to Personal Construct Theory

When Kelly (1955) first introduced the repertory grid it was used only
for significant people in the life of the individual being considered,
and was known as the Role Construct Repertory Test.

More recently it has been used with a variety of elements, including
inanimate objects and abstract ideas, e.g. in personnel management with
parts of a job as the elements (Easterby-Smith, 1980); in politics using
attitudes as elements (Slater, 1980); and Runkel and Damrin (1961) used
grid methodology to explore the way in which student teachers learn their
subject.

Elements are chosen to represent the area in which construing is to
be investigated. For example, if it is interpersonal relationships, the
elements would probably be people. Elements can also be groups of people,
such as colleagues at work or members of the family; they can be objects
such as books; events such as holidays; and they can be experiences such
as selecting a career, or participating in a drama production.

The distinction between elements and constructs has been examined by
Smith (1978), who defines elements as the objects of people's thoughts,
and constructs as the qualities that people attribute to those objects.
Humphries (1973) refers to the grid as a two way classification of data,
consisting of a set of things rated called elements, and a set of rating
scales called constructs.

A construct differs from a concept in that it is bi-polar. Black and white are two separate concepts whose opposites are 'not black' and 'not white'. Therefore, a person's shoes could be just as much 'not white' as a forget-me-not and her blouse could be as 'not black' as a pillar box. Kelly rejected the notion of concepts and assumes a different structure of thought. He says that we see things in terms of how different or similar things are to each other. It is the idea of a contrast that separates out Kelly's notion of a construct from the traditional idea of a concept. A concept sometimes includes a connotation of 'natural' or inherent features while a construct is always only an interpretation.

A construct is the way in which we look at something and determines the interpretation we make of it. Suppose somebody construes in terms of a 'black' vs. 'white' construct. Such things as her blouse, shoes, the paper on which she writes, the skin of her neighbour, etc. are amenable to the 'black' vs. 'white' construct. Although it is possible for the construct to be misapplied - she may call her grey blouse white when her friend sees it as black - it is still applicable to those things which, for her, can be either black or white. The same is true for an inappropriate construct; merely to construe her neighbour's skin as black may not be a very informative way to look at her neighbour. However, there are other things, such as a pillar box or forget-me-not, for which this construct is obviously irrelevant.

People vary in the number of constructs that they use in their appreciation of something, or somebody. One person may see a chair only in terms of its function and another may employ so many dimensions in her perception of the same chair that it becomes quite unique for her. For example, a client may see a hairdresser's chair as a place to sit while

having her hair washed. The hairdresser, on the other hand, would have chosen it for the angle it could reach, the material from which it is constructed, the shape, portability and storage design built into it, its cost and durability.

A construct system is a way of seeing that is determined by our attitudes and experiences. It results from our perceptions of similarities and differences between objects and events. Our present perceptions are open to question and reconsideration - 'even the most obvious occurrences in daily life might appear utterly transformed if we were inventive enough to construe them differently.' (Kelly, 1966, p.1). This idea is the basis of the philosophical position known as 'constructive alternativism'.

Construct systems are unique to each individual and, because of this, our experience of the world is different from the next person's. For example, let the play 'Whose Life Is It Anyway', a story of an artist paralyzed as the result of an accident, be taken as an element. One person may say that it is about illness vs. health, the second person that it is about euthanasia vs. murder, the third that it is about personal freedom vs. society's values, another that it is a comedy rather than a tragedy and yet another that the principal actor could have been a woman instead of a man. All these people have different opinions about the element which are determined by their values and expectations. Each of them brings a different set of constructs to bear on what they are seeing.

The person who saw it as a comedy may also have seen it as suitable for a female star and as being about personal freedom. In this case the individual has applied three constructs to the one element. The element is, of course, the play and the constructs are comedy vs. tragedy, female star vs. male star and personal freedom vs. society's values.

According to Kelly's theory and to empirical work with the repertory grid by other researchers (Runkel and Damrin, 1961; Bannister and Mair, 1968), it is usual for the way in which we construe aspects of the world to change over time. This change is concerned with the amount of differentiation with which people view particular elements.

Kelly included two different cyclic processes in construing within his theory of personal constructs. One was to do with learning, which Kelly saw as a general life activity, and the other he referred to as a creativity cycle. The creativity cycle involves using 'loose' constructs which can be linked to each other in different ways until one way is accepted as more useful than the others. When this happens the constructs are 'tightened' so that people can see where they have got to and try out the ideas.

This can be interpreted to mean that initially, when a person is new to an area one would expect a lack of differentiation, i.e. most aspects would be treated equally. For example, an untrained person might construe 'flowers' by their appearance and group them accordingly into 'tulips', 'carnations', 'roses' etc.

Once an individual starts to explore an area and becomes familiar with parts of it there is a period of high differentiation. For example, if this person were to study botany she would probably categorize flowers into one or two important parts such as 'stamen', 'pollen' etc. At this time, most aspects are treated separately and difficulty might be experienced when attempts are made to co-ordinate all the individual components.

By the time she has become a specialist in botanical classification she would use a taxonomy for categorizing flowers that was at the same time more complex than the two preceding systems, but less differentiated

than it had been during the learning period. However, this new and expert

way of viewing flowers would be qualitatively different from the original.

At this point the way in which the topic is differentiated in the person's

thoughts helps her to grasp the significant features without being confused

by more trivial details. Even if there were to be a similar number of re-

lationships between constructs, the constructs themselves would be grouped

in quite a different way to the earlier groupings, and would probably in-

clude different constructs to those she possessed before she became a pro-

fessional.

This way of interpreting Kelly discriminates between learning about

something specific and the kind of learning that occurs as a result of

living our lives.

A construct system is constantly changing and becoming more complex

as we learn more about our environment. We build up our picture of the

world by construing patterns in events from the ways in which they re-

semble or differ from each other. Constructs are personal, bi-polar ab-

stractions used by people to structure aspects of their world, for example

- doing a Ph.D.

Some Criticisms of the Repertory Grid

The repertory grid is not a test, but a methodology aimed at revealing an

individual's personal construct system as clearly as possible. It has

sometimes been rejected as a diagnostic tool on the grounds that it cannot

be validated, except from within the construct system of the individual

being investigated (Foulds, 1973). It has also been said that the concept

of reliability, or stability of measurement, is thrown overboard in this

particular method of psychological assessment. Further, that it takes

only cognitive measures, while purporting to look at the total individual
(Bruner, 1956). The decision to use the grid in this study was only made
after these particular criticisms had been carefully considered.

Concerning reliability and validity, Kelly himself said that re-
liability was 'that characteristic of a test which makes it insensitive
to change.' (Quoted in Fransella and Bannister, 1977, p.82.) He also
said that validity was 'the capacity of a test to tell us what we already
know' (quoted on p.92). This study is concerned with a topic about which
very little is currently known. Its primary focus is the extent to which
student's experiences of the process being explored change over time. For
these reasons the criticisms based on traditional concepts of reliability
and validity were considered to be less relevant to the case studies of
this project than to other, more experimental types of approach.

Bannister and Fransella (1971), summarize several research projects
using the repertory grid and conclude that it permits a variety of valid
inferences to be drawn. Further, that accurate predictions could be made
and patterns identified when grids were used in single case studies.

So far as Bruner's 'mentalistic' criticism is concerned, Kelly re-
jected the cognitive and emotional dichotomy, believing that a person's
psychological construction of external reality was the result of thoughts,
feelings, and sensory experience all interacting with each other. This
belief also explains why a person would not be expected to construe a
situation in identical terms on two occasions. The construct system is
in a constant state of flux because of the interactions between the
changing emotions, thoughts and sensations.

Even if this explanation was not acceptable, the criticism is not
really very relevant to the present study because it could be argued that

doing research for a higher degree is primarily a cognitive activity.
But the explanation is relevant to this study because it provides yet
another reason for undertaking a holistic approach and avoiding post
hoc surveys.

As well as general criticisms of the grid, more specific criticisms
have been directed at it as a tool for measuring aspects of a person's
psychological world. Such criticisms are based on some of the assumptions
which are built into the procedures for administering the grid.

Some of these criticisms were both relevant and important to the
present study. Difficulties that were encountered during the course of
this research were sometimes directly related to known criticisms of the
repertory grid as a methodological technique. How such criticisms affected
the data collection are considered in some detail in chapter 6. The delay
in presenting these considerations is mainly because they are concerned
with scaling and rating procedures which will be described in the next
chapter. The difficulties that were encountered can be more usefully dis-
cussed in relation to known criticisms but will be more easily understood
once the research has been described and results presented.

On the other hand, due partly to the new methods of analysis used for
the grid and partly to the nature of the study, certain predicted difficul-
ties were not experienced. The important thing to remember is that the
grids were being used in conjunction with other methods of data collection,
and it was easy to discuss with the postgraduates any difficulties that
were encountered as and when they arose. Because of this the author de-
cided that it was unlikely that any grave distortion of evidence would
result from using the grids in the way described in the next chapter.

Implications of Using the Methods

The choice of method being used in this study meant that there was consider-
able interaction between the participants and the investigator/author.
Therefore, rather than being either an experimental or 'pure' research
project, this project was like 'action' research insofar as the methods
might have affected the outcomes to a limited extent. This would result
from a raised awareness on the part of the people being studied of the
issues involved, due to discussing specific problems and particular areas
of interest. Action research is a usual and accepted method of exploratory
investigation in industry (Foster, 1972; Argyris, 1970; Seashore and
Bowers, 1963) but has not been widely used as a methodological technique in
educational research. This is not to say that it is less than appropriate
in an educational context. On the contrary, Laurillard (1981) emphasized
that there was a swing away from psychometrics and towards action research
'at the coal face - in the classroom'.

It was not the intention to produce results from which generalizable
conclusions, applicable to all postgraduates in all universities could be
drawn. Instead, the research aimed to produce an accurate and comprehen-
sive description of the experiences of a group of postgraduate students
as they learned to do research and obtain their Ph.D. degree.

This thesis now continued with a description of the methods in detail
and then a report of a systematic study of what happens when postgraduates
first learn how to do research.

CHAPTER 4

METHOD

Summary of Methods

The methods will be discussed in greater detail in the pages that follow
but a summary is given here in order for the relationships between them
to be highlighted.

1. Interviews

Students and their supervisors were interviewed separately, regarding
specific aspects of the students' work. All interviews were conducted
in private and with an assurance of strict confidentiality. The students
were interviewed every month for the three years and the supervisors
every six months. For the seven student and supervisor pairs in the
sample this amounted to approximately 300 interviews over the course of
the study. The students' and their supervisors' accounts were later com-
pared by the author.

2. Repertory grids

The repertory grid was used with the postgraduates to acquire more precise
and detailed information about areas identified by them as important to
the development of their work. The students appraised and re-appraised
their positions with regard to their Ph.D. in order to enable them to ob-
serve changes as they occurred. The information which resulted from the
use of the grid technique was then available for use in relation to the
interviews. Therefore, in addition to the regular semi-structured inter-
views, twice yearly the postgraduates took part in a 'feedback' interview
based on the computer analysis of their repertory grids.

3. Progress rating forms

Students and supervisors were given sentence completion sheets annually.
Those completed by the supervisors were used as report forms concerning

their opinion of their students' progress in a number of areas. The sheets completed by the students were used to assess their perception of their own progress in the same areas. The quantifiable data from these forms could be used for comparing students' and supervisors' estimates of the students' progress over a given time. This data could also be used in conjunction with the interview material to give a more precise picture of what was happening during the postgraduates' research programme.

4.   Paragraphs

Every month the students wrote short paragraphs concerning their research problem. These paragraphs described the work the students were doing at the time of that interview, what they thought they would be doing at some future date and what they had been doing some time previously. The paragraphs were used by the author, together with the interviews, to assess the rate of progress of the postgraduates' work. They were also used to discover how accurate the students were at estimating their own progress. The paragraphs helped with the interpretation of the supervisors' and students' progress rating sheets and also interacted with the grid data to give a picture of particular areas of concern at specific times.

The different degree of validity attached to the results of data collected through these various methods is considered in chapter 6. Primarily, the status of findings based on the paragraphs is more tentative than that of findings based on the other three methods.

Role of Researcher

The postgraduates used the monthly meetings with the author to sound out ideas for future action as well as to report grievances which bothered them but which they felt unable to discuss with their peers or supervisors.

This means that the seven postgraduates in this study have no idea how it feels to do a Ph.D. without the opportunity to talk in considerable depth about what they were experiencing.

The use of the grid-plus-feedback technique helped them to articulate aspects of their thinking about their work that had not previously been clearly defined. The feedback interviews often involved discussion of specific areas which located the source of irritants of which the postgraduates had been aware but which they had been unable to understand. This sometimes led to a course of action, and often helped them to define their roles as research students.

Similarly, the supervisors took the opportunity to explore with the author, specific aspects of their own role in relation to the particular student who was being studied. The author's interventions at both the student and supervisor levels were kept to a minimum. Nevertheless, there was still more involvement by a third party than is usual in the process of learning to do research; hence the action research component of the methodology.

The Institutions Involved

The author was a part-time lecturer in a technological campus university and a postgraduate student in an old-established traditional university. The latter was located in several buildings which covered an area of several miles.

The 'red-brick' university had a four year undergraduate programme which included several periods spent gaining work experience. The other university had a more conventional three year undergraduate programme which included a long summer vacation period not available to the students

of the newer university. The higher degrees programmes of the two universities were more similar in structure than were their undergraduate degree programmes but still there were obvious differences. Examples of these differences are (a) the traditional university recruited a far greater number of postgraduate students each year than did the technological university, (b) there were no Arts students at the newer university, (c) the campus university had much stronger links to industry than did the traditional university.

These differences of location, structure, demography and philosophy were important for the study being reported. This is because it was hoped that even though the sample was very small, any observable patterns which occurred <u>across</u> the two universities would be reliable indicators of the processes experienced during the course of a research degree regardless of institutional variations. For these reasons, and because of their easy accessibility to the author, the study was based in the two universities described.

Selection of the Cases

For this study, it was necessary to select postgraduate students who:

(a) had supervisors who were agreeable to taking part in the study;

(b) were willing to spend at least an hour every month talking about their work and

(c) would commit themselves to this arrangement for a minimum period of three years.

In addition to the above, it was necessary that the cases should be, as far as possible, representative of the disciplines involved in doctoral research. Social Science students were, however, excluded as it was thought

that the goals and method of the present study might intersect too closely
with their own research involvements.

Departmental secretaries of the two universities were contacted by
letter and asked to supply the names of people who had registered for a
full time M.Phil/Ph.D. degree for the first time in October 1976. It was
decided to involve only full time students in order to keep external in-
fluences on the progress of the research to a minimum.

From the lists of names supplied by the sixteen departments replying
to the introductory letter two names were randomly chosen, one male and
one female, from each departmental list. Letters were sent to these post-
graduates asking them to contact the writer regarding research into prac-
tical problem solving in the academic context (letter in appendix). The
thirteen postgraduates who replied to this letter were given appointments
to discuss the possibility of becoming part of the research sample. Only
nine of these students came for the preliminary meeting. Three of the
others could not participate in the research because they would be spending
their second year abroad and the one refusing had decided to become a part-
time student after an initial full-time year.

At the preliminary meeting, the respondents were told about the pro-
jected research. They were also advised that they would need to commit
themselves to being interviewed at monthly intervals throughout the whole
three year period of their higher degree training. All those who wanted
to take part in the study, seven of the nine, were accepted on condition
that their supervisors agreed.

The supervisors of those postgraduates who would be available and
willing to meet the author every month were then telephoned and an ap-
pointment to meet each of them individually was arranged. At these meetings,

the supervisors were told about the research and that their postgraduate

student was being considered as a participant for the study. They were

asked if they agreed that this could happen and whether they themselves

would be willing to be interviewed about the student's work and progress

at six-monthly intervals. All seven supervisors were enthusiastic about

the projected research and agreed to participate in it.

Using the procedures described above seven student and supervisor

pairs were selected. The selection process continued for one academic term.

It was decided that seven cases would be a sufficient number for this par-

ticular study. The decision was due partly to the time it took to conduct

these preliminary interviews, partly to the difficulty of getting commitment

for three years and partly because of the analysis needed for what would

eventually amount to masses of qualitative data. The seven postgraduate

research students, from two universities, were interviewed at monthly inter-

vals over the three year period of their higher degree training. Four of

these students were from a college of an old, traditional university and

three were from a technological, 'red-brick' campus university. Six were

male and one female. The college students came from the departments of

astronomy, English, history and architecture. The campus students came

from the departments of bio-chemistry, nuclear physics and industrial

chemistry (see Table 2, p.68).

Confidentiality

Supervisors and students were told that all information obtained would be

completely confidential. They were assured that nothing that occurred

during the research would be reported in a form which would allow them to

be identified, to anybody except the supervisor of this study.

This meant that the author would give absolutely no information to either the student or the supervisor about the other, even if some particular item was specifically requested. Of course, the more usual guarantees regarding anonymity in published results were also given.

As soon as the supervisors' co-operation was obtained, the postgraduates were notified that, if they still wished to do so, they could become one of the research sample and an appointment for the first interview was made.

TABLE 1   POPULATION FROM WHICH THE CASES WERE DRAWN

Numbers of postgraduates registering for full-time M.Phil./Ph.D. degrees in October 1976.

University or Institution		Male	Female
Traditional	A	198	98
Technological	B	42	5

TABLE 2   STUDENTS AND SUPERVISORS TAKING PART IN THE STUDY

Institution A = traditional, college type university
Institution B = technological, campus university

Postgraduate	Age	Sex	Institution	Subject	Supervisor	Sex
Adam	25	M	A	Architecture	Dean	M
Bradley	24	M	A	English	Lecturer	F
Charles	21	M	A	Astronomy	Lecturer	M
Greg	29	M	A	History	Lecturer	F
Diana	23	F	B	Bio-chemistry	Head of dept.	M
Ewan	24	M	B	Nuclear Physics	Snr Lecturer	M
Freddy	22	M	B	Industrial Chemistry	Head of dept.	M

The supervisors included two women. Of the seven, only one had never

had a postgraduate research student to supervise before. Three of the supervisors were professors and heads of department; of these one was made dean during the course of the research. All three had been supervising research students for about 25 years. The three remaining supervisors had all had previous experience of supervision, and only one did not herself have the Ph.D. degree.

The Interviews

Choosing the interview format

It was necessary for the postgraduates to report precisely how they viewed their experience of learning to do research. Specialized, depth interviewing techniques take various forms from which the kind most suited to the topic being investigated may be selected. There are structured interviews where all respondents are asked identical questions. These may be either closed or open ended. Open ended interviews permit the respondents to elaborate on their answers before continuing to the next question; closed interview schedules require a reply from a multiple choice of possible responses. While structured interviews use precise questions covering a large range of topics, the responses may be superficial and many of the areas investigated superfluous. Alternatively, some important features which would not be predicted may be missed out completely. The data which results from structured interviews is unambiguous to analyze and code, the final information is mainly in the form of quantitative statistics, which are very useful for making general statements about large samples.

There are also semi-structured interviews which focus on certain areas but, instead of a question and answer format, the interview is conducted as a conversation where the interviewer takes up a relevant point made by

the respondents and encourages them to develop it. Semi-structured inter-
views open up areas to be discussed and the open ended approach means that,
instead of answering specific questions, the respondents will continue
with a particular train of thought. This allows them to reveal their own
point of view on the topic in some depth. It is the respondent who de-
velops the areas that are important, instead of having the interviewer
determine which these areas should be.

A structured interview would have been inappropriate for this particu-
lar study, as it was not known what questions to ask, neither was it possi-
ble to guess in advance which areas of the postgraduates' experiences would
be most relevant to the way in which they progressed through their course.
If the questions were to be answered, rather than areas explored, then
much valuable information could have been lost. Therefore, in the present
study, an unstructured interview was used at first, during which respondents
could talk quite freely about a variety of areas concerning their Ph.D.

Following the example of Bott (1957), once some hypotheses had been
formulated the interviews were semi-structured in order to explore some
areas more fully. This form of interview contributes directly to the
aims of the present study, especially as an open ended design was used
throughout this research which meant that the respondents were able to
operate within their own frame of reference. Only when the answers became
esoteric or specific to the student's thesis did the author intervene to
redirect the response to a more general area. However, if the respondent
insisted that it was essential to explain some technical point no further
objection was raised.

Choosing the interview recording method

The author did have previous experience of data collection using tape

recorders, but decided not to tape record these interviews for several reasons:

1. people are sometimes inhibited during the early part of an interview while conscious of being recorded;

2. people sometimes distrust promises of confidentiality when they know that their words are being stored, and so monitor what they say during a recorded interview;

3. a one hour interview takes several hours to type up into a transcript;

4. much of what is transcribed is meaningless without the contextual cues contained in the form of intonation, expression, gesture etc. (The 'sense' of an utterance can much more accurately be conveyed in notes taken by the interviewer during the conversation.)

5. Scripts deriving from recordings of interviews are extremely difficult to analyse and manipulate as a data base due to their unwieldy format.

For these reasons, all the interviews were recorded in writing. Recording them in writing immediately after they had taken place was seriously considered. It was decided however, that what would be lost in spontaneity as a result of writing throughout the interview would not be compensated for by what would be lost in detail if too heavy a demand were to be made on the author's memory! Therefore the notes were always taken during the interview and during the first year were read back to the respondents so that they could verify what had been recorded as an accurate account of what they had said.

Postgraduate interviews

The students were encouraged to talk about their work, what they had been doing and how they felt about what they were doing. They talked about their day-to-day problems and achievements while working, their relation-

ship with their supervisor and others, what they expected to accomplish
in the period until their next interview, or the end of term, and how they
saw their research developing. When they could think of nothing else to
tell, the author would either ask a follow-up question to cover a point
that had not yet been adequately covered, or else introduce a new area to
explore. The interviews were conducted as a conversation in a relaxed
atmosphere at each of the two institutions. The postgraduate students
went to the room used by the author at their own university. Each inter-
view lasted between 45 and 75 minutes, with the exception of the very first
interview which took considerably longer. This was because it was used for
eliciting the repertory grids (described on p.75) in addition to construct-
ing a historical biography of the students.

After interviewing the seven postgraduates for about four months, the
interviews gradually became more focused on particular issues that had
been identified. These were:

1.   discrepancies between expectation and achievement of work planned
      for a given period

2.   the amount of independence the postgraduates had from their super-
      visors and

3.   how the students either kept records or reported what they had been
      doing.

From this information it was later possible to consider the students'
own perception of their work as a factor in what they managed to achieve,
and how this related to the plan they had for their research.

The deliberate restriction of the discussion to specific issues
during these later interviews did not make the interview sessions any
more formal. The students now reported what they had been doing since

the last interview session and the author checked with the interview notes

for that session, or an earlier one if relevant. If the postgraduates had

not mentioned spontaneously whether or not certain things had been com-

pleted the author asked about them. Similarly, the author asked whether

the students had had any meetings with their supervisor during this period

and guided the interview along lines that encouraged the students to talk

of their perception of their supervisor's role in their own work. This

was done whether or not there had been a recent meeting.

If the students did not mention writing as one of the items of work

undertaken, the author would ask if they had written anything. If the

reply was 'no' the topic would not be pursued except to ask when the stu-

dent contemplated writing something. If the answer was 'yes' the interview

would continue as though the respondent had introduced the topic and the

researcher would ask for a detailed account of how the postgraduate set

about this task.

When the author felt that all areas of interest had been covered and

the student felt that there was nothing more to report or discuss, a date

four or five weeks into the future was set for the next interview. The

postgraduates would then return to their own department of the university.

Supervisor interviews

The interviews were conducted as a conversation in a relaxed atmosphere

in the supervisors' rooms at the relevant university. In this case it

was the author who went to the appropriate department. There were two

exceptions to this in the three years, when interviews were conducted

with supervisors over lunch. The supervisors were asked to report on

the progress of the postgraduate student being studied for this research

and to estimate how the work would go over the next six months. They

were encouraged to talk in detail about any meetings they had had with the student during the period up to the interview and to evaluate the student's ability to plan their work. In addition they talked about their own work, and how supervision of research students fitted into the overall work load. They also discussed the amount of interest they personally had in the work that the student was doing. Each interview lasted about one hour.

In later interviews, matters such as relationship between expected and achieved output and progress of work reported in the student interviews, were checked during the supervisor interviews. This was done without the supervisor being informed that information was being used that originated from the student. When neither the author nor the supervisor could think of anything to add to the report, the interview was concluded. The author confirmed that the supervisor was expecting to set aside another hour, in about six months' time.

Analysis of interviews

It was later possible to consider the supervisor's perception of the student's work and how this related to the student's own perception, by comparing the student and supervisor interviews. Also, the supervisors' comments to the author on the written work of their students were compared with what the students had said about the way in which they tackled the task of writing about their work.

After about four months, i.e. four interviews with students and one with each supervisor, the student and supervisor interviews were subjected to a content analysis from which central topics were discovered. These topics, which recurred over time and across the cases, later formed the basis for the semi-structured interviews described above (p.72). At the

end of the research period, the interviews were all closely analysed and major points were noted against the date of the interview. It was from summarized versions of the interviews that the general points were extrapolated.

The way that the methods used in this study overlapped each other during the three years was:

	1st year	2nd year	3rd year
Unstructured interviews	_____		
Semi-structured inter- views		_____
Repertory grids	_____
Rating forms		_____
Free writing	_____

Repertory Grid Methodology

Many different procedures have been developed for the construction and analysis of grids. These usually involve a standard form of grid in which both elements and constructs are provided by the researcher. This form of grid testing has advantages in providing useful information when undertaking large surveys. In its pure form however, the elements and constructs of each grid are elicited from the person whose construct system is being explored. Studies which have compared elicited with provided constructs, show that people prefer their own constructs to those supplied by researchers (O'Donovan, 1965; Bonarius, 1970; Landfield, 1965). In the present study the students' constructs were obtained through the process of categorizing the similarities and differences between the elements which they themselves had selected. How this was done is explained in the next section.

Elicitation and rating procedures

The elements and constructs were elicited from the postgraduates during
their first interview. All of them, separately, were asked to think of
eight things that were essential to successful completion of the Ph.D.
They were told that these could be either activities which needed to be
undertaken or qualities necessary for anybody registering for a research
degree. They were to include anything of importance for the whole period
until the doctorate was awarded. These lists of eight items were used as
the elements of their grids. Eight was chosen as a minimum because it
was necessary to have a reasonably comprehensive view of how the post-
graduates thought about doing their Ph.D.

Each element was written on a small (7½cm x 5½cm) yellow card. The
students were then asked to select any two elements which they thought
were in some way similar to each other and a third that was different
from the two selected. The reasons given for the perceived similarities
and differences for each triad of elements were the constructs of their
grids. Perceived similarities are called the 'emergent' poles and per-
ceived differences are called the 'implicit' poles of the constructs.

Each construct was then written on a card similar in size and colour
to the cards on which the elements were written. Initially, eight con-
structs were elicited from each of the students in this way. Once again,
eight was selected in order that there would be at least at the start, an
equal number of elements and constructs. Also, the postgraduates found
it quite arduous to produce even eight elements and constructs during
their first interview. (List of elements and constructs for the seven
postgraduates is given on pages 98 and 99 of this thesis.)

The method of elicitation described above is time consuming for both
the participants to the procedure but gives detailed information about

each individual. In fact, the whole procedure of construct elicitation

by triadic sorting of elicited elements and rating of all elements on all

constructs took 90 to 120 minutes. The process was as follows.

Five cards of the same size but coloured orange and bearing the

numerals one to five were placed, in order, in front of the student. The

student was then instructed to imagine these cards as representing a five-

point scale ranging from the emergent pole of the construct under consider-

ation as '1' to the implicit pole of the construct as '5'. Each student

was asked to rate first the three chosen elements on the construct just

elicited and then all the other elements. This was done by placing each

element card over the appropriate numeral card. Actual instructions

were: 'You have selected these two items as being - say - "difficult"

and this one as being "easy" for you. Would you please rate them on the

scale one to five in front of you, with "difficult" being one and "easy"

five. Would you now rate all the other items in the same way.' The

ratings were noted down on a blank grid.

Adam gave the following as his eight elements:

1	2	3	
Devise tests	Synthesize theories	Make conjectures	

4	5	6	7
Meet with supervisor	Deal with students	Reading	Thinking

8
Writing

(In the conventional grid matrix the elements form the column headings,

while the constructs form the rows.)

When asked to choose two elements which were similar and one that was different Adam selected 'synthesize theories' and 'devise tests' as being similar because they were analytical activities and 'making conjectures' as different because it necessitated making a creative leap. His first construct therefore, was analytic activity (emergent pole) vs. creative leap (implicit pole). Next he was asked to assign numbers to the three chosen elements on a five-point scale from 1 (analytic activity) to 5 (creative leap). He rated the elements as follows:

Devise tests 3; Synthesize theories 2; Making conjectures 4.

He was then asked to rate his other elements on the same scale. This he did as follows:

Meet with supervisor 2; Deal with students 2; Reading 3; Thinking 4; Writing 4; so that the first line of his grid looked like this:

3   2   4   2   2   3   4   4

Having rated all elements on his first construct, he was asked to choose two more elements that were similar and one that was different from them. He chose Meet with supervisor (E.4), Deal with students (E.5) and Writing (E.8). He said that E.4 and E.5 were similar because he had to be interdependent with others but E.8 was different because he had to rely on himself. Therefore, his second construct was interdependent with others (emergent pole) vs. rely on myself (implicit pole). He was then asked to repeat the rating procedure. The new construct line looked

like this:

| 4 | 3 | 4 | 2 | 3 | 2 | 4 | 4 |

So far his grid matrix consists of eight elements and two constructs and looks like this:

	E1	E2	E3	E4	E5	E6	E7	E8
C1	3	2	4	2	2	3	4	4
C2	4	3	4	2	3	2	4	4

The procedure continued until he had an eight by eight matrix. Here is the completed grid as it was elicited.

CONSTRUCTS   ELEMENTS

		Devise tests	Synthesize theories	Make conjectures	Meet with supervisor	Deal with students	Reading	Thinking	Writing
		E1	E2	E3	E4	E5	E6	E7	E8
Analytic activity/ Creative leap	C1	3	2	4	2	2	3	4	4
Interdependent with others/Rely on myself	C2	4	3	4	2	3	2	4	4
(Intellectually) Active/Passive	C3	1	3	1	4	4	4	2	1
Difficult/ easy	C4	3	2	2	3	2	4	3	1
High degree of fulfilment/ low fulfilment	C5	3	1	2	4	4	2	2	3
Grow develop through immediate feedback/ long term result	C6	5	1	4	4	1	2	2	3
Understand myself/ Helps me understand others	C7	3	5	1	4	4	4	1	2
Most like to do/ least like to do	C8	4	2	1	2	3	2	2	5

FIGURE 1   Raw grid showing elements, constructs and first set of ratings
on a five-point scale of all elements on all constructs.

Re-rating procedures

Subsequent grid sessions were held with each student six months from the date of the previous grid session. These later sessions took only about 45 minutes as the elements and constructs of the original grid were used as a starting point.

At the beginning of the second grid session, each postgraduate was handed the cards bearing the element names and told to refamiliarize themselves with them. Once they had done this they were asked whether, now that they knew more about what was entailed in doing a Ph.D., they wanted to add anything. This was to ensure that if there was an item which they had not thought of previously, but which they now considered to be essential to successful completion of the higher degree course, it would be included. Any new elements elicited in this way were written on a card similar to those which they held in their hand.

When they were satisfied that they could think of nothing else, the five numeral cards were placed in front of them and they were handed their first construct card. Using the construct 'difficult' (emergent pole) to 'easy' (implicit pole) as an example, the instructions were: 'Please select two things which you consider to be similar, because they are both (difficult) for you and one that is different from those two because it is (easy) for you.' When they had done this they were asked to rate the three selected on the five-point scale and then to rate all the other items on the same scale i.e. 'difficult' (1) to 'easy' (5). In fact all subsequent grid sessions were a complete repetition of the original experience so far as rating procedures were concerned.

Once they had completed this exercise for all the constructs already elicited and written down, they were asked whether they could now see any

way in which two of their elements were similar and one different that had

not occurred to them previously. Any additional constructs were then

written on cards and rated as before. In this way the grids remained sub-

stantially the same over the three years, but with additional elements and

constructs creating larger grids over time. Exceptionally, a student sub-

tracted an element because it was no longer relevant, but no student ever

wished to subtract any construct over the period of the study.

Analysis of the Grids

It is important to bear in mind the theoretical basis of grid methodology

when considering computer programs for the analysis of a repertory grid,

and there were many from which to choose. Fransella and Bannister (1977)

in their summary of the various methods available, warn against reaching

a stage 'approaching statistical gibberish' (p.72) where the links between

what the person was doing when completing the grid cannot be traced to the

information in the computer printout.

The most widely used methods of grid analyses are principal components

analysis (Slater, 1964) and cluster analysis (McQuitty, 1960). Both of

these methods provide information concerning relations between constructs

and relationships between elements. More detailed information about these

methods are given in the appendix (pp.289-91). In the present study the

grids were analysed by the Focus and Core programs, both of which use a

cluster analytic technique.

Relevance of these programs to the study

Although different computer programs for the analysis of repertory grids

are based on different mathematical approaches it has been shown that

their different outputs show no significant variations at the level of

interpretation (Keen, 1979). This means that the interpretations arising from a group of constructs that are clustered together will be very similar to those arising from a group of constructs that go to make up one principal component, or the group of constructs that constitutes a factor. As principal component and factor analytic techniques are the main alternatives to clustering this is an important point to be noted by anybody interested in interpreting repertory grid data.

It means that the use of Focus for analysis of the students' grids would not result in a significantly different interpretation of the data from that resulting from the use of any other program. It also had the advantage that it would be compatible with the use of Core for measuring change over time. This is because both the programs are based on similar mathematical assumptions. By using these two, complementary, programs as the basis for an interpretation of the data it was possible to compare the grids of one postgraduate elicited at different times during the three years.

These two programs, Focus and Core, are described in more detail in the appendix (pp.292-5). The Focus and Core programs were selected because there is the minimum complex mathematical computer output, but optimal restructuring of raw data in a systematic manner. By using these two programs, two analyses of the grid were available for discussion with the participants during their feedback interviews.

FOCUS

The Focus program (Shaw and Thomas, 1978) prints out individual grids, re-ordered in such a way that relationships between elements and constructs are visible. The re-ordered elements and constructs are presented in a

re-sorted grid matrix complete with tree diagrams which show how the clusters are formed.

Focus highlights the similarities and differences in the use of elements and constructs in a single repertory grid, elicited at a particular time and re-orders them in such a way that the printout can be used for feedback purposes.

The following is an example of the way in which a raw grid is sorted by the Focus program:

Raw Grid   ELEMENTS

CONSTRUCTS		obtain results	analyse results	literature survey	put analysis of results into larger context	writing clear, concise, believable thesis
		1	2	3	4	5
Boring/Interesting	C1	5	5	4	4	3
Numerate/No need for mathematical ability	C2	2	1	3	1	3
Linked to each other/ Not involved with work	C3	4	5	2	4	3
Escape/Has to be done	C4	1	1	2	1	3
Knowledge of prior art/Don't need prior knowledge	C5	3	1	3	1	3

Construct 1 reverse

Construct 3 reverse
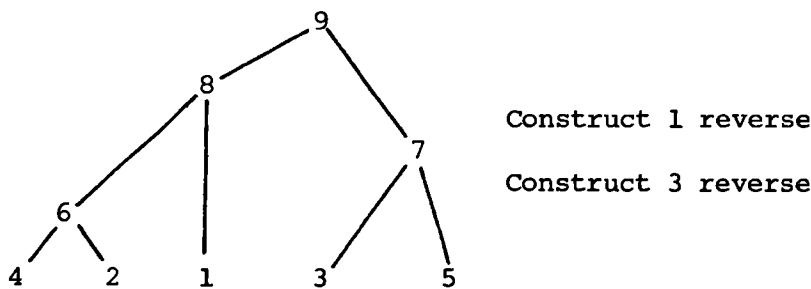
		1	2	3	4	5
Escape/Has to be done	4	1	1	3	3	3
		1	1	2	3	3
Interesting/Boring	1	1	1	1	2	3
		2	1	1	2	3
Not involved with work/Linked to each other	3	2	1	2	4	3

FIGURE 2   The same grid re-sorted by the Focus program and including tree diagrams which show the relationship between element and construct clusters.

It may be observed (Figure 2) that the re-sorted grid is presented with two tree diagrams which display the patterns of responses within the grid. These tree diagrams give a visual representation of which elements and which constructs cluster together.

In the above grid, construct 1 has been reversed so that what was originally scale point 5 has become scale point 1, scale point 4 becomes scale point 2 and so on, the same is true of construct 3. An example of this is Ewan's two constructs 'Escape/Has to be done' and 'Boring/ Interesting for me'. When one of the two is reversed, it becomes clear that 'Boring' and 'Has to be done' are being used in a similar way. Because of this reversibility, complete mismatching between constructs, is as significant as complete matching. A negative match between two constructs, is a positive match if the poles of one construct are reversed. 'Matching' in this context refers to elements or constructs that are highly related to each other while 'mismatching' refers to constructs that are negatively related to each other. Elements or constructs that bear no similarity to each other are those where the ratings along them form no particular pattern.

CORE

The grid technique was also used to monitor change over time for each of the postgraduates as they proceeded through their three year course. In order to do this, consecutive grids from one individual were analysed using the Core program (Shaw, 1979). This program analyses two grids, comparing each element and each construct with itself and prints out those constructs and elements that have changed the most in the way the postgraduate is using them.

The printout is in the form of a typed page and it states the percentage match of a given element or construct on two separate occasions. By keeping the constructs constant and entering the ratings for the elements on two occasions in the same raw grid, it is possible to compare the ratings for each element. For example, in the grids below, which are from Adam's first six months, it can be seen that Element 1 'Devise tests' has not changed very much but Elements 2 and 3 have been rated very differently.

Time 1   Time 2

	Devise tests E1	Deal with students E2	Making conjectures E3		Devise tests E1	Deal with students E2	Making conjectures E3
C1	5	5	4		4	2	5
C2	2	1	3		2	3	1
C3	4	5	2		4	3	4

Comparison of two grids elicited at different times from the same person.

Element 2 'Deal with students' and Element 3 'Making conjectures' have probably been affected in the way that Adam thinks about them as a result of his having spent some time engaged in postgraduate activities. In fact he said that when he began he didn't know what kind of undergraduate student contact to expect. After six months he knew what was entailed and always had an eye on what 'I'll do with the students'.

The same procedure was adopted for considering changes in the constructs but this time the core analysis was based on comparison of ratings across a construct line, i.e. rating all elements on a particular construct.

DIFFERENTIATION SCORES

In addition to these computer analyses of the grids, a rough differentiation score was calculated from the Focused grids at different times during the three years. The scores were calculated by taking a re-sorted grid and looking at the element and construct clusters. The clusters are arranged into a hierarchy on the printout and the percentage point at which they are linked together is given. Taking a 40% cutoff point and drawing a horizontal line across the page reveals a mixture of clusters and isolates for both elements and constructs.

McKnight (1981) explains that 40% was chosen as the cut off point because, in discussing conceptual points with his subjects, he found that they had little difficulty in talking about cut off points in the 90-100% range. Progression 'up' the hierarchy led to increasing difficulty and by about 40% he found that there seemed to be some sort of 'meaning barrier'. By this he meant that most people began to have great difficulty in articulating their thinking. Therefore, it was hoped that the differentiation scores for the postgraduates might be an indicator of the amount of internal organization they had achieved, relative to their Ph.D.s, at different periods of their work.

McKnight says that it might be expected that someone who is undifferentiated would have very few clusters at the 40% level and someone who is highly differentiated would have many clusters at the 40% level. He devised a method for calculating a crude measure of differentiation and that is the method adopted here.

The scores were calculated by counting the clusters and isolates produced for the constructs at 40% (Focus grid) and multiplying this by the number of clusters and isolates produced for elements at 40% and dividing the product by the total number of cells in the grid. (The differentiation scores are included on each of the grids in the appendix, pp.277ff.)

Feedback Interviews Based on Grid Analyses

In the present study the re-sorted grid was used as the basis for a feedback interview, where the individual from whom the grid was elicited discussed with the author the results of the Focus and Core analyses of the original data. The use of this technique enabled the postgraduates to develop the interview in a way that would not have been possible without the information contained in the re-sorted and compared grids.

The information presented in this manner, allowed the students to consider and comment upon their personal construct systems. This is because people are able to articulate reasons for changes in relationships when they are confronted by them, although it is unlikely that they would spontaneously recall precise differences in ways of thinking about particular areas if asked to do so. This was a more structured interview procedure than was the case in the regular interviews. It concerned primarily, the information relevant to those elements and constructs which had changed the most during a given period. Depending on which two grids were being discussed, it was possible to give the postgraduates information concerning changes in the way they thought about certain aspects of their work. The feedback session was the forum for discussing possible causes of changes in thinking about their work since they last completed a grid,

or since they started the Ph.D., or since the same time a year earlier.
In this way the postgraduates were helped to articulate, in some detail,
aspects of their thinking about their work that had not previously been
clearly defined.

Progress Rating Forms

In addition to the open ended interview and repertory grids, progress
rating forms were used. All students and supervisors were given sentence
completion forms to evaluate progress once a year during an interview.
The sentences were derived from some research carried out on architectural
students (Miller, 1970) and concerned definition of the research problem
as well as the progress being made towards the overall goal of the Ph.D.

The forms are in the appendix (pp.279-80) but examples of the senten-
ces are given below:

1. I think I am making   progress
2. I think my supervisor considers I am making   progress
3. I consider my research problem to be   defined

These sentences were presented to the postgraduates while their supervisors
were asked to complete the following:

1. I think   is making   progress
2. I consider   's research problem to be   defined.

The choice of words for completion of the progress rating sentences were:

1. Excellent   2. Good   3. Reasonable   4. Poor   5. No

and for the problem definition sentences were:

1. Totally   2. Fairly well   3. Vaguely   4. Beginning to be
5. Not yet started being.

These choices were the same for both students and supervisors.

In addition to the sentence completion assessment, the forms contained several rating scales and students and supervisors were asked to rate their satisfaction with various aspects of the students' programme. The rating scales ran from 1: very satisfied to 4: dissatisfied. These ratings were averaged for each student over the three years on all items. All participants were required to complete three of these forms over the period of the study, but only two forms were completed by the student who dropped out at the end of the second year. His supervisor also only completed two forms. Another of the supervisors completed only one rating form in the three years due to absence abroad, but his student completed all three forms. The table below summarizes the number of forms completed.

TABLE 3   NUMBER OF PROGRESS RATING FORMS COMPLETED BY ALL PARTICIPANTS
          OVER THE THREE YEARS

Student	No. of forms completed	Supervisors	No. of forms completed
Adam	3	Prof. Andrews	3
Bradley	3	Mrs Briggs	3
Charles	2	Dr Chadwick	2
Diana	3	Prof. Dymond	1
Ewan	3	Dr Eustace	3
Freddy	3	Prof. Forsdike	3
Greg	3	Dr Green	3

The results of these ratings were a useful summary and check on what
the students and supervisors had been saying in their interviews. It was
also a way of making 'at a glance' comparisons across students of areas
showing particular difficulty or progress at given times in their research.
For example, the 'degree of isolation' experienced by the postgraduates at
the beginning, middle or end of the three years, and which they referred
to from time to time during their interviews, could be roughly assessed
merely by looking at the ratings given to the 'interaction with peers'
scale.

Paragraphs

At every interview students were asked to write short paragraphs entitled:

> The problem I am currently working on
>
> The problem I will be working on (a month, a term) from now
>
> The problem I was working on (a month, a term) ago

The author compared these paragraphs each month. The comparisons showed
what the students had actually accomplished compared to what they had
said they would accomplish during the period. Earlier paragraphs were
not shown to the students but the information was incorporated into the
following month's interview in the form of a query relating to whether
they felt that they were progressing according to plan.

The projected work of the students was made into tables showing the
degree of success they had in meeting their targets (pp. 145,149-50,151).
The tables were compiled by noting how long a piece of work was supposed
to have taken at the first estimate, checking after the prescribed period

whether or not it had been completed, and if it had not, extracting a
further estimate of time required. In some cases, students voluntarily
extended the required period before the original one had elapsed by
writing about that work again in a later set of paragraphs.

The tables, constructed from the paragraphs, formed the basis of the
analysis showing how the students planned their work over time. This
analysis together with the information from the grids enabled the author
to develop a picture of how the students structured their time over the
three year period of their research degree.

The paragraphs concerned with work they had been engaged in at some
time in the past few months were not used in the analysis. The main reason
that this information had been requested during the study, was to distract
the students to some extent from being conscious of the emphasis given to
their anticipated performance.

The Overall Picture - Summary of Methods

It was decided to acquire some systematic information from the viewpoint
of the students. The idea was that the information should be primarily
concerned with the process of research as it was experienced by the par-
ticipants. Quantity and comparability were considered less important
than the depth and quality of information. A case study format was ac-
cordingly adopted.

The interviews, grids, progress sheets and paragraphs each made a
unique contribution to the overall picture of how the postgraduates in
the study experienced their career as Ph.D. students while, at the same
time, allowing certain aspects of this experience to be looked at from
different angles due to the degree of overlap of information contained
within the various methods.

Examples of such overlaps are:

1. the information from the grids contributed to the interviews by

    identifying more precisely those areas relevant to the student

    and supervisor relationship and the students' perception of the

    Ph.D.;

2. the written paragraphs gave more detail on what was happening

    relevant to the question of planning work than did the interviews

    alone;

3. the progress sheets provided a rough measurement of the importance,

    to the postgraduates, of the different aspects of their work to

    (a) the overall development of their research and (b) their per-

    ception of the Ph.D.;

4. all of the techniques blended to provide qualitatively different

    kinds of information on writing - the grids showed how it related

    to the research as a whole; the interviews revealed characteristic

    styles of approaching written work; the paragraphs gave information

    about the progress of such work and the progress rating forms allowed

    comparison of student and supervisor estimates.

In these ways the questions being asked were addressed and tentative

answers gradually emerged.

CHAPTER 5

RESULTS AND INTERPRETATIONS

Introduction

The interviews, grids, progress sheets and paragraphs all combined to give a picture of how the seven postgraduate students experienced the process of doing a Ph.D. Due to the nature of this work it is impractical to deal with the results in isolation. To do so would require complete transcripts of every interview; reproduction of all written paragraphs; a complete set of repertory grids and their accompanying analyses; and three sets of progress rating sheets for each of the seven cases. Therefore this chapter highlights the salient points that emerged from the results and brings relevant examples to support these interpretations.

It became apparent from the grid and interview data that the postgraduates' perceptions of doing research for their Ph.D.s changed dramatically over the three years of the study. These changes seemed to be a function of the process itself, including those aspects of learning to do research being addressed in this thesis, namely the student and supervisor relationship, planning work and writing the thesis. The question 'How does perception of doing a Ph.D. change as time progresses?' is, therefore, addressed throughout all the sections which make up this chapter.

The way that the postgraduates' perceptions of doing a Ph.D. changed was a result of the experiences they had over the three years of their course. Therefore, the results are presented so that the detail of <u>how</u> the changes occurred is contained within the answers to the remaining three questions. These questions, which make up the three main sections of this chapter were given on page 23 and are:

(1) <u>What is the effect of the student and supervisor relationship on the outcome of the research?</u>

(2) <u>How do postgraduates plan their work?</u>

(3) <u>What is the role of writing in learning to do research and to</u>

<u>report it?</u>

By presenting the results in this manner, it is hoped that significant aspects of learning to do research can be identified and changes in perception noted as they occurred.

The way in which particular aspects of the students' work changed over time can be clearly seen from the accounts of the discussions which took place between the author and the postgraduates. Much of the data is presented in what may appear to be a rather anecdotal fashion, but the discussions being reported were based either on the resorted grids (every six months) or on the written paragraphs (every month).

In particular, the interviews provided most of the information for the section on the student and supervisor relationship and the paragraphs for the planning section. The grids contributed to the section concerning writing primarily in the form of the differentiation scores, and to the overall topic - 'changed perception of the Ph.D.' - through the Focus and Core analyses.

Throughout this study the repertory grids were used to support the interviews. The original eight constructs and eight elements of the seven students are given overleaf (pp.98 and 99). It can be seen that some of the elements recurred. Six of the students had 'thinking' and four had 'supervisor contact' while all seven of them included 'writing' in their grids. Also, constructs such as 'difficult/easy' and 'enjoy/dislike' turned up in some form in several of the grids.

TABLE 4   - 98 -

| Elements | Constructs |

Adam - Architecture - Supervisor: Prof. Andrews

Elements	Constructs
Devise tests	Analytic activities/Creative leap
Synthesize theories	Interdependent with others/Rely on myself
Make conjectures	
Meeting with supervisor	(Intellectually) Active/Passive
Deal with students	High degree of fulfilment/low fulfilment
Reading	
Thinking	Grow and develop through immediate
Writing	feedback/Long term result
	Helps me to understand myself/Helps me to understand others
	Most like to do/Least like to do

Bradley - Literature - Supervisor: Mrs Briggs

Elements	Constructs
Reading	Concerns discussion with others/
Writing	Important for me only
Thinking	Private activities/External discipline
Seeing supervisor	Natural inclinations/Self discipline
Contacting others in the field	Possibility of termination/Acceptance
Setting and meeting targets	of research
Avoidance of overwork	Non-professional life/Professional
Intervention of unprecedented	Activity.
event	In London/Anywhere
	Home/College
	Fulfilling/Frustrating

Charles - Astro Physics - Supervisor: Dr Chadwick

Elements	Constructs
Reading	In your own mind/communication
Thinking	Taking in from outside/externalizing
Talking	from myself
Computing	Machine 'thinks'/internal
Writing	Relaxations/activity
Praying	Difficult/Easy
Music (Relaxation)	Like/don't like
Using other people's programs	Takes a long time/Doesn't
	Productive/non-productive

Diana - Biochemistry - Supervisor: Prof Dymond

Elements	Constructs
Think of relevant experiments to test hypothesis	(Thought) Almost same process/ Mechanical rather than thought
Be able to interpret results of experiment	Involves reading/Involves writing Reference to literature/None
Survey literature and keep up to date	Making conclusions/formulating hypothesis
Pick out item from literature that needs investigating	Validity of experiment assured/ Validity of experiment assumed
Carry out experiments	Difficult/Easy
Present conclusions verbally	After Experiment/Before experiment
Present written conclusions	Time consuming/Quick
Check experiments	

Ewan - Nuclear Physics - Supervisor: Dr Eustace

Obtain results	Needs thought/Tells if on right path
Carry out measurements	Gather information/Give out information
Reading	Positive feedback/Own initiative
Thinking about what you have read	Mere recording/Technique important
Interpret results	Ability to notice mistakes important/
Linking literature and measurements	Reproducibility
Complete write-up	Enjoy/Laborious
Good relationship with supervisor	To do with understanding/Ability to
	use what is understood
	Takes long time/Quick

Freddy - Industrial Chemistry - Supervisor: Prof Forsdike

Obtain results	Linked to each other/not involved with work
Analyse results	Escape/Has to be done
Literature survey	Scope for original thought/
Put analysis of results into	Following other people's ideas
larger context	numerate/no need for mathematical ability
Writing clear, concise,	Boring/Interesting for me
believable thesis	Beneficial to future career/unnecessary
Design well thought out	for career
experiment	Bulk of thesis/important but small in
Working and socializing with	space occupied in thesis
others	Knowledge of prior art/Don't need prior
Relaxation	knowledge

Greg - Medieval History - Supervisor: Dr Green

Reading	To do with time/can do anytime
Taking Notes	(All to do with people) Directly
Writing	PhD/More indirectly
Attending classes	To do with people/Not to do with
Getting on with tutors	people
Keeping other work in bounds	Almost mechanical process/Not
Organizing time	automatic
Thinking it out	(Process) Means/(Results) End
	Like/Don't like
	(Self-assessment) Good at/Not good at
	Creative/Not creative

These overlaps show that, whatever expectations the postgraduates had had at the start of their Ph.D. course, there was some similarity across disciplines. In fact, very few of their elements or constructs are at all related to their subjects of study. Even though their attitudes towards, and perception of, the Ph.D. changed over the three years, there was some common, if rather vague, idea of what it was that they were embarking upon.

Before we look at the results in more detail a general summary is given in order that readers may familiarize themselves with the outcome of this study.

General Summary

The postgraduates' perceptions of actually doing their Ph.D. changed over time, from enthusiasm for a unique project, to determination to finish a job of work. The author's interpretation of the data suggested that the stages through which they passed were:

(a) Enthusiasm (b) Isolation (c) Boredom (d) Job of work to be completed.

The repertory grids showed it to be the repetitive work and monotony of concentrating on the same thing for a long time which resulted in the postgraduates finally wanting to just sit down and keep going until they had finished.

The data indicated that this changed perception of the Ph.D. and the process through which the students passed was a function of (i) their relationship with their supervisor, and (ii) discrepancies between what they thought they could achieve in a given period of time and what they did in fact achieve.

With reference to the first question being asked in this thesis, it appeared that there was a relationship between the length of time it took for students to become independent of their supervisors and the amount of contact they had with them. This was because students relied on their supervisors for feedback regarding their progress. The greater the contact with supervisors experienced by the students, the longer it took for them to become autonomous researchers. 'Autonomous' here means being able to interpret the results of one's own actions without having to rely on another person's (the supervisor's) assessment of one's work. Some of the evidence from the interviews suggested that the students and their supervisors often experienced similar, or shared, situations in different ways and that they had very different perceptions of the nature and value of their interactions. The progress sheets showed differences between students' and supervisors' assessments of the students with regard to several variables, but in particular with regard to attitudes to supervision.

Information relevant to the second question concerning how the students planned their work, emerged from the paragraphs but was followed up in the interviews. The discrepancy between what the students expected to accomplish in a given period, and what they actually did accomplish was relevant to the way in which their work developed. It appeared that the discrepancies between expectation and achievement were important for planning (and replanning) their projects.

The question concerning writing was gradually answered by information contained in the interviews, while the grids also contributed to interpretations which were made regarding the relationship of writing to the Ph.D. as a whole. Not only was there a suggestion that writing performed dif-

ferent functions at different times, but also that it forced the students to think about their work as a coherent whole. Writing helped them to structure their work once they had overcome difficulties which ranged from the conceptual to the organizational.

It was from the student and supervisor relationships and the differences between expectation and achievement in the planning of work that the students' perceptions of the Ph.D. process were formulated. The progress rating sheets gave information about the postgraduates' perceptions of their progress in general and their definition of their research problems in particular. The interaction between these separate areas of their higher degree experience resulted in the changes in perception of doing a Ph.D. as time passed. Both the interviews and the grids showed that by the time they reached their final year, how the postgraduates thought about their Ph.D. had changed considerably since the start. What these changes were and how and why they happened is the focus of the rest of this chapter.

What is the effect of the student and supervisor relationship on the outcome of the research?

Introduction

It had been established during the preliminary interviews that in most cases the new postgraduates were placed by the university department according to their research interest and neither they, nor their supervisors had any information concerning the others' customary way of working. Exceptions to this were Freddy and Diana both of whom were persuaded by their heads of department to register for a research degree upon comple-

tion of their undergraduate courses. At first the supervisors either left the students alone to get on with their work, or else they were constantly around keeping themselves informed of the day-by-day (or week by week) progress of the postgraduates.

Three of the science students, Diana, Ewan and Freddy, worked in laboratories where other people were engaged in related, but different, activities. Dr Eustace and Prof. Forsdike were both in and out of the laboratories quite frequently. Charles, the one remaining science post-graduate, shared a room with others and divided his time between his room in college, the observatory and the computing centre. Dr Chadwick had a room just across the corridor from the postgraduates' room.

In contrast to the geographical and physical availability of others in the science departments, not one of the arts students, Adam, Bradley or Greg, had a space available for their use in college. All were ex-pected to work at home, in libraries or at the British Museum. The probability of any of them coming into contact with other postgraduates in their department without having arranged a meeting was, therefore, very low. The probability of a chance encounter with their supervisors was even lower.

The Overall Picture 1976-1979

The frequency of meetings between student and supervisor pairs was calcu-lated from a content analysis of the interviews. The figures in the table below result from noting any references made to meetings of students and supervisors. Although individual postgraduates are not identified, it is clear that there is very little pattern to the development of meetings for supervision.

TABLE 5   FREQUENCY OF MEETINGS BETWEEN STUDENTS AND SUPERVISORS

	Beginning	Six months	One year	18 months	Three years
Weekly or less	3	2	2	1	1
Weekly to monthly	2	3	1	3	2
Monthly to 3 monthly	2	1	3	2	1
Less frequently than 3 monthly	–	1	1	1	2

The effect that the different time intervals between meetings for supervision had on the development of the postgraduates' research will be considered in more detail later. At a general level, however, Ewan, Freddy and Greg, who were constantly reporting results to their supervisors throughout the period of research, remained dependent upon them and worked more as research assistants than autonomous researchers until quite an advanced stage of their Ph.D. programme. In contrast, Adam, Bradley and Diana, whose supervisors saw them only infrequently, became independent of them after the first year. The exception here was Charles, who dropped out of the programme because he did not see his supervisor as often as he needed. These findings are discussed in more detail in the next chapter. At this point it is sufficient to observe that a gradual 'weaning' process appears to be necessary.

At the start of their three year period of postgraduate research, the interviews showed that Ewan, Freddy and Greg were seen weekly or more frequently, while Adam, Bradley, Charles and Diana had meetings with their supervisors on a regular but less frequent basis. Table 5 shows the variation in intervals between meetings of the students with their supervisors over the whole three year period.

There was from one month to three months' interval between meetings in the case of those students who were not seen weekly. These time intervals, which would seem to be quite unequivocal were sometimes experienced differently, either shorter or longer by the students and the supervisors. While consistent with the theory of personal constructs, some examples of this 'double vision' are, nevertheless, quite striking when given in parallel. The data permitted several glimpses of the divergent ways in which students and supervisors perceived their situation.

This is illustrated in the following quotation taken from transcripts of Freddy's and Prof. Forsdike's early interviews:

> Freddy said: 'He really oversupervises, he's in twice a day to see what results I've got' but

> Professor Forsdike insisted: 'We don't meet as often as we should, about once a month.'

What is happening here seems to be that the student counts every contact with his supervisor in the laboratory as a meeting while the professor only thinks of the formal tutorial appointment as contributing to supervision.

Professor Forsdike commented that Freddy had 'Plenty of ideas and it's very much a shared meeting'. This is very different to thinking merely in terms of 'Keeping tabs on results' which is how Freddy seemed to interpret his supervisor's role.

The students and supervisors also perceived what happened during their discussions in different ways. The following examples show how the same event is experienced quite differently by the two participants. The first quotations come from Adam and Prof. Andrews during the first six

months of interviewing. Speaking of tutorials

Adam said: 'I haven't found a way of telling him how very frustrated

I am with these meetings' while

Professor Andrews said: 'He always appears to go off in a more

contented frame of mind than when he arrived.'

Consider Ewan's perception of how he was coping and compare it with

Dr Eustace's impressions:

Ewan: 'Whenever I get a few results I discuss them with my super-

visor but otherwise I work on my own.'

Dr Eustace: 'At the moment he's more of a research assistant, and

needs to be told almost everything but he does occasionally show

bits of independent thought.'

These divergent perceptions appeared to translate back into the re-

search situation and to affect the student and supervisor relationship.

The 'double vision' here took the form of misunderstandings about such

things as (a) the role of the supervisors, on the part of the student and

(b) the students' willingness to take responsibility for their own work,

on the part of the supervisor. There were other areas of misunderstanding

and communication breakdown between the student and supervisor pairs in-

volving such things as student progress and performance and supervisor

involvement. These issues were identified with the help of the progress

rating sheets and discussed in the interviews. Tables 6,7 and 8 give

the ratings over the three years for both students and supervisors. The

ratings provided some quantitative data from both the students and their

supervisors. They rated their degree of satisfaction with a variety of

areas relevant to the students' work. The areas were:

(a)   interest in work

(b)   independence to plan work

(c)   attitudes to supervision

(d)   peer interaction

(e)   personal development

Examples of the two forms (those given to students and those given
to supervisors) are in the appendix (pp.279-80). Each person completed
one of these forms a year and their mean estimates for the three year
period are given in Table 6. The mean differences between rating of
students and their supervisors are also given. The ratings were from 1
(very satisfied) to 4 (dissatisfied).

It may be seen from the table that the biggest discrepancy between
the ratings of students and their supervisors was concerned with atti-
tudes to supervision (mean difference 0.97). The seven supervisors were
happier with their students (average 1.5) than were the students with the
supervision that they were receiving (average 2.5). This result is con-
sistent with the interview material where the students often referred to
supervision as a source of dissatisfaction. Throughout the course of
this study there were examples of the 'double vision' of specific aspects
of the research degree course by students and their supervisors. While
entirely consistent with Kelly's theory, it may be that in this instance
dissatisfaction was the result of different expectations. Such expecta-
tions may be due to the divergent perceptions of what supervision meant
to the people involved. For the postgraduates, at the start of their
research, it meant structure and direction, for the supervisors it meant
support and guidance. How this changed over time for the postgraduates
was dependent upon their experience during the research period. Adam,

TABLE 6: STUDENT AND SUPERVISOR RATINGS OF SEVERAL VARIABLES RELEVANT
TO THE STUDENTS' EXPERIENCES OF LEARNING TO DO RESEARCH

	Interest	Mean differ-ence	Independence	Mean differ-ence	Supervision	Mean differ-ence	Peers	Mean differ-ence	Development	Mean differ-ence
Adam	1		1		2.6		3.3		1	
		0		0		1.6		1.2		0
Prof. Andrews	1		1		1		1.6		1	
Bradley	1.6		1.3		2		3		2.3	
		0.6		0.3		0.7		0.2		0.7
Mrs Briggs	1		1		1.3		2.3		1.6	
Charles	2		1.5		4		1.5		2.5	
		0.5		2.0		1.5		1.0		0
Dr Chadwick	2.5		3.5		2.5		2.5		2.5	
Diana	1.6		1.6		2.3		2.3		3	
		0.6		0.6		0.3		0.3		1
Prof. Dymond	1		1		2		2		2	
Ewan	2		1.6		2.3		2.3		2	
		0		1.0		1.3		1.0		0
Dr Eustace	2		2.6		1		1.3		2	
Freddy	2		2.6		2		1.6		2	
		0.2		1.3		0.7		0.4		0.7
Prof. Forsdike	1.3		1.3		1.3		2		1.3	
Greg	1.6		1		2.3		2		1.6	
		0.7		0.6		0.7		1.0		0.7
Dr Green	2.3		1.6		1.6		3		2.3	
Students' average	1.7		1.5		2.5		2.3		2.1	
Super-visors' average	1.6		1.7		1.5		2.1		1.8	
Mean differ-ence		0.44		0.82		0.97		0.87		0.44

Bradley and Diana who were seen by their supervisors only about once in three months, later defined supervision as support and guidance. Ewan, Freddy and Greg who were seen by their supervisors more frequently, i.e. once a week or less, continued to define supervision as direction. Charles, who saw his supervisor every six to eight weeks, continued to define supervision as structure and direction. He felt that he was not getting this and left after two years. His supervisor, Dr Chadwick, described the difference between guidance and direction as support versus spoonfeeding.

Charles was the only student with a mean rating of 4, dissatisfaction, on the scale for supervision. All the other students rated above 3, the neutral point on the scale. These ratings were slightly higher than would be expected from the comments made in the interviews. The supervisors' ratings were consistent with their interviews. It may be that the students were more critical in their verbal than their written judgements of the supervisors because a rating of 4 on a 4-point scale was perceived by them as very harsh indeed.

Ratings concerned with peer interaction were lowest for both students (average 2.3) and supervisors (average 2.1). The only real difference on this variable was that the science students were less dissatisfied than the arts students. All the supervisors seemed to be aware that this was potentially a problem area for postgraduate students.

The variable that received highest ratings overall from the students (average 1.5) was that concerned with degree of independence to plan their work.

The progress rating sheets also gave the students the opportunity for self-evaluation.

Students completed the sentence 'I consider my research problem to be   defined' and supervisors 'I consider (student's name) research problem to be   defined'. They were asked to complete the sentences with one of the following words:

1. totally 2. fairly well 3. vaguely 4. beginning to be

5. not yet started being.

In the sciences the project was usually presented as part of a continuing programme of research. In the arts it was often the result of trial and error. A typical comment from one of the students during the first year of postgraduate study was 'one is not very sure what one is supposed to be doing'.

The results of the sentence completion task were calculated by taking the mean estimates for each student and each supervisor over the three years and comparing them. Table 7 shows the results.

TABLE 7:   STUDENTS' AND SUPERVISORS' RATINGS OF DEGREE OF DEFINITION
           OF RESEARCH PROBLEM

Postgraduate	Students' rating 'My problem'	Supervisors' rating 'Student's problem'
1. Adam	1.6	1.3
2. Bradley	1.6	2.2
3. Charles	2	2
4. Diana	3.6	2
5. Ewan	1.3	1.3
6. Freddy	2	1.6
7. Greg	2	2.6

The ratings are from 1 (Totally defined) to 5 (Not yet beginning to be defined).

This table shows that three of the students in the study under-estimated how far they had got with the definition of their research problem. Two of the postgraduates considered their research problem to be in a more clearly defined state than did their supervisors. Only two of the students assessed their research problem in the same manner as their supervisors.

The progress rating sheets gave the students the opportunity to assess their progress from both their own point of view and the point of view of their supervisors.

The supervisors completed the sentence 'I think (student's name) is making   progress' from their own point of view only. The ratings are from 1 (Excellent) to 5 (No progress). Table 8 gives the mean estimates of the student and supervisor ratings for the three years.

TABLE 8: STUDENTS' AND SUPERVISORS' RATING OF PROGRESS

Postgraduate	Student rating 'My progress'	Student rating 'Supervisor sees my progress'	Supervisor rating 'Student's progress'
1. Adam	2.3	2.3	1
2. Bradley	2.6	2	1.2
3. Charles	3.5	3.5	3.5
4. Diana	3	3	2
5. Ewan	2.6	2.6	2.3
6. Freddy	2.6	3	1.6
7. Greg	3	3	2.6

The table shows that in six of the seven cases the supervisors con-sidered the students to be making better progress than the students thought they were making.* The only exception to this was where both Charles and

----

* P = 0.036 (Mann-Witney U Test).

Dr Chadwick rated Charles's progress at 3.5. There was a tendency for the supervisors to rate the degree of problem definition in a similar way to that in which they rated student progress. Comparison of the two tables (7 and 8) reveals that six of the seven postgraduates considered their definition of their research problem to be more satisfactory than the progress that they were making. Only two of the supervisors considered this to be so.

Professor Dymond's, Professor Forsdike's and Dr Green's mean estimates for their student's problem definition were the same as their mean estimates of that student's progress.

Using the supervisors' assessments as the criterion for estimating progress (average 2) it seems that in all but one of the cases the students were underestimating the amount of progress they were making (average 2.8). In addition, five out of the seven students were quite sure that their supervisors would agree with their own assessment of their progress. This was just another aspect of the 'double vision' observed throughout the study - but a most surprising one. It had certainly not been anticipated that postgraduates would be likely to underestimate their rate of progress.

Whether or not the supervisors decided how frequently to meet their students on the basis of their assessment of their student's progress, was something that was never made explicit during the interviews with the supervisors. However, the content analysis of the interview transcripts show this to be doubtful.

Bradley, who had had irregular meetings with his supervisor from the start, said 'I'm a bit out of patience with my supervisor. I thought that by this far into it she'd be taking more interest, but she isn't exercising

any kind of discipline. She seems to be leaving everything up to me.
I'm surprised I've got so far with so little contact.' Mrs Briggs con-
sidered him to be very efficient and said: 'He's quite outstanding and
seems to understand what it is to write a doctoral thesis, so many don't
have a clue about that.' This pair seem to have been reasonably well
matched as far as need for contact and discussion was concerned, although
Bradley did become worried that his 'confidence in my own powers' would
prove to be mistaken.

Bradley had started his research degree with an idea that he may not
complete it. This had gradually changed so that finally the thesis had
become one of the most important things in his life. He gave 'I've sur-
rendered to my fate' as a superordinate construct when asked if there was
any way in which he could describe why these things were important to him.
He added, 'at first there was a lot of chafing and inner rebellion and I
was dissatisfied with the department and supervision but, although I don't
admire the way things are handled ... I don't contact first year post-
graduates because I wouldn't want to be part of helping them to not ex-
perience anything that they need in order to become more self-reliant'.
This was not only a reversal of the way in which he had originally seen
things, but also a direct comment on the relationship between lack of
direction from outside and development of autonomy.

This student had been left alone for long periods from early in his
research except for occasional meetings with his supervisor, which he
initiated when he wanted to discuss the plan of his work. Because of
the lack of postgraduate seminars and contact with others in his depart-
ment, Bradley had experienced postgraduate life as one of almost complete
isolation. His supervisor's role had been mainly to help him to structure

his work, including the use of short term goals, and eventually to comment on the results. This strategy helped Bradley to become more confident of his ability to plan, carry out and evaluate a research project on his own.

The grids helped to clarify the position regarding what was happening between the students and their supervisors. When Adam's first and final grids were compared it became clear that the 'supervisor' element was being used by him in a very different manner within his construct system for the Ph.D. The first grid had been relatively undifferentiated. His element 'meet with supervisor' was linked very closely to those of 'synthesize theories', 'reading' and 'organizing sequence of ideas'. In the later grid, which was more differentiated, his element 'meet with supervisor' stood alone. Adam said that he hoped that his supervisor, Prof. Andrews, would help him to organize the administrative side of getting the Ph.D. but otherwise he was very remote from anything to do with his thesis. The Core analysis showed that the match between the construct 'Immediate feedback/Long term result' on his first and last grids was only 40 per cent which meant that his use of this construct had changed considerably over the three years. Adam explained this when he said 'in the beginning I wanted immediate feedback and was afraid to ask. When I got it, plus the confidence, I stopped working so hard and felt secure.' Here he is relating growing autonomy with lessening dependence on productivity.

It is from output from the student that the supervisor is able to evaluate progress in explicit terms for feedback to the student. Therefore, this comment from Adam may be interpreted as independence from external approval coupled with increasing reliance on the information he

received as he worked on his topic. The more he felt he could understand and rely on his own judgement of the quality and standard of his work, and the longer he could follow the development of his thinking through continuing to interact with his own ideas, the less he needed to turn to his supervisor for comment, criticism, or interpretation. As he became his own supervisor, by evaluating his efforts without needing to depend on a third person to act as mediator, he felt less pressure to produce something tangible to show his supervisor. This meant that although it might appear that he was doing less, in fact he was working steadily without forcing himself to complete a piece of work before he was ready to do so, merely in order to be seen to be working.

He may be compared to Ewan who did not continue to develop the confidence in his own work that was necessary if he was to be able to rely on the information provided by the results. This became apparent from the Core analysis of his final grid which showed that the construct 'Own initiative/Positive feedback' had changed radically in the three years, when compared with his original grid, but that it had also changed significantly when compared with the grid completed only six months earlier.

In his original grid this construct had been isolated from the others and all the elements, with the exception of 'interpret results' and 'think about what you've read' were assigned to the positive feedback end of the construct. In his final grid the construct was not closely linked to any other but most of the elements were rated towards the 'own initiative' end of the construct. In the grid he had completed six months earlier the construct was linked to his 'needs thought/tells if on right path' construct. When asked about this, he replied 'I don't think that my early relationship with my supervisor was good and he wouldn't give me

information first hand. At first I had to do all the work without any

lead, but later that changed. If you begin to enjoy the relationship

with your supervisor then positive feedback is obvious. Some supervisors

would opt for the student to dig up the research themselves; it would

make you approach the problem differently and is a better training for

later work when you have to cope alone.'

This postgraduate was happy to depend on his supervisor but commented

on how the particular style of supervision he had received had affected

his work. He linked the amount of dependence on his supervisor with a

lack of intrinsic satisfaction from and involvement with his work. He

was explicit about the importance of external reinforcement and aware

that his own training may not have been the most efficient for later

autonomy in research. This indicates, that together with the importance

placed on the need for information concerning progress which the students

expected to receive from their supervisors, was the equally important

need for the students to understand and accept the feedback which was

constantly available in their own work.

In his final grid Ewan's 'supervisor' element was linked to his

element labelled 'good relationship with lab. technician'. He said when

asked about this that he could never have the peace of mind to settle

down and get good results if things weren't 'O.K.' with both the super-

visor and the lab. technician. This was because he needed to please them

both in order to get the help of the latter and the approval of the former.

He said 'it's important to get good guidance and I feel my supervisor is

doing this'. Dr Eustace said of his student 'following superhuman effort

to get sense into him, he's got experimental results as good as anyone',

which shows that it was the product, rather than the method by which the

product was achieved, that was being designated as acceptable in this case.

In fact by this stage in the higher degree programme, Ewan was the only postgraduate of the six remaining in this study who was still being seen weekly by his supervisor. Adam and Diana were seen about once in six months and the others met their supervisors at intervals that varied between one and three months.

The General Malaise

The major issues with which the students had to cope over the three years can be summarized as follows:

(a) Enthusiasm

(b) Isolation

(c) Boredom

(d) Job of work

These issues became apparent from the interviews and were interpreted as stages through which the students had to pass. The grids pinpointed when any of the research students were experiencing any particular stage. The stages are considered to be important because they were part of the total process which the postgraduates described as they worked towards their Ph.D.

Each student experienced these stages at a different time and one stage did not necessarily end when another commenced. It was sometimes noted that a postgraduate was both enthusiastic about the work but isolated socially because of it, or bored with the routine tasks but nevertheless determined to continue with the job of work to be done.

Nevertheless, the stages are introduced to the rest of this section

in the order that they emerged as issues to be discussed with the post-graduates. The length of time that they had been engaged in research for their higher degree before encountering one of the stages is recorded. Also noted is the 'double vision' of what was happening at that time by the student and supervisor pairs.

Although the stages are introduced in this section they are, of course, equally relevant to all aspects of the Ph.D. as a learning process. The sections on planning work and writing should, therefore, also be read in the light of these different attitudes to the work.

(a) Enthusiasm

At their original briefing interview, when the postgraduates had first agreed to become one of the cases to be studied, they had all been asked why they had taken the decision to study for a research degree. At that time they had said either that it would allow them to make a personal contribution to their field or that it would enhance the choices open to them for their future career, or both. Charles and Diana reported that they had tried to get jobs before commencing the Ph.D., Bradley and Freddy felt it had no particular status but they wanted to do the Ph.D. for its own sake and Adam, Greg and Ewan wanted to make their marks on their disciplines. These ways of thinking about what they were doing were initially modified after less than six months of their research degree studies.

During the first year of this research (1976-77) the different attitudes of the supervisors to research reported above were reflected in the way the beginning students were handled. The postgraduates all began the three years full of enthusiasm for their new undertaking, but this changed

during the time it took to complete the course. The science students were started immediately on experimentations or computing while the arts students were left more or less alone and told to think. This would tend to suggest that the science students are off to a better start as they are involved with equipment, surrounded by others in the laboratory and engaged on a real problem. However, the interview material does not show these students to be at an advantage over their contemporaries in the arts at any point during the first year. While they were getting bored with repetitive experiments and lack of interest shown in their work by the others around them, the arts people were becoming concerned about inactivity and lack of intellectual exchange with their peers.

The way that postgraduates were started on their course by their supervisors inevitably resulted in different degrees of structure of the research project. The unstructured life of the arts students, in which they were asked only to produce a piece of written work at the end of the first year, led to a need for them to discipline themselves to work on their own and for them to structure their own work load. The more formally structured approach of the science students led to their having to give interim reports on experimental progress and keep notes of experimental procedures and results. These differences did not always coincide with frequency of meetings between the student and supervisor pairs. In fact two of the science students, Charles and Diana, were expected to take the initiative in arranging meetings with their supervisors.

The postgraduates were at different stages of dependence upon their supervisors by the time they reached what was officially supposed to be

the half way point in their higher degree courses. During the course

of their second year (1977-78) the interviews showed that supervisor

style, directly affected the way in which the research was approached.

The result was often frustration and doubt on the part of both student

and supervisor. For example, Freddy who appeared to need time to plan

his work and continue unhurriedly until he was satisfied that he had

something interesting to contribute, was paired with Professor Forsdike

who constantly asked if he had got any worthwhile results.

The student became irritated and felt that he was not working to

adequate standards while the supervisor felt that the postgraduate was

too cautious and unable to work alone. An example of this situation is

given below:

> Prof. Forsdike: 'I give him a lot of rope but see him every day.
>
> I think a student needs a considerable amount of direction right
>
> through the research period.'
>
> Freddy: 'The prof. controls the work and won't let me get down
>
> to anything new.'

This pair were scientists working in the same laboratory which may

have contributed to the feeling that Freddy had of being over super-

vised.

Two of the other science postgraduates, Charles and Ewan, who

needed constant feedback and encouragement, were paired with supervisors

who wanted to be kept informed of progress and ideas at intervals that

allowed for some development to have occurred. In these cases the

students felt neglected and the supervisors resented the demands being

made on them (if the students were able to ask for more of their super-

visors' time). A typical example of a supervisor in this position is

given in the following quotation from one of the interviews:

 Dr Eustace: 'He'll probably do a good Ph.D. if my colleague and

 I put enough effort into it.'

His student, Ewan, in an interview around the same time said:

 'I don't really like the set-up here.   I'd prefer it if supervisors

 told research students to report every week at a certain time.'

While this comment reflects a conflict between enthusiasm for the

work and disenchantment with the way he was being handled, it was becoming

clear that the students' perception of their Ph.D. was related to their

relationship with their supervisors.   Students such as Greg and Ewan were

relying on their supervisors for ideas of how to interpret their results,

what they should do next, and feedback about the usefulness of what they

had already done.   Students such as Adam and Bradley, who were beginning

to use the information contained in the results of their work as a source

of feedback instead of relying on their supervisor's assessment provided

contrary examples and were making decisions based on their own assessment

of their efforts.   Nevertheless, their early enthusiasm was changing to

a more pragmatic way of viewing what was happening.

 Students and supervisors continued to perceive their interactions

differently.   At the start of the second year Freddy was still being

seen by his supervisor every day.   The professor considered his student

to be 'self-reliant and can work for two to three weeks without super-

vision.   My role is that of stimulant, giving him things to think about.

I've given him a great deal of freedom and will continue to see him

every day but won't discuss results more than once a fortnight.'   Freddy

said about this situation 'I do more when the prof's not around.   I'm

happier to be left alone.'   This was during an interview when the professor

was away on holiday.

Freddy was enthusiastic about his work but perceived himself to have been oversupervised throughout his higher degree. He said 'I feel just another pair of hands for my supervisor. No matter what I do there's always more. I still see him about twice a day. I'll have to be very firm with him, he's still on my back trying to get me to do more practical work but I won't.' By this time, towards the end of the second year, Freddy was struggling to redefine his role and to become independent of his supervisor. As soon as he made his statement to Professor Forsdike he was encouraged to hand in chapters of the thesis as he completed them and the professor reported to the author how delighted he was with his student's self-confidence.

With this pair, the supervisor assumed that the student needed his support for as long as the student accepted it. The student suffered what he felt to be oversupervision because he thought it would be disrespectful to speak his mind to the professor. Once he found the courage to do this, the supervisor accepted that his student was capable of more independent work than previously and modified his style of supervision.

During this period Adam was seeing his supervisor only about once in three months. He had been very unhappy with this arrangement but after about 18 months he said 'my supervisor is at last interested in what I'm doing. He's offering constructive criticism and suggesting people I should see. This could be due to the preparation I've put in and the fact that I've now got something worthwhile to say. This change in the quality of our meetings is very important.'

Supporting evidence for this statement of Adam's comes from the interview with Professor Andrews which took place during this period. The professor volunteered the information that he had arranged meetings

for Adam with one of the lecturers in his department with a view to giving Adam the opportunity to talk about his ideas to a group of under-graduate students. Professor Andrews had also arranged for Adam to lunch with him and a former Ph.D. student of his who was visiting from America. He said 'I wish all my students were as good as he. I'm really happy with him. He's produced five or six short papers about his work, all exploring various aspects.' In the relationship between Adam and Professor Andrews the student worked autonomously but felt neglected, while the super-visor was under the impression that more contact would be interference. Here is an example that is related to the amount of attention given by the supervisor to the postgraduate's work:

Adam: 'After seven weeks of writing he only talked about a very minor aspect of my paper.'

In contrast,

Prof. Andrews: 'each time I choose a single aspect from a paper he has written and suggest he develops it.'

It can be seen that they are in agreement about what happened but their interpretations of the event are quite different. For the student it shows disinterest on the part of the supervisor, while for the professor it shows selectivity and his way of helping the student to focus his work.

A further quotation taken from their interviews shows how the differ-ent perceptions led to a significant breakdown in communication between them.

Prof. Andrews: 'I consider his research problem to be fairly well defined.'

Adam: 'The problem I have is determining what the scope of a research thesis should be.'

In this example of 'double vision' it is easy to see why the professor left Adam alone to get on with his work, feeling satisfied that his student was in a very good position to develop his ideas and continue independently until he asked for a meeting or presented some work for inspection. It is also easy to see why Adam perceived the professor's behaviour as disinterest and neglect while he floundered aimlessly, trying to understand what it was that he should be doing.

As meetings between Adam and the professor took place at the initiative of the postgraduate and were often at intervals of four to eight weeks, it is clear that 'a great deal of freedom' is very different for Professor Andrews and Professor Forsdike yet both of them had students whom they considered capable of autonomous work.

A counter example comes from Ewan and Dr Eustace. Here it was the supervisor who had to make explicit the need for the student to work more independently. The supervisor said during the third year, 'He's become an independent research worker, he's doing original work all the time, but he wouldn't have got very far without the supervisor. But that's all part of the game.' Ewan, who had wanted even closer supervision than the very regular contact he had with Dr Eustace, said 'I can see now that from a supervisor's point of view, if he thinks you have something to do he leaves you alone to get on with it.' This was towards the end of the research period (mine and theirs) when Ewan had regained a little of his early enthusiasm for his Ph.D.

With this pair, the student assumed that as long as he wanted to lean on the supervisor, the supervisor would monitor everything he did. In order to break out of this and make his own position more tolerable the supervisor had to force the student to make his own decisions without

checking every step with him. In this instance, however, Ewan was unable

to construe his Ph.D. in such a way as to include himself as evaluator of

his own work. Therefore, he continued to depend on his supervisor for

assessment and feedback; this was even though the tasks he undertook

were spread over a longer period than previously. In this case, the

practical part of the work was continued independently, while the monitoring

of results was still handed to the supervisor.

(b) Isolation

After a year of being registered for their higher degrees, the postgraduates

in the study said such things as 'Now I know what not to do for my Ph.D.'

and 'working on the problem led to improved techniques for experimenting

with the same problem.' The interviews showed that all the postgraduates

felt that they could have been further ahead than they were. Greg said

'I don't feel I've got very far after a year. I think I could have done

more. I'm frustrated at not making as much progress as I hoped but don't

know how I could have achieved more.' Adam said 'It's difficult to know

how well I'm doing as I'm working well but progressing really slowly.'

These comments are representative of all seven in the study, except

perhaps for Charles who diagnosed his problem as one of 'mental inertia'.

By this he meant that he was unable to concentrate on his Ph.D. at all.

Even reading was an effort for him. The interviews, supported by the

grids, showed that Charles was isolated and bored by the end of his first

year of research. Charles was doing research in the astronomy department

of University A. His second grid indicated that his construct 'Communi-

cation/In your own mind' had changed significantly in the way that he was

using it compared to six months earlier. In the feedback interview he

said that he was puzzled that this change was so pronounced, as all that had happened was that his idea of what constituted 'communication' had changed!

This comment in itself is indicative of the sensitivity of the Core program which compared each element and construct of two grids (in this case the first and second) and printed out those that had changed the most. The student had not been aware that his changed definition of 'communication' was affecting his perception of his Ph.D. When this change was looked at in more detail it helped him to see why he felt so blocked in his work.

He said that real communication was very intimate and only occurred between people who were on the same wavelength. 'Most of the time communication is artificial. Conversation is just polite, you do it all the time with people. Communication, if it's real, is more between two minds. So I don't think of conversation as communication any more.' As he was dissatisfied with the amount and quality of his interactions with his supervisor, and also felt he had very little in common with others in his department, he was not talking about his work with anybody. This resulted in a period of isolation even though he shared a room with another postgraduate and came to the university every day. The lack of intellectual stimulation and exchange of ideas with either peers or supervisor eventually led to loss of interest in his topic, which he thought was of no importance or interest to anybody else.

This period ended for him when he went to a conference and met somebody from another college of the university who was interested in his area of work. After this he visited his new colleague several times to talk about his work. Comments from Charles during the 'fallow' period

were all to the effect that he knew he should be very much further on than he was but that he needed a push. Once he got back to work he talked about all the things he intended to do and how he would make up for lost time.

Of course, the students had different perceptions from each other as well as from their supervisors regarding the process of pursuing a research degree. After a year, Diana was saying 'I work alone in a lab. full of people, all research students, all working alone.' Adam complained 'the social system of doing a Ph.D. is very discouraging' and Bradley provided a balance with 'I'm utterly alone but don't feel isolated. I'm happy to get on in my own time.'

Although the observer may report that Diana is less isolated than her two contemporaries, for her the reality is one of total isolation, while Bradley's perception of spending so much time on his own is not as extreme as either hers or Adam's.

At the end of the first year, Freddy declared 'I'm in the wrong field but I'll stick it out'; Ewan commented 'It's the same thing over and over again. I'm making a few steps towards my Ph.D. but it's slow progress.' Bradley summarized what he was feeling when he said 'postgraduates are treated scandalously. We're not treated in any way as members of the academic community. The pleasures of isolation are wearing thin.'

Regardless of university base, what the postgraduates in the study were perceiving seems to be more relevant to the social conditions in which they were working than to the work itself. Nevertheless, the effect of these feelings was to dampen their initial enthusiasm and slow down their pace to almost nil.

At this point, about 18 months into the programme, Charles wanted

much more direction from his supervisor and referred to their monthly meetings as 'rather silent affairs'. Dr Chadwick said that he considered his role to be one of guidance rather than direction. He interpreted direction as spoonfeeding students by giving them books and articles instead of allowing them to go to the library and seek out the relevant literature for themselves. Guidance he considered to be pointing the students onto the right path and allowing them to get on without inter-ference. He was concerned about dominating their meetings and, therefore, waited for the student to take the initiative and introduce a particular topic for discussion.

By the end of the second year Charles had dropped out of the pro-gramme without having written his M.Phil. He said that he decided not to continue due to what he considered the lack of structure and direction. During the period preceding his decision that he was unsuited to academic work, he went to several members of his department and asked what he should be doing. The differentiation scores on his grid (see p.176) had remained relatively stable over the two years, only once showing that he had managed any degree of organization in his perception of his Ph.D. This could have been an indicator of the extent of his confusion.

In his final interview he said: 'Nobody cares if you come in or you don't, if you work or you don't. There's no point in making any effort here. It's important to have somebody standing over you.' It seems that Charles needed more direction than guidance but his supervisor preferred to give guidance rather than direction. Charles was unable to achieve the gradual 'weaning' process which the postgraduates could be expected to complete as they learned to rely on their own, rather than their super-visors' observations of their work.

Greg, who was seeing Dr Green only about once in three months during the second year (1978-79), was very depressed that she expected to receive chapters from him. The 'supervisor' element in his grid had not changed in the three years and was still linked to his element 'attending class'. Dr Green was aware that her student still expected 'highly structured courses' and that he was considering settling for an M.Phil. Earlier, Greg had had weekly meetings with Dr Green and had been concerned 'to maintain my own style and my own identity and not become merely a disciple of my teacher'. In this instance, the supervisor was gently trying to 'wean' the postgraduate and increase his autonomy by requesting draft chapters to form the basis for discussion at their meetings. She was also encouraging him to write by setting deadlines to coincide with their tutorial discussions. The interviews suggest that Greg was consciously worried about losing his autonomy and conforming to departmental requirements quite early in his higher degree course, while the structure of the grids showed that his perception of the part of his Ph.D. related to supervision was very similar at the start and the end of the programme.

Diana, on the other hand, rarely saw Professor Dymond and was left to work alone for long periods from the very beginning. She said during the interviews that she had known that this would be the case when she first registered but that it continued to bother her and that she felt as though she were working in a vacuum. Her grids contained no 'supervisor' element and it was only in her final grid that she added 'discussion with colleagues' to her list of elements. Until this late stage in her Ph.D. work she had not thought about including talking about her work as an important component in her perception of her Ph.D. She had accepted the original agreement when the head of department had become her supervisor.

She did not discuss her research with anybody. In fact, she thought the only opportunity she had to talk about her work was with the author, or at occasional postgraduate seminars organized by her department.

These two postgraduates demonstrate the way in which their perception of the role of the supervisor affected their work. Their perceptions played a more significant part in the eventual outcome than did the reality of supervision. For Greg, supervision meant weekly meetings to discuss aspects of his area of interest that may or may not be related to his research. For him doing a Ph.D. was similar to any other higher education course because there was a teacher who held 'classes'. When this private idea was denied by the reality of a supervisor who refused to hold 'talk sessions' and requested intervals between meetings that permitted him to have developed his own thinking in written form, Greg was unable to restructure his internal conception of his Ph.D. He became depressed and seriously considered giving up.

For Diana supervision meant rare hasty meetings with a very busy 'jet set' scientist who had far more important things to attend to, and several of them at any given time. Therefore, her internal conception of her Ph.D. excluded any possibility of lengthy discussion about her work. Because she, too, was unable to restructure her private idea, conceived at the time of registration, of the components that made up the world of her Ph.D. she spent long periods feeling totally isolated even though she worked in a busy laboratory. Unlike Greg, however, by the time she came to the end of her three year period she had managed to substitute colleagues for professional conversations to develop her thinking. She no longer believed that an absent supervisor meant an absence of professional conversations of any kind.

(c) <u>Boredom</u>

After eighteen months six of the research students were depressed, con-
fused and 'fed up' with the whole idea of the Ph.D. They felt isolated
and that they were going nowhere. About this time the author was con-
vinced that all seven cases would drop out and that <u>this</u> Ph.D. would
have to be done on reasons for wastage in research degrees. To my sur-
prise, this 'fed up', 'I'm stuck' phase, when the seven postgraduates
were asking if any of the others were as depressed as they were, led
very quickly into another quite distinct phase. The students who had
initially been reading now started to write and those who had been ex-
perimenting or computing stopped and relaxed. Hudson (1977) mentioned
this 'getting nowhere syndrome' in his own experience of doing research
and the supervisors in the sample commented on various aspects of it too.

Professor Forsdike, a science supervisor, said of Freddy, 'during
the next six months he'll get through the sticky patch and the results
should just pour out'. This way of talking about the progress of research
also seems to be significant. The science supervisors were interested in
results, while the arts supervisors were more concerned with ideas. An
example of these differences comes from Dr Eustace who said of Ewan
'after a slow start he's got experimental results as good as anyone',
and Mrs Briggs who commented about Bradley 'he's always telling me things
I don't know and that's exciting'.

Half-way through their programme the comments of the postgraduates
showed a different attitude to their work. The following quotations are
taken from the interviews which were held at that time. Freddy, research-
ing industrial chemistry in the technological university, said 'It's the
boring part now, essential to the thesis, just plodding on. Just churning
out results with no thought, no challenge.'

He reported, during the grid feedback session, that he had become
more remote and detached. He said: 'In the beginning I had to concen-
trate hard on what I was doing, it completely occupied my mind. In some
ways I've got less enthusiastic, all I want to do is finish and get out.'
His first grid looked quite different from his later one, and, instead of
going through the various constructs that had changed he treated the over-
all change as one that typified his whole relationship to his Ph.D. He
said: 'At first I was full of enthusiasm for work and work was going to
be very important, but at the end other things gave me much more satisfac-
tion. The work was boring and monotonous and I was waiting for it to be
over and done.' This is very different to Bradley's comments at the same
time.

Freddy's supervisor said of him towards the end of the three years
'he suffers from periods of depression and I feel he hasn't put all the
energy he might have into his work recently'. Nevertheless, he did not
pursue the matter with Freddy who continued to treat his research problem
as though it were a routine 'nine to five' type of work task.

Bradley, an Arts student who was doing research into Italian liter-
ature at the traditional university, provided a contrast to the picture
of increasing boredom. He said: 'I see it's always darkest before the
dawn. The thesis is a job of work that has to be finished. It's just
me and it; working until it's done, that's how it is. As the end draws
nearer I feel a greater need for intense work and less importance for the
idea of keeping a balance in my life. The only thing that matters is to
get it finished.'

Bradley was the one postgraduate who changed to a more positive per-
ception of his Ph.D. over the three year period. He commented, when asked

about his reaction to the grid feedback sessions, 'I might have formulated it differently, but I'm not surprised. It's a useful breakdown of the conceptualization of my gradual acquiescence.' Evidence of this gradual acquiescence to complete the research and write the thesis comes from the Core analysis of the two grids elicited during his final year. His construct 'Looking forward/looking back' had changed the most. (50% match). He explained this change by saying 'my concern about the future has acted to keep me going on the thesis. I need to feel I've rounded off a schedule of work in the three years.'

At first Bradley had gravitated into research because he couldn't think what else to do, but had said that he was doing the research 'because I want to do it and if I had to force myself to do it then I would stop'. Throughout the three years, his grids showed up this oscillation between the poles of constructs that he labelled 'Natural inclinations/self-discipline' and 'non-professional life/professional activity'. The difference in the way he thought about these constructs at the start of his re-search and towards the end were shown up in the Core analysis of his grids. His comment on this is most specific: 'These two concepts have often fought for mastery over me. I think the discipline has gradually gained the upper hand. In the three years the natural inclinations to do anything other than finish the thesis have become less pressing so the concepts are less radically opposed now than they have been in the past.'

Adam, researching architecture in the traditional university, re-iterated 'Now that I know what I'm doing is good enough for a Ph.D. I've lost interest, there's no challenge.' In a similar vein, Diana, the bio-chemist working in University B, explained 'I want to do anything that will write up into a cohesive thesis.' At a relatively early stage in

their programme, these three students were beginning to see their Ph.D. as a job that just had to be worked at until it was finished. The others got to this point much later.

(d) Job to be completed

In the beginning, three years had seemed to be a vast amount of time for working on a single important problem. But by the start of their final year the students felt that they had had very little time indeed to accomplish any really significant work. At the same time, they were tired of concentrating on just one problem which they now perceived as relatively trivial.

Diana, working on an anti-cancer drug in the technological university, added more new elements to her grid over the three years than did any of the other postgraduates. The feedback interviews revealed the extent of the change in her perception of the Ph.D.

The following example is taken from the end of Diana's second year. Discussion of the several constructs that had changed since she had completed her first grid led her to comment 'it's a totally different way of thinking because I'm aware that I've only a year left and two years have already gone. Three years doesn't seem half long enough. It seemed a long time in the beginning.'

When she was shown that the element 'Be able to interpret results of experiments' was grouped quite differently in her latest grid compared with all the preceding ones, she said, 'that's because I'm trying to finish off groups of experiments and say "that's the answer" rather than exploring it more fully, which is what I used to do. Before I was aiming for "the truth" now I'm aiming for results. I'm looking forward to finishing rather than doing the work for its own interest.'

Greg, researching Russian history at the traditional university, had originally seen his work resulting in a creative end product which he assumed would emerge from the mechanical process of collating manuscripts. Therefore, his construct 'Almost mechanical process/not automatic' is a key one for showing how he felt about his work. The Core analysis of his first grid and the one he completed in his final year showed that this was the construct that had changed the most. Merely from studying the two Focused grids it was difficult to understand what this change signified as the grouping was not as different on the later grid as a 56% match would suggest. However, when Greg was shown the analyses he said 'I'm really fed up with it right now, doing the mechanical things just goes on.'

At first the mechanical part of his research was seen as making a direct contribution to the original, creative conclusions he would be able to draw out of his efforts by the end of the three year period. As the end drew closer the mechanical work was just that, boring repetitive mechanical work. He said at this point 'I couldn't cope with another year like this so it <u>must</u> be finished by the end of the year.'

The students had commenced their three year course full of enthusiasm, but once the research had been completed and they had only to write the thesis in order to complete the Ph.D. they spoke of wanting to 'get it and forget it'. The following table shows the changes in the ways the postgraduates thought about their Ph.D.

TABLE 9: ATTITUDES TOWARDS THE PH.D.

Post-graduate	Start	One year	18 months	Three years
Adam	Contribution	Depressed	No challenge	Must finish
Bradley	For its own sake	Alone	Feeling low	Job of work
Charles	Career	Going nowhere	Hard slog	---
Diana	Career	Isolated	Must get it	Slog
Ewan	Contribution	Confused	Plod	Just continue
Freddy	For its own sake	Fed up	No challenge	Just do it
Greg	Contribution	Nobody interested	Better	Got to get it

It can be seen from the table that Diana, at three years, was thinking of her Ph.D. in a manner similar to Charles the year previously. This should be cause for concern as Charles had dropped out at the end of his second year. All the others, even Greg, were thinking more as Diana had been thinking in the second year. It seems to be important for the morale of the postgraduates that they think in terms of a goal - 'got to get it' - or an unfinished task that needs completion - 'must finish'.

The table shows how the seven students who had started their higher degrees for a variety of reasons gradually became dispirited about working alone as their research became more familiar to them. Having begun enthusiastically, they went through periods of isolation and boredom until in the end they forced themselves to put in the effort needed to complete the Ph.D. Parts of this process were identified in the grids through the discussions based on the computer analyses, while the comprehensive picture emerged as a result of combining this information with the information obtained from the semi-structured interviews. The construct and element

groupings changed according to what period of their research the post-
graduates had reached and the interviews showed that they realized that
it was determination and application, rather than brilliance, that was
needed to complete what they had started.

Changing Perceptions

Three years from registration Charles had dropped out and taken a job.
The rest of the postgraduates in the study were talking about just
'sitting down and slogging'. They saw their theses as a job of work
that had to be finished. In addition to this change in their perception
of the Ph.D. itself, the students changed their perceptions of what was
important to the completion of a three year Ph.D. programme. At first
they had listed only practical activities as their grid elements, but
gradually they added qualities and characteristics that were important
such as self-confidence, enthusiasm and determination. Table 10 over-
leaf gives the additional elements and constructs supplied by the post-
graduates.

TABLE 10:   ADDITIONS TO ORIGINAL REPERTORY GRIDS BY THE FINAL YEAR

Postgraduate	Elements	Constructs
Adam	-	Internal expectation/ necessary for career
Bradley	Keeping up with latest research	Looking back/looking forward
	Concentrated work on thesis	Of permanent importance/ of temporary importance
		Irrelevant to academic career/important for academic career
Charles	Music (playing)	Important/not important
	Application to problem	Expression of ideas/ precision
Diana	Discussion with colleagues	Like/don't
	Self-confidence	Good at/not
	Present papers at scientific meetings	Not directly related to work activity/active work
	Stable home (social) life	
	Learn new techniques	
Ewan	Good relationship with technician	Important/room for manoeuvre
		Need for experience/ training sufficient
Freddy	Being given a workable project at start	My own time/lab. time
	Enthusiasm and determination	Important for everything/ relatively unimportant
Greg	Chasing up books	-

By the time they had completed the research part of their work, the post-graduates were realizing that certain characteristics were as important to success in a higher degree as was practical expertise.

The supervisors had not completed any grids but had listed certain elements that they considered to be important to the successful completion of a Ph.D. They supplied the elements, listed in Table 11 below, during their second interview.

TABLE 11: SUPERVISOR ELEMENTS

Professor Andrews

Reading around different viewpoints

Planning their own time

Prepared to expose their own work to others (talk or write about it)
Outgoing

Prepared to focus their work closely (take a step forward not solve the world's problems)

Commit ideas to paper at earliest possible point.
(Need to see how they change over three years)

Develop healthy scepticism
Understanding (avoid attachment to a single well known theory or name)

Need to study techniques to carry out experimental work

Read for style relevant to written thesis
(Literature not architecture, e.g. Joseph Conrad writing in third language,
Must coincide with their own interest)

Mrs Briggs

Aiming towards coherence of ideas and of work
(cross references at the mundane level)

Not getting out of habit of writing

Having series of definite discreet goals, not just 'a thesis' at the end.
(being able to divide project into parts, i.e. start with idea of finishing)

Maintain interest in things other than topic of research

Tidiness in collection data (don't lose references)

Capacity to relate the particular to the general (some sense of relationship of your project to wider area)

Not to be lonely

Maintaining regular working habits

TABLE 11 (continued)

Dr Chadwick

 Study background rather than single problem

 Physical effort - spend time working

 Results and conclusions from the method

 Implications of the results and what they mean

 Originality in solving problems that arise

 Write thesis

 Oral examination

Professor Dymond did not supply any elements

Dr Eustace

 Originality

 Ability to express oneself clearly

 Expertise and care in experimental work

 Enthusiasm and interest

 Extensive reading

 Competent mathematician - background and expertise

 Integrity (honesty)

 Capacity to work well with others

Professor Forsdike

 Initiative/drive

 Determination (not to let it get you down)

 Ability to think logically

 Humility (appreciation of one's own limitations)

 Practical skill

 Facility in spoken and written communication

 Imagination

 Personal relationships (ability to pick up ideas
 and tips from others)

TABLE 11 (continued)

_____

Dr Green

> Self-discipline
>
> (mad) Ambition
>
> Ingenuity
>
> Ability to discriminate what is important
>
> Conformity (despite value placed on originality)
>
> Self-confidence

_____

It can be seen that all of them included abstract qualities such as

Imagination, Self-confidence, Determination and Enthusiasm in their list

of requirements for a Ph.D. student. It was not until well into the

three years that their students added similar qualities to their grids.

Eventually, just as they had learned to accept that their progress was

inevitably slower than they had expected and that their theses were just

another job of work, so too did they begin to understand that qualities

such as self-confidence and persistence were as important for them as an

ability to conduct experiments or take notes. Diana's comment, taken

from an interview towards the end of her third year when she was working

on her thesis, epitomizes this change 'I was lacking in self-confidence

and you need to be flamboyant. I've improved but others were confident

to start with.'

Section Summary

The main features that had emerged were that the relationships with their

supervisors were dependent upon the students' expectations of the super-

visory role, the frequency and type of contact that the students had with

their supervisors and the students' interpretations of these meetings. These in turn, affected the students' perception of what doing a Ph.D. meant and the amount of independence they achieved in their work.

As the students developed self-confidence and gradually became independent of their supervisors, so too did they become more involved with their work because of its own intrinsic interest. In the present study, the grids showed the relationship between involvement with work and a lessening of the need for external approval. The students gradually learned how to interpret the results of their efforts and this helped them to grapple with problems as they arose instead of immediately turning to their supervisors for advice. Over the three year period students passed through stages that ranged from early enthusiasm to boredom with their research and feelings of isolation regarding their work environment.

During their final year, the students perceived their Ph.D. as a routine task that had to be finished. The change in perception of their Ph.D. from something unique and special, to work that had to be completed was important to their progress. This was because initially they felt that extraordinary abilities were needed and they were not at all sure that they had these abilities. After the change in the way they saw their Ph.D. they realized that the abilities that were needed were more ordinary ones, such as perseverance and determination.

In order to gain more information concerning the postgraduates' relationship with their work, the free writing that they had done at the start of each interview was analysed. The next section examines in some detail the way that the students planned their work so that the effect of the planning on the outcome of the research may be considered. It is to this aspect of their work that we now turn our attention.

How did the postgraduates plan their work?

Introduction

The students wrote short paragraphs at the start of each interview. These paragraphs were headed 'The problem I'm currently working on' and 'The problem I will be working on in a month's/term's time'. (Sometimes the students preferred to estimate their work over three months rather than just up until the date of the next interview.)

By checking the prediction of what they thought they would be doing against what they were actually doing, at the time of the next (or end of term) interview, it was possible to measure the accuracy of their estimations.

The deadlines provided short term goals for the postgraduates at each stage of their research. The short term goals fitted into the overall general plan that they had for the three years. As they worked towards these goals it was possible to understand how their projects were developing in relation to the time available. The basic assumption here was that students learn from experiencing the difference between expected and actual achievement in a given period. As a result they should improve the accuracy of their predictions.

The definition of planning being used in this thesis is given on page 38. It is 'a strategy designed by an individual to achieve a specific goal in a given period of time'. The use of such a definition is, in itself, an acknowledgement that there are other important aspects to planning besides estimating the amount of time needed to reach a stated goal. Other aspects of planning include:

(1) designing a project of reasonable size

(2) actually getting started on it

(3) reviewing the results of the actions

(4) coping with setbacks

(5) focusing on a particular problem

Although these aspects are given some consideration in this section, the major part is devoted to time estimation.

There are two reasons for such emphasis:

(1) managing work over time is important for most occupations - not least research and completing a thesis

(2) It was found, as a result of analysing the paragraphs, that time estimation was a central problem of planning for the postgraduates.

The First Year

In the first year the students usually overestimated what they could achieve in a given period. This was true whether the deadlines were self-imposed or suggested by the supervisors. Table 12 overleaf shows the differences between the estimated and actual time taken to complete a written report on the first year's work, for all the students in the study.

It can be seen from this table that Bradley was considerably more accurate in his predictions than were the other postgraduates during their first year. Also, he may have learned from this exercise as he allowed a little more time when estimating progress on his second paper. Adam provided a marked contrast to this. It is evident from the table that Adam grossly underestimated the amount of time he would need to complete his first paper but still predicted that a month would be suf-

TABLE 12: FIRST YEAR ESTIMATES OF TIME NEEDED TO COMPLETE REPORT, COMPARED WITH ACTUAL TIME TAKEN TO COMPLETE

Student	Estimate in Weeks				Actual Time Taken	Difference in Weeks between Expectation and Achievement
	Original Estimate	Revised Estimate 1 month later	3rd Estimate another month later	4th Estimate a month later		
Adam:						
Paper 1	4 weeks	+3 weeks	very slow	+1	20 weeks	16 weeks
2	4 weeks	very slow	+4 weeks		abandoned*	
Bradley:						
Paper 1	9 weeks	+3 weeks	+1 week		15 weeks	6 weeks
2	12 weeks	+2 weeks	+2 weeks		16 weeks	4 weeks
Charles:						
Paper 1	4 weeks	**			abandoned*	
Diana:						
Paper 1	24 weeks				abandoned*	
2	12 weeks	+4 weeks			abandoned*	
3	4 weeks	+4 weeks			abandoned*	
Ewan:						
Paper 1	1 week	**	**	+4	19 weeks	18 weeks
Freddy:						
Paper 1	12 weeks	+8 weeks	**	+8	40 weeks	28 weeks
2	2 weeks	+2 weeks			abandoned*	
3	8 weeks	+8 weeks	**	+8	Not completed***	
Greg:						
Paper 1	4 weeks	+8 weeks	+12 weeks	**	Not completed***	

* Paper abandoned means that the student decided to do something else.
** Indicates that the student considered the paper to be practically completed at the time of the interview.
*** Paper not completed means that the student kept returning to it and did eventually complete it up to one year later.

ficient time for him to write his second paper. An interpretation of this might be that, unlike Bradley, Adam did not learn anything about scheduling work from his first experience of attempting to do so.

In fact, the Core analysis of Adam's first two grids showed that his most changed construct was 'easy/difficult' (44% match). Inspection of the two Focused grids (in appendix) showed how it had changed. In the first grid this construct had been quite separate from the others. In the second grid it was linked to the constructs 'most like to do/least like to do' and 'immediate feedback/long term result'. This was inter- preted to mean that the easiest way for Adam to achieve reassurance that he was on the right track was for him to concentrate his efforts on tasks that would result in immediate feedback.

Adam was asked about the second grid and his reactions to the particu- lar cluster. This cluster (easy, most like, immediate feedback) was sig- nificant, he said, because 'the obvious thing is the uncertainty and the conviction of failure. I worry about doing the right thing and what others think.' The author interpreted this change in the following way: at the time of the first grid Adam was not very worried about the level of difficulty in his work but, by the time he had been in the higher degree system for a year, the second grid revealed that he was anxious to be reassured that what he was doing was acceptable. At that point in his research career, he most enjoyed easy tasks that gave instant information that he was 'doing O.K.'.

Another cluster, also revealed by the Focus analysis of his second grid, seemed to be in some opposition to the idea of immediate feedback. The cluster consisted of two elements, 'thinking' and 'making conjectures' linked to the constructs 'intellectually active' and 'giving a high degree

of fulfilment'. When asked to comment on this grouping Adam said 'I get

fulfilment from the intrinsic nature of the work'. It appears that an

interpretation of the grid information and Adam's response to it might

be that, counterpoised against the need for instant approval, there was

the equally important need for Adam to derive satisfaction from solving

intellectually challenging problems.

After only one year, it was becoming apparent that satisfaction

from the work itself was balanced against the need for explicit informa-

tion and approval from external sources. It appeared that Adam, at this

relatively early stage, was already beginning to substitute his own

evaluation of his work for that of his supervisor's. However, he was

still saying 'I don't yet know what a Ph.D. student is supposed to be

doing'; hence the apparent lack of learning observable in Table 12.

Analysis of the paragraphs showed that Adam was not the only one

to set himself unrealistic goals. Usually work not completed during the

stated period was given as the goal for the next period. In this way,

although it seemed that no learning was achieved from experiencing the

differences between expectation and achievement, the work continued to

develop. The time allowed for completion was extended and the short term

goals were used as building blocks upon which to base further estimates.

Coping with setbacks appeared to be related to planning insofar as

a setback and the consequent difference between expectation and achieve-

ment led to an adjustment of the plan. Two different episodes that re-

sulted in delays are presented in order to illustrate how the degree of

dependence of the students is reflected in how they responded to the set-

backs. The first illustration shows a setback due to problems with

apparatus.

'I finished the last of the set of experiments I was working on yesterday and then the reactor blew up and split in half. I've got to get that repaired before I can press on. Each day is going normally and I just get on with basic data gathering.' This was from Freddy who felt no dissatisfaction with the delay in his programme as this was quite clearly due to events over which he had no control. He could very easily attribute the cause of any frustration of his efforts to external factors.

In contrast, Charles commented, at the same stage of research: 'I'm not really where I thought I'd be. What I'm doing is really routine calculations so I should be getting on much, much faster than I am.' This second illustration shows a setback due to errors in calculation. In this case it was more difficult for Charles to attribute responsibility for frustration to causes outside of himself.

The interpretation made from examples such as these was that Charles's frustration and feelings of lack of progress arose because he had no external causes on which he could lay the blame for postponement of his stated deadline, yet he was not ready to take responsibility for his own efforts. He could have decided to put aside the calculations that were causing him so many problems and to continue with something else until he felt fresh to tackle them in the hope of discovering the error. What he was actually doing was merely to continue trying to get his computations to work out without investigating the possibility of locating an error made very early on. Charles had close contact with other postgraduate students whom he perceived to be making more headway than he was able to do and this added to his feelings of frustration. Charles was frustrated at his lack of progress in discovering a basic error in what should have been a straightforward bit of computing. He

revealed that he had attributed the cause of his frustration to external rather than personal factors, when he expressed the opinion that it was his supervisor's job to 'unblock' him.

Adam had very little contact with others in his department yet still managed to evaluate his own progress against what he perceived others to be accomplishing. He mentioned in one of his interviews 'I have a friend in Hall who's doing a Ph.D. in literature and although he's a year ahead of me I compare myself with him. The thing about work is, I feel I don't do very much but maybe I do.'

Neither Charles nor Adam had any external criteria against which to measure the results of their efforts. Both felt that they could have been doing more, but Adam was beginning to realize that perhaps he was expecting too much of himself.

Freddy had decided to continue with routine work while awaiting the apparatus he needed in order to conduct further experiments. According to the supervisors, both Freddy and Adam were relatively autonomous even though Freddy had considerable contact with Professor Forsdike. Both of them were making decisions, and basing their evaluations of how to structure their work over time, on the learning that had occurred as a result of spending several months as research students.

Charles, however, was not making decisions about optimum use of time and resources. He was dependent on his supervisor (p.120) even though he did not have very much contact with him. Charles was continuing to follow a single strand of work without exploring other avenues such as reading journal articles or discussing his mathematical and computing problems with others. He was thinking only of the task upon which he was engaged without attempting to fit it into a wider context. Consequently,

he felt that he was achieving very little while blaming his supervisor
for not helping him to complete the task faster.

A question which arises from these results is whether there is a
relationship between dependance on the supervisor and the ability of the
postgraduates to use information from their work for planning. The degree
of independence the students had achieved was reflected both in the way
they planned their time in relation to their work and in the way they
coped with setbacks. Most significantly, it showed itself in the extent
to which they could understand the feedback coming to them from their work
and then use this information to plan their time in the most efficient way
possible.

The way the seven students planned their work was observable through
the written paragraphs. These were worded in such a way that either they
reflected consideration of what the supervisor might have in mind or else
they gave a positive statement of intention. The former is illustrated
in the following extract from Charles's paragraph 'I will be continuing
to work on the programme suggested by my supervisor while also keeping
up with the computing'. At this time Charles was describing what he
would be doing during the following month in terms of things that had
originated from his supervisor. The kind of paragraph written to illus-
trate a degree of independent planning comes from Diana who predicted
her work for the following month in terms of what she was currently doing:
'this depends on the results of my current experiment'.

These examples have, of course, been selected because they are quite
explicit about the source of the next round of work. Usually, the para-
graphs were more ambiguous or the work source more blurred as in the case
of work that had originated from joint discussion or was continuing over

an extended period. Nevertheless, how far the postgraduates were planning
their work as a result of something their supervisor had said, or some-
thing that had occurred in an earlier piece of work, became clear from
the paragraphs from time to time.

The Second Year

In order to get some idea of how the students were getting on with the
planning part of their work, a table, similar to the previous one, was
compiled for the postgraduates' second year. It was also used to investi-
gate whether any learning had taken place regarding the amount of work
they were able to accomplish in a given period of time.

The table incorporates two important features: (1) a period of one
year had elapsed since the previous table; (2) the tasks being estimated
were different from those in the previous table. The table on page 145
concerns written work while the table overleaf is primarily concerned
with practical work.

A brief glance at these results shows that postgraduates were more
successful in achieving estimates of the practical work they could com-
plete in a given period of their second year than they had been in
achieving the earlier estimates of their written work. It can be seen
that Diana and Freddy were able to predict their performance exactly
when they were considering experiments to be conducted; Bradley's reading
programme was equally accurate with the exception of the time schedule for
his plan at the end of this work period. The delay was due to his having
to give a conference paper as well as being asked to undertake some
summer school teaching that he had not expected.

Adam was the only one of the cases to select writing as his most

TABLE 13: ESTIMATES OF TIME NEEDED TO COMPLETE SECOND YEAR PROJECTS OR
REPORTS COMPARED WITH THE ACTUAL TIME TAKEN TO COMPLETE

Student	Original Estimate	Estimate in Weeks 2nd Estimate 1 month later	3rd Estimate another month later	4th Estimate a month later	Actual Time Taken	Difference in Weeks between Expectation and Achievement
Adam: writing	6 weeks	+8 weeks			14 weeks	8 weeks
	8 weeks	+8 weeks	+4 weeks		20 weeks	12 weeks
	4 weeks				4 weeks	O weeks
Bradley: reading	6 weeks				6 weeks	O weeks
	8 weeks				8 weeks	Ò weeks
	8 weeks				8 weeks	O weeks
	6 weeks	+6 weeks	+8 weeks		20 weeks	14 weeks
Charles: computing	4 weeks	+4 weeks			Abandoned	
Diana: experi-mentation	8 weeks				8 weeks	O weeks
	12 weeks				12 weeks	O weeks
	12 weeks				12 weeks	O weeks
Ewan: experi-mentation	8 weeks	+6 weeks			14 weeks	6 weeks
	8 weeks	+8 weeks			16 weeks	8 weeks
	12 weeks				12 weeks	O weeks
Freddy: experi-mentation	8 weeks				8 weeks	O weeks
	6 weeks				6 weeks	O weeks
	8 weeks				8 weeks	O weeks
Greg: collating MSS	12 weeks				12 weeks	O weeks
	8 weeks				8 weeks	O weeks
	4 weeks	+2 weeks			6 weeks	2 weeks
	12 weeks				4 weeks	-8 weeks

relevant problem of work for the second year. He continued to give deadlines that were too early, with one exception of a very short paper to be completed between interviews.

It is difficult to know whether the improvement in the estimates that the postgraduates gave at this period were due to the type of work or to the learning that had occurred during the previous year. The important question which arises here is: Can they estimate practical work better than written work? The other results show that Ewan experienced unexpected delays due to difficulties with apparatus, but achieved his predicted performance towards the end of this period. There is considerable improvement in his estimation when compared with his predictions of the first year.

Charles decided to give up and take a post in industry due to continuing difficulties encountered with the computer program he was trying to create. He refused to complete the written paragraphs until his third term, by which time he had already decided to relinquish his hopes of the Ph.D. degree.

Originally Greg's thesis was to have given an outline of the life and times of Pinchas of Koretz, a Russian sage of the eighteenth century (1728-91), but this was later changed to be merely a systematic bibliography of the sage's work. Although at first he seems to be the only one of the cases to give an example of gross overestimation of what could be accomplished in a given period, this was due entirely to the fact that the final manuscript that Greg had to work on had only one quarter of the original work he thought it contained. Therefore, he had to work only 25 per cent of the material for which he had allocated time as the rest was repetition of earlier manuscripts which he had already collated.

Even though the reading times allocated by Greg for compiling notes from the texts were very much more than he needed, there was still a discrepancy between the expected and actual time required to do the collation and write it up. This was because there were long delays in getting manuscripts from other countries. Eventually, because of these delays, the length of time needed to collate the manuscripts led to the decision to modify the topic of his thesis.

Greg noticed the discrepancy as the detailed plan was constantly re-targeted and so he had to adjust the general plan accordingly. Although this does not show up in Table 13, which was compiled from the paragraphs, the information was made available during the interviews.

According to Table 13, it appears that the postgraduates did learn to be more accurate in their estimates during the second year than they had been in the first year. The picture is confused, however, when the interview material is taken into account. Students' comments at the end of the second year were not very different from their comments of one year earlier. For example, Diana said: 'This last stuff should have taken a month, but it took me six months. I'm working, but what I thought would take a day actually takes a week.' Charles (speaking of the pro-posed M.Phil.) said: 'It's going well, but I know I'm still wasting time. I'm satisfied with what I turn out, but I should be doing much more.' Consequently, when considering only discrepancies between expectation and achievement in the amount of work the postgraduates thought they could accomplish in a given time, it is difficult to know whether they learned to be more realistic. This is mainly because of the additional informa-tion of the interviews. The change of plans, not always revealed in the paragraphs, tend to contradict, to some extent, what had been written in the paragraphs.

The Final Year

At some point in their third year all the postgraduates started work on their theses and this activity became their most important practical task. The paragraphs and interviews show the concern of the postgraduates regarding over-running the deadline of their period of registration. Table 14 shows their estimates and predictions concerning the reporting stage and how long it would take to complete the thesis.

At the time of completion of this thesis four of the remaining six postgraduates had received their doctorates. Freddy obtained his in January 1980 and Ewan in August of the same year. Bradley and Adam got theirs in June and August 1981 respectively. Greg and Diana continue to experience considerable difficulty with writing and this, coupled with very little contact with their supervisors, has resulted in both of them becoming rather demoralized and doubtful about being able to get the thesis written at all. At the end of 1981 Greg was seriously considering settling for an M.Phil. while Diana had managed to obtain a research appointment in a hospital and was once again planning to write her thesis 'every weekend'. Even these two postgraduates had not given up hope of 'having something to show for all this' to put it in Diana's words. In fact, she said that being called 'Dr' in her new job was sufficient reason 'to make it be true otherwise I feel guilty all the time'.

It seems that Adam's and Bradley's ability to estimate the time needed for a piece of work deteriorated over the three year period; although Bradley had been able to make accurate estimates for his reading programme. In fact, comments taken from his own and his supervisor's interviews show that neither of them considered him to have a problem in the area of planning his work and fitting it into the time available:

TABLE 14: ESTIMATES OF TIME NEEDED TO COMPLETE DOCTORAL THESIS COMPARED
WITH THE ACTUAL TIME TAKEN TO COMPLETE

| Student | Original Estimate | Estimate in Weeks | | | Actual Time Taken | Difference in Weeks between Expectation and Achievement |
		Revised Estimate 1 month later	3rd Estimate another month later	4th Estimate a month later		
Adam:						
Introduction	4 weeks	+8 weeks	+4 weeks		16 weeks	12 weeks
Chapter 2	6 weeks	+8 weeks	+20 weeks	+4 weeks	46 weeks	40 weeks
Complete	36 weeks	+4 weeks	0 weeks	+12 weeks	Not completed	
Bradley:*						
Chapter	12 weeks	+8 weeks	+4 weeks		24 weeks	12 weeks
Complete	52 weeks	+52 weeks			Not completed	
Diana:						
Results	4 weeks	+4 weeks			Not completed	
Introduction	4 weeks	0 weeks	0 weeks	4 weeks	Not completed	
Complete	12 weeks	+8 weeks	+8 weeks		Not completed	
Ewan:						
Lit. Survey	8 weeks	+4 weeks			13 weeks	5 weeks
Discussion	8 weeks	+2 weeks	+4 weeks		14 weeks	6 weeks
Complete	12 weeks	+8 weeks	+4 weeks		Not completed	
Freddy:						
Results	12 weeks	+6 weeks			18 weeks	6 weeks
Discussion	8 weeks	+8 weeks	+2 weeks		18 weeks	10 weeks
Complete	4 weeks	+6 weeks			Not completed	
Greg:						
Chapter 2	4 weeks	+8 weeks			12 weeks	8 weeks
Chapter 5	4 weeks	+4 weeks	+4 weeks		Not completed	
Complete	24 weeks	+4 weeks	+32 weeks		Not completed	

* Bradley was awarded a scholarship to study in Italy and decided to delay
  writing his thesis for a year.

Charles dropped out after two years without writing an M.Phil.

Mrs Briggs: 'He has this capacity to delimit his topic. He does

this, not me. He seems to know exactly where he's going.'

Bradley: 'I think things have been going to plan. I'm getting

on quite well and I'm about where I intended to be although I

haven't set myself hard targets, Christmas is a kind of terminus.'

Reference to Table 13 shows that he was accurate in his predictions

and did achieve what he had expected to accomplish in his second year.

However, he decided to modify his overall general plan due to his experi-

ences while carrying out his detailed plan. He explained: 'I'm thinking

seriously of changing my thesis topic. I had to do some background work

and I found myself interested. When I started reading in this area I found

it very refreshing. I feel I've got a much more viable Ph.D. project now.'

This example of the interaction between general and detailed plans

is important because it shows that it is not necessary for something to

go wrong with the plan in order to modify it. It appears that what is

necessary is that some action should occur on the parts of the plan so

that the individual can decide whether to continue to put the plan into

operation as originally intended or to make some amendments before pro-

ceeding.

Table 14 shows that three months after the end of the registration

period, the postgraduates' estimates of the amount of time needed to

complete the task of writing parts of their theses were far short of

what was actually required. An interpretation of this might be that

of the many things they do learn during their Ph.D. training, estimating

time needed to complete a piece of written work is not one of them. Why

this should be so is considered in the next section.

Diana, who never once misjudged the length of time she would need to

complete the experimental part of her work, spent long periods of time
trying to write up this completed work without ever finishing the written
reports. Greg followed a very similar pattern but had managed to complete
one chapter towards his thesis. These two students were very precise
about practical work but had great difficulty in estimating the time
needed for writing.

Ewan and Freddy were the only ones who appeared to make more accurate
estimates than they had done in their first year. However, these estimates
seem to be related to their ability to add on longer periods of time when
they were in the process of writing. Such revised estimates are not the
same as making more accurate initial predictions. The main difference
for these two postgraduates when comparing their estimates in Table 12
with their estimates in Table 14 is that, in their first year, they were
more likely to say that a piece of work was almost completed when they
were actually very far from having finished it.

Changing Perceptions

It seems that what the tables show is that the postgraduates are learning
how to handle multiple pieces of information, without missing out im-
portant details, as they move from one sub-goal to another during an
extended project. During the final year of a research degree, it is
the ability to unite a variety of disparate parts into a cohesive whole
which is needed. Something of this kind was observed when Ewan's grids
revealed a change that had occurred over the three years. When comparing
his first and final grids the most changed construct was 'Enjoy/Laborious'.
It bore no similarity to the way in which he had been using it three years
earlier. (12½% match). Originally this construct had been linked to the

construct 'Quick/Takes a long time', but at the end of the research period
it was linked to a new construct which he had added. This construct was
labelled 'Important/Room for manoeuvre' and was clustered with elements
relating to his laboratory based work. Ewan explained the change in
thinking by saying 'in the beginning you don't fully understand why you
do things. Once you begin to appreciate it more fully it makes a differ-
ence.'

However, although he did appear to become more involved in his work
after he had been registered as a research student for some time, he never
completely convinced his supervisor that he understood the theoretical
basis of the work he was doing. An indication of this is given on page 121
of this chapter, but the important point is that Ewan himself felt that
there was more room for him to do things other than merely carry out his
supervisor's instructions when he was in the lab. He had not been able
to do this in the beginning and so only enjoyed work that was speedily
completed. He was similar to Adam insofar as they had both needed feed-
back and approval from their supervisors at the start.

By the end of the three year period Ewan was still handing work to
his supervisor at frequent intervals but was using additional resources,
such as the laboratory technician, to help him in his work. He had been
unable to do this during his first year. The understanding of additional
possibilities that could contribute to his work, made a difference to the
way in which he perceived his Ph.D. This was regardless of whether the
new understanding was related to people, apparatus or the wider field
that was relevant to his research in nuclear physics.

In addition to seeing their work in an integrated way, the postgradu-
ates needed to become independent in their approach to their projects

during their research degree course. How they allocated their time and decided upon which goals to pursue was taken to be an important indicator of the degree of autonomy they had achieved in their work. Surprisingly, although this information was clearly available to the author, it was not necessarily recognized by the students themselves. Here is an example to illustrate the point. It is taken from one of Diana's interviews half-way through her period of registration.

'If I do the new project I'll start looking at the other enzymes I'll be measuring. This means setting up a new assay method with very small amounts of tissue. I'll have to find out about this method by going to the literature.

If I continue with platinum and I get negative results from my present experiment it will mean that platinum affects something other than adenoyl cyclase so I'll need to look at what this is, which means reading and experimenting.

If I get positive results from my present experiment I'll repeat it in vitro to try to determine whether the effect is a direct or indirect effect on the enzyme. This also means reading and experimenting. Therefore, whichever direction I go in will necessitate reading and setting up a new experimental procedure.'

This shows an extremely carefully thought out set of alternative plans which take account of all possible outcomes of her previous actions. Yet, she insisted that she had absolutely no plan and did not work in such a way as to be able to plan at all times. She wished that this were possible as it gave her a feeling of 'knowing where she was going' but her work did not always permit this. She wrote on the paper provided for her paragraph at that time: 'Don't know because my present project seems to be coming to an end.'

Towards the end of the three years Adam spoke in a way that suggested he was perceiving his work in a more unitary way than he had in the past. He used such terms as 'develop a synthesis between two extremes' when talking of his research topic, which previously he had referred to as separate and potentially competing aspects of theoretical interest. He said 'the two will be simultaneous' when discussing how he planned to approach the remaining reading and writing that he had to do. Earlier in his course he had had difficulty in deciding whether to set deadlines for reading all his references and then write about what he had read or to write what he thought and then spend time reading to fill in the gaps. He said too, 'I know I'm going to produce a theoretical thesis, hopefully by the end of November, although it gives me a sinking feeling to think about it.' However, he did not complete as anticipated within the next six months. This was not unusual and the reasons for the general under-estimation of time needed to meet deadlines on the part of the postgraduates is an important topic in itself. It will be addressed in some detail in Chapter 7.

Suffice it to say at this point that the postgraduates' early enthusiasm, discussed in the previous section, revealed itself in the form of over-ambitious time estimates during the first year. These appeared to become more realistic later on.

The boring part of their work seemed to be associated primarily with repetitive tasks and 'churning out results'. In fact, during the second year Freddy said: 'It's varying one parameter every time but basically the same work. I'm not doing any thinking work at all - a chimpanzee would probably do a better job as it wouldn't keep stopping for coffee breaks.' Yet this was also the part of the work for which they were most successful in estimating time limits.

It was only because of the doubt which arose as a result of the post-graduates' comments in interview and the lack of support for statements written in the paragraphs that the problem of comparing different tasks was considered. As a result of concentrating on thesis writing for the third year it was shown that the students were still unable to give accurate time estimates. This was probably due to the nature of the task and a full discussion of why this should be so commences on page 235 of this thesis.

Section Summary

The data from the paragraphs and interviews, while sometimes in conflict, gave an overall picture of what was happening in relation to the goals and time scheduling of the postgraduates' work. There was no evidence to support the author's original expectation that discrepancies between expectation and achievements in the students' estimates of the work they could manage in a given period of time, would lessen as they progressed through their course. In fact there was quite surprising evidence to the contrary. Not only did the estimations not improve, they actually worsened over time.

Why this should be is the question taken up later in this thesis but one explanation has to do with the work that was being estimated. It may be that written and practical work are activities so different that comparisons of time management for them reveal little about the learning which is taking place as a result of engaging in such tasks. The students' expectation of how much they could achieve in a given time were unrealistic with regard to writing, both at the start and at the end of their course. Their estimates of time needed for tasks such as com-

puting, experimenting and reading, however, were far more realistic.

These more accurate assessments of time occurred in the postgraduates'

second year. Their final year estimates were as unrealistic as their

first year estimates had been. The students coped with setbacks in their

work by adjusting the task and with delays in meeting deadlines by adjust-

ing the time allowed. Plans, whether long term and general or short term

and much more detailed, were changed as a result of actions on parts of it.

The students attributed blame for perceived lack of progress to

internal factors when comparing themselves unfavourably to others and to

external factors when relying on their supervisors for direction. Revised

time estimates were substituted for accurate initial predictions and

students tended to say they had almost completed a piece of written work

long before they had actually done so.

Decisions concerning goals and how to achieve them were sometimes

the result of independent action on the part of the student and sometimes

the responsibility of the supervisors. Joint decisions arising from both

supervisor and student were less readily identifiable.

The learning that occurred seemed to be more closely related to

handling discrete bits of information and merging them in an integrated

way than to improving judgements about how long this might take. The

students also appeared to be moving towards more independent planning

of work and time schedules as time passed. Whether these decisions were

well-judged may not be possible to determine precisely, but it is this

ability that is now considered in relation to writing the thesis.

What is the role of writing in learning to do research and to report it?

Introduction

This section is divided into three parts. The first looks at the process of writing as described by the students. The techniques adopted by them are reported and considered from (a) the point of view of expressing their thoughts in a gradual step-by-step way or (b) getting them out in any order and only then organizing them.

The second part deals with the strength of the relationship between writing and thought. It begins to illuminate the problem the postgraduates had in reporting their work in written form.

The last part of this section is concerned with how the students' perceptions of their work were affected by their approach to writing it up, and by the extent of their supervisors' involvement in the writing process.

Approaches to Writing

The two writing types identified by Lowenthal and Wason (1977) and described on page 42 of this thesis were found to be present in the postgraduate sample. An illustration of the first type, or serialist approach, comes from an interview with Adam who said: 'It's stylistic, the phrasing of the work and the way it flows that I'm having difficulty with at the moment. When I do write sentences I feel good about my style. I don't feel like an inadequate writer, but writing sentences is very slow.'

Here the emphasis is on the writing of 'sentences' which is very different from the way in which Greg, who is an example of the second

type, i.e. a holistic writer, talks about his work: 'I write a complete first draft in longhand. As I go along I tend to revise a bit, but when I've finished I revise a great deal and it tends to look like World War 3 on paper. If I'm really interested in it I'll start at 8.30 or 9.30 a.m. and go on until late at night. Once I start I want to see it finished, the shorter the time between conception and finished article the better.'

Both Adam and Greg had an Arts background, were at University A, and were at the same stage in their research, yet each employed a different approach to writing.

Two further excerpts from the interviews show Bradley's serialist approach and the holistic approach of Freddy, who was in the chemistry department of University B. Both these students still had a considerable amount of practical work to carry out but both knew the direction in which their work was going. The serialist conceptualizes writing as 'building a wall and papering it' where the important thing is building the wall. Bradley describes how he sets about writing: 'I take separate sheets of paper and write down headings which I arrange in order of importance and eliminate some ... the bulk of the work is very detailed because each paragraph modifies all the others so it involves working out thoroughly the overall form of the paper before writing any of it.'

Freddy spoke of his writing in quite a different way: 'I tend to do things in short bursts of intense activity. It can be on my desk for months, then I get sick of it ... It's about 106 pages, I just sat down and wrote solidly, I'd spent three or four months looking at it and I had to get it off my back. I intend to write up my thesis in a month at the end.'

The reference to the writing of the thesis is significant because it

is consistent with the holistic approach he adopted for the paper he wrote in his first year. Bradley, who spoke of building a wall, had approached his thesis by writing a chapter every three or four months. The definition of a serialist type of approach to writing includes the idea of a detailed outline before ever setting pen to paper. This particular serialist had the titles for each chapter of his thesis, together with a general idea of the content, very early on in his research programme. He was aware, however, that this might change somewhat at a later stage.

It seems that for the postgraduates taking part in this study, the style of approach to writing is independent of the discipline within which the research was being conducted but consistent within a given individual. The serialists or holists used the same techniques whether they were working on a short paper, extended essay or article, or complete thesis. This became apparent from the way they discussed their work in the interviews and described their plans for it in the paragraphs they wrote each month.

Writing and Thinking

It was clear that the seven postgraduates all had considerable difficulty in writing. Conducting the research is, of course, very important but needing to communicate exactly what has been done and why, forces researchers to think about work in a different way from that in which they think about a possible solution to a research problem. Not least of these differences is that writing demands the joining together of several strands of thought; while working on a specific problem may leave other strands in abeyance for a while.

The arts students spent long periods throughout the three years of this study engaged in written work. The science students on the other hand spent most of their time in practical work. Several comments from the scientists in the postgraduate sample showed quite clearly how they felt about the experimental and reporting aspects of their work. Diana, the bio-chemist, said 'If it's time consuming and mindless, like just repeating experiments I like it, but if it's difficult too, like writing and introduction and conclusions, then I don't like it.' Freddy, in industrial chemistry, commented 'I'd rather potter about the lab. during working hours - it's less taxing mentally' and Ewan, the nuclear physicist, reported 'I prefer to be working with my hands than writing, I don't like a lot of this book work.'

This preference, shown by all the scientists, for experimental work in the laboratory to occupy them during the working day, meant that writing was assigned to evenings, weekends and holidays. It was not perceived as 'real work' and, as it was of only secondary importance, was never undertaken at the time intended. Diana said 'I'm doing bits and pieces of writing up whenever I get a minute' but had not managed to complete a single piece of written work commenced during the year.

Table 12 on page 145 shows that Ewan took very much longer than he expected to complete his report. The same is true of Freddy. These two postgraduates, both in the sciences, continued primarily with practical work during the following year. Freddy worked intermittently on other papers once his supervisor had judged the first to be 'absolutely excellent' but continued to underestimate the time he would need. He accounted for this quite easily as the following quotations, taken from his interviews, show. 'At the moment I'm doing a complete and thorough literature

search because I intend to start writing up the work I've been doing so far.' A month later he explained 'I've been distracted from writing up the old work because of reading for the new work, so I've laid off the writing for the moment.' In this way 'getting started' on writing very soon became 'putting it aside'.

Greg eventually completed his first report, which was used for up-grading him from M.Phil. registration to Ph.D., about a year later. Charles and Diana abandoned all the papers they had planned to write. These two students experienced particular difficulties with writing. Charles dropped out of the Ph.D. programme at the end of his second year and Diana wrote almost nothing in the three years of her research pro-gramme. She delayed beginning to write her thesis until nearly the end of the third year and even then kept putting it aside for long periods. This was true despite the fact that after one year she had said 'I intend to start writing up my current work which will take a couple of months. I don't want to write up everything in the end, so I'll have to start now.' She did not, in fact, carry out this intention.

Most of the postgraduates postponed writing until their final year. Greg said 'I hate writing and I'm lousy at it. The thought will come when I put it all together, at present it's still a mechanical process. Once started I know I need to write without a break, it's essential to keep going once started.' This theme recurred. Ewan said 'sometimes the writing takes longer than you expect. Writing is difficult and quite different from lab. work. It's one of those things it's very difficult to get into. Once you've started it's O.K. but it's hard work.'

The interviews show how the postgraduates tackled this problem, while the grids show how writing was related to the other constructs in each

student's perception of their Ph.D. When links that were not obvious or acceptable to the postgraduate were present in the Focused grid, they were seriously considered by the author and the postgraduate in the feed-back interview. It was in this way that writing was identified quite early on as an important component in the learning process.

The students had originally planned to write up parts of their work as they got results but, with one exception, they left work on the thesis until they could leave it no longer. The one exception to this pattern was Adam who was writing throughout the whole of the three years. His perception of writing was different from that of the other postgraduates because he saw it as an activity which helped him to understand himself and during which he had to rely on himself.

Adam's first focused grid revealed that his elements 'synthesize theories', 'deal with students', 'Meet with supervisor' and 'reading' were all seen by him as passive, analytical activities which were inter-dependent with others and helped him to understand others. Similarly, his elements 'thinking', 'Making conjectures', 'writing' and 'devising tests' were seen by him as intellectually active and creative, requiring him to rely on himself and helping him to understand himself. These links were apparent from the re-ordering of the grid during the computer analysis. Because he saw writing as creative it was the way he helped himself to open up new areas of importance and play around with ideas. When the links between elements and construct clusters were made explicit, his reaction was one of extreme disappointment. Adam said that he completely recognized himself from the analysis and, therefore, had not learned anything as everything that had been said he had taken for granted for years. He changed his mind about the usefulness of the grid information

because of the accuracy of the overall picture presented. He said that there was some promise that future information from the grid analyses might be relied upon to help identify potential problem areas as they developed.

During his first year, after long delays, Adam had eventually completed a paper setting out his ideas. He had abandoned a second paper intended for that year. His first grid had shown that 'Writing' had not been closely linked to any of his other seven elements. The Focus analysis of his fourth grid showed that this had changed as 'Writing' and 'Making Conjectures' were linked together. (84%). His reaction to this was to say 'I'm not afraid of writing any more, in fact I find it quite enjoyable. Before I didn't know if I could do it and the whole business frightened me.' It appeared that part of his increase in confidence was to do with using writing to test ideas. In his second year, he had continued to produce written work, and the third year was spent struggling with the thesis. During the time that he was supposed to be writing, he spent long periods not writing. At the time of the feedback session of his final grid, when the Focus analysis showed that his elements 'Making Conjectures' 'Organizing sequence of ideas' 'Thinking' and 'Writing' were all clustered together (77%), Adam explained 'writing and organizing sequence of ideas is an obvious connection, that's what I'm doing. I'm not being creative, that's making conjectures, I'm only thinking when I write. There are two kinds of thinking - creative and organizational - I'm doing the latter only.'

The equating of his element 'making conjectures' with being creative, which had been hinted at during his first year, suggested that when he spoke of being afraid, it was not simply writing that he was afraid of.

In his first year writing and making conjectures had been thought of
very similarly by him, according to the grid he had completed, and
so it would seem to follow that his fear of not being creative enough
to do a Ph.D. was shown as a fear of writing.

If this were true, it could account for the difficulties experienced
by all seven postgraduates in this area of their work. Perhaps it is only
when higher degree students acquire confidence in their own ability that
they are able to relax sufficiently to give their efforts form by writing.

In his final year, Adam no longer needed to worry about his creative
ability, and by this time was perceiving the relationship between writing
and thinking as an organizational, rather than a creative activity. It
seems that his two kinds of thinking were closely related to the different
ways in which he construed writing at the start and towards the end of
his course.

Bradley expressed the co-ordination aspect of writing quite clearly
when he said after a year 'I don't think you really have an idea until
it's verbalized or written. I don't begin to think seriously until I
start to write out the first draft of a paper.'

Bradley's 'supervisor' element was the most changed when his first
and fifth grids were compared using the Core program. He said that the
supervisor served two different functions. In the beginning his grid
was divided into three main parts, one of these was linking supervision
to his element 'contacting others in the field'. He said that at the
start the two essentials for him were 'reading' and 'not reading' so
that everything split into two. Discussions and writing were subsidiary
to reading. Later, his grid showed that Contacting others was linked to
keeping up with research and that 'seeing supervisor' was grouped equally

with those two elements and also with his element 'setting and meeting targets'. He said that this was all to do with writing which was the least enjoyable of his activities. This was because he saw writing as a private thing but linked to contacting others because ultimately it would be read by people who were interested in that particular area.

The focus analysis of Charles's first grid showed that his elements 'talking' and 'writing' were closely linked (90%). When this was pointed out together with the information that 'thinking' was also joined to them (81%), he was puzzled at first. Charles said after a few moments of silence 'when you talk you have to think. When I write letters it's the same for me as talking. When I write something scientific it's the same as thinking.' In this way the link between writing and thought was identified for Charles during his first year in a similar manner to that in which it had been identified for Adam. Yet the link itself was not similar. Charles separates writing letters from more academic kinds of writing while Adam separates the different functions of writing.

Whether or not the students were aware of the link between writing and thinking, they all acknowledged it to be an activity that served to integrate different parts of their work. The focus analysis of Freddy's final grid revealed an unusual grouping. His elements 'Obtain results' and 'Analyse results' (75%) were linked to 'Writing clear, concise believable thesis' and 'Literature survey' (72%). His response to this novel grouping was: 'It all comes down to writing the actual thesis. They're all bits that tie in and go into the thesis. Before writing I'd separate them. Obtaining results would be to do with designing the experiment. Everything is rigidly defined and separated. These pieces only come together within the body of the thesis so it's all to do with actually writing it.'

At the end of the three years Freddy reported 'I'm getting on with the thesis and it's all very systematic. It's taking longer than I thought but I'm working on it solidly now.' In fact it took him six months to complete and he obtained his Ph.D. in January 1980, the first of the remaining six to do so.

Once they had got down to it, students from both the Arts and the Sciences agreed that writing helped them to think. One postgraduate said that he found writing difficult 'because it's at the level of ideas', another that 'when you start writing a paper you see how everything goes together'. Even Bradley who insisted on a very detailed outline before commencing to write said: 'Obviously you don't formulate what you're going to say completely until you come to write it down ... it was only when I was writing it that I realized that in one section my interpretation was completely wrong. The point I was trying to make just wouldn't embody itself verbally, so I thought it out again and rewrote the whole section.'

Bradley is an Arts student but Ewan, a Science student, agreed 'writing up my experimental work helps me to see where I'm going.' It is the organizational aspect of writing which seems to be particularly useful at this point in their higher degree course. Even when a link between writing and thinking was acknowledged, writing was not accepted as an integral part of research work. More usually it was perceived as merely the logical conclusion of months (or years) of data collection.

It may be that it is precisely the link between writing and thinking that was responsible for the apparent failure of the students to learn how to estimate accurately the time needed to complete a piece of written work. The main problem appeared to be that students were not quite sure of what

they were going to say, or of how to express what they had been doing, in their theses.

Acquiring the discipline to start writing meant not only developing the necessary state of mind and motivation, but also making it legitimate for working hours to be spent in composition. Comments such as 'when I have the enthusiasm to sit down and write it's not as frustrating as it used to be, the difficulty is actually getting the enthusiasm to sit down in the first place' and 'getting up the energy to tackle it was actually worse than writing it' from Adam and Freddy respectively, are typical illustrations of the kind of discipline needed in order for 'getting started' not to become 'putting it aside'.

Supervisors' ideas about the thesis were as different as they had been about supervision. Mrs Briggs said of Bradley 'his writing's cautious and dull, much more boring than you'd expect from talking to him. It may be deliberate, due to the constraints of the Ph.D.' She handled this situation by discussing the written work with him and encouraging him to be a little more daring.

Dr Eustace on the other hand, while at least equally dissatisfied with Ewan had a very different way of handling the situation. He said of an early draft of Ewan's thesis 'at the moment it's all grenade and carnival but with a lot of support from my colleague and myself he'll get it. He's written about two chapters. I suppose we'll rewrite it for him. It's an arduous task, but it's still easier for us to lick it into shape than to spend forever getting him to do it.' Ewan would continue to receive the very close supervision and help to which he had become accustomed. He had already analysed the effect that this approach to supervision had on his development as a researcher (page 116) but still remained dependent on his supervisor.

Changing Perceptions of their Ph.D.s

In order to get some idea of how, or indeed whether, such variation in the treatment of written work and supervisors' responses to it were reflected in the grids, the differentiation scores were used as a guide to relative differences.

The differences being considered were concerned with the postgraduates' perceptions of their work. When the differentiation scores tended to be higher (.04) rather than lower (.01) it was taken as an indication of disorganization in the way that the students saw their work. This disorganization has to do with perception of their research as separate parts which they are, as yet, unable to integrate into a unified whole.

The clusters of elements and constructs were used as the basis for a differentiation score for each grid. The way these scores were calculated is given in Chapter 4 (p.89) and the detail of this calculation appears on each of the grids in the appendix. The results are given in Table 15 overleaf.

A differentiation score of .04 means that the postgraduate is more differentiated than if the score had been .01. Nevertheless, a score of .01 is not far enough away from .04 for any significant interpretations to be made. While acknowledging that very little of substance can be said on the basis of these scores, some observations, based on the direction of the scores may legitimately be made. The comparisons that follow, are related to the relative direction of the scores towards either:

(a) greater differentiation i.e. aspects of the Ph.D. are perceived more separately from each other

(b) little differentiation i.e. either the whole is organized or discriminations cannot be made.

TABLE 15:   DIFFERENTIATION SCORES

Postgraduate	Grid 1	Grid 2	Grid 3	Grid 4	Grid 5	Grid 6
Adam Ph.D. Aug.81	.02	.01	.01	.02	.03	.03
Bradley Ph.D. April 81	.02	.01	.01	.01	.01	Went to study in Italy Sept.79
Charles dropped out	.03	.03	.02	.03	-	-
Diana writing up	.03	.01	.01	.03	.03	.01
Ewan Ph.D. Aug.80	.02	.04	.01	.03	.04	Did not appear for interview after July 79
Freddy Ph.D. Jan.80	.02	,02	.01	.02	.01	.02
Greg M.Phil.	.05	.02	.03	.04	.01	Did not appear for interview after July 79

Given these reservations, the table indicates that Bradley and Freddy both perceived their Ph.D.s in a similar way throughout the three year period.

Freddy was working on experiments in a very methodical manner until the final year when he organized the reports he had kept for each of them into the central core of his thesis. He then wrote chapters in order and arranged graphs and diagrams systematically, giving his supervisor each section as he completed it. Bradley worked relatively autonomously from the start. His overall approach was to read, research and write up a pre-determined section of his topic in three months and put it aside until the whole thesis existed in draft. After the sections had been completed

according to plan he set about the task of weaving them together into a coherent whole.

Adam had similar scores to Bradley and Freddy during the first two years while Diana's were the same as Adam's at the six months and one year points. When they decided to start writing their theses, which was different in each case, the trend suggested by the differentiation scores is towards a greater degree of disorganization than had been shown at earlier stages of their work. This is also true when their scores are compared to the scores of Bradley and Freddy.

'Disorganization' in the present context is being used as 'a relative inability to perceive their Ph.D. as something other than a collection of discrete parts'.

Diana had received very little supervision and had to work on her own while lacking the necessary confidence to do this successfully. However, she was very organized when working in the laboratory and planned her experiments carefully.

The differentiation scores towards the end of her registration period may have been a reflection of the state of her thesis. She was dividing her work into four chapters which related to separate types of experimental work, and was finding it increasingly difficult to write any of them. She was very anxious about how she would manage to condense all her work into only four sections and unable to discover a means of linking them into a form that presented the kinds of experiment she had been conducting in a way that showed them to be complementing each other.

Adam was writing constantly throughout the three years but concentrated on different aspects of his topic, completing each as a separate paper which he handed to his supervisor. From the time that he decided

it was necessary to think in terms of a whole, unified thesis, he found

it very difficult to write anything at all. His differentiation scores

tend to reflect his inability to integrate the parts of his work into

one cohesive unit by the time of his final grid. At that date he was

more involved with establishing himself in his new job than in completing

his thesis. In fact, he commented that he felt very far removed from it

indeed but hoped to work on it during the next holidays.

Ewan's differentiation scores are variable, his final score is the

same as the score at the end of his first year as a postgraduate. Given

that he remained very dependent on his supervisor until almost the end of

the research period and was presenting large sections of written work to

Dr Eustace who would more or less completely rewrite them for him, this

is not really surprising.

Charles and Greg were the only postgraduates of the seven (except for

Diana) whose first differentiation scores were over .02. This may be an

indication that Greg had organized his perception of his Ph.D. by the

end of the first year i.e. at the time of his second grid. Charles, on

the other hand, did not manage to do this until the time of his third

grid i.e. during his second year. In fact, if the differentiation scores

are to be taken in any way as indicators of the degree of organization

that the students had imposed upon their topics, then the start of the

second year may be said to be the only time that Charles succeeded in co-

ordinating what he was trying to do. This coincided with the time that

he was visiting a friend in another college of the university to discuss

his work. Greg continued to perceive his thesis as disparate bits until

the start of his final year. By this time he had agreed to write an

M.Phil. rather than a Ph.D. and had settled for a systematic bibliography,

instead of a historical documentation of the life and time of the Russian scholar whose work he was studying.

It must be emphasized that these interpretations are based more on the data than on the differentiation scores. The scores are used in order to give some idea of the trends that were present in the repertory grids.

Section Summary

Writing was identified as a particular source of difficulty quite early in the research but it also appeared to be a means of co-ordinating disparate ideas - perhaps this was the reason for the difficulty.

It seemed to be serving two functions for the postgraduates:

(1)   creative - in the early stages of their research

(2)   organizational - at thesis writing time

Both of these functions were related to thinking; the first to creative thought and generation of ideas and the second to logical thought and the integration of separate pieces of their work. It is probable that this link to thinking was the reason that the postgraduates did not appear to learn how to improve their estimates of time needed to complete written work. Namely because they were unaware before starting to write, precisely what it was they were going to say or how they were going to say it.

The role of writing seems to be central to successful completion of the Ph.D. Not, for the very obvious reason that the thesis has to be written, but rather because writing helps the students to learn what it is that they know. The way that they achieved this was either by getting out an overall outline of the work they had done and then gradually building up the whole report section by section, or else by trying to

get out all that they wanted to say without any particular preliminary outline. The latter approach involved several successive drafts while the former involved a series of changing sections that were ultimately combined.

Summary of Results

At the end of the registration period the data showed that, regardless of their current relationship with their supervisors, the six remaining postgraduates were aiming to finish what they had started so enthusiastically three years earlier. The enthusiasm may have waned but the determination persisted. They realized that brilliance was no substitute for perseverance; that the thesis did not need magical qualities but was merely a job of work that had to be completed. Their perception of what was needed to complete a Ph.D. extended to include abstract qualities in addition to the practical skills they had considered to be important at the start of their course.

The students' relationships with their supervisors were all very different and tended to affect their perception of what doing a Ph.D. meant. The regular interviews showed this to be so but it was the grids which made it possible to bring out the topic for further discussion. The combination of the analyses of the grids and the feedback sessions, revealed links between dependence on the supervisor and a lack of involvement with the work for its own sake.

The link was concerned with the source of feedback from the students' work. As long as it was possible to do so, the students looked to their supervisors for information about how well they were doing. When this was not possible for any reason they were thrown on their own resources

and had to make decisions on the basis of what they thought of the outcome of their efforts to date. The student and supervisor relationship, therefore, does seem to be a significant variable in the development of the research. The length of time it took for the postgraduates to become autonomous with regard to their own work was largely a function of the amount and type, of contact that they had with their supervisors, coupled with their expectation of what the role of the supervisor ought to be.

The regular interviews had established that there was a growing disillusionment with, and disinterest in, the programme on which the postgraduates had embarked so enthusiastically. When the discussion was based around particular elements that were added or constructs that had changed to a more negative perception of the Ph.D. within a given period, the reason for the disillusionment and unrest - so far as it was related to the work itself - became clearer. Students of all disciplines and from both universities referred to the repetitive nature of the work.

At first the postgraduates in the study, confused and disoriented as they were, would make certain demands of their supervisors regarding frequency of meetings and instructions about work to be carried out. As they learned what was expected and how to set about achieving it, their supervisors were not used so frequently for assessment of their efforts, information concerning what to do next, or interpretations of the results of work completed. They learned how to mediate between their own efforts and the outcome, instead of needing to turn to the supervisor to act as intermediary between themselves and their work.

The suggestion that there was a link between dependence upon the supervisor for information and involvement with work originated from the grid data but was borne out in the analysis of the written paragraphs.

These data showed that the plans of the postgraduates in this study varied according to their ability to base decisions upon the outcomes of their predictions. If they used the information available then any discrepancy between expectation and achievement was integrated into their future plan of work. If they were unable to do this then they turned to their supervisors for advice and direction.

Writing too had a role to play in the development of the research and the students' perception of their work. Some of the postgraduates approached the task of organizing their work into a coherent form by attempting to get it all down at one sitting and then revising it. Others wrote sections of their reports/theses, correcting them as they went along, according to a previously designed outline. Regardless of which approach was selected the seven postgraduates had to manipulate the information they had acquired in the more practical areas of their work into a series of sub-sections that blended together. They experienced considerable difficulties in attempting to do this but working on their material in this way contributed to them seeing their work as a whole rather than a collection of experiments or theoretical perspectives.

Changes in the students' perceptions of their Ph.D.s appeared to be dependent upon the interaction between (a) their relationship with their supervisors, (b) the information upon which they based decisions concerning the time scheduling of their work and (c) actually writing up the results of the years spent as postgraduate research students.

CHAPTER 6

SOME METHODOLOGICAL PROBLEMS

This chapter is concerned with problems encountered while conducting

the research and analysing the results.

The status of the findings which resulted from the different methods

used are considered with regard to:

(i)   the difficulties which were expected but did not occur, and

(ii) unexpected difficulties which did occur during the course of the

      research.

The Repertory Grid: Technical Considerations

On page 59 of this thesis it was explained that some difficulties were

encountered during the administration of the repertory grids. These

included the problem which arose due to the assumption of equal intervals

between the ranks along a construct dimension, which had been predicted

by Humphries (1973). What this means is that there is no way of knowing

whether rank '1' on the scale is very far removed from ranks '2', '3',

'4' and '5', or whether ranks '1' and '2' are closer together on the scale

than ranks '2' and '3'. Also, there is no way of knowing whether the

rank '1' along one construct scale for a given element means the same as

the rank '1' along another construct scale for the same element. This is

because it is assumed that all constructs are equally important.

For example, a student might rank the element 'seeing supervisor'

at '1' on both the construct scale 'interdependent with others' and the

construct scale 'immediate feedback'. However, while the immediate feed-

back of 'seeing supervisor' might be vital for his developing confidence

and progress in research, the 'interdependent with others' might well be

just a function of the situation needed for him to obtain his immediate

feedback. The first construct is a top priority, the second a mere inci-

dental factor. These kinds of problems were discussed in the feedback interviews which were described in detail in Chapter 4 so that some understanding of the importance of the construct to the student could be reached.

Other difficulties which had not been anticipated were discovered during the study and seem to be directly related to the new analytic techniques and the development of the method to include feedback interviews. These were:

(a) The requirement that all elements must be rated on all constructs resulted in a forced choice where some elements were included even though the student considered it to be meaningless. Related to this was

(b) The neutral rating of '3' was ascribed to

   (i)   elements that were equally relevant to both ends of the construct scale and where the postgraduate would have preferred a rating of '1' and '5' in that part of the matrix,

  (ii)   elements that really merit a rating of '3',

 (iii)   elements that were irrelevant along that construct line.

(c) At first there was a tendency for postgraduates to agree with the output of the computer analyses in a way that is comparable to comments on reading astrological predictions in daily newspapers, i.e. by discovering how the interpretations could be generally applied. For example, explaining what had appeared to have happened in such a way as to make sense of everything especially if excuses or antecedent causes seemed to be required. This is related to the 'astrological accuracy' tendency and has been referred to as 'rationalization' in problem solving situations by Evans and Wason (1976).

By rationalization they mean that justifications for intuitive explanations can be made to vary experimentally, yet still be given with a high degree of confidence. However, the re-sorted grid cannot be 'wrong' in terms of how the postgraduates were thinking about particular features of their Ph.D. at the time of compiling the grid. This was because the process followed by the focus program, results in a grid which is merely a simplified presentation of the original.

One of two things are responsible for somebody being unable to accept or understand a particular set of relationships in their grids. These are either that the interpretation placed on the relationship is wrong, or that the time elapsing between grid construction and computer analysis and feedback interview (between one to two months) is sufficient for the student to have changed his view about something that was not originally recognized. Therefore, the revealed links are incorrect when presented and, as they were never brought into consciousness, the individual denies that they were ever appropriate.

The first two difficulties occurred during the actual grid rating session and the other one occurred during the feedback interviews. Once they had been identified by the author they were easily recognized as they occurred and discussed with the students at the appropriate time.

These criticisms and difficulties, having been made explicit, were not sufficiently disruptive to the research for the grid to be abandoned as a methodological tool. This was primarily because it gave valuable insights into the subjective experience of the postgraduates that would have been difficult to obtain by any other method.

Certain predicted difficulties which were not experienced as such, included such things as the assumption of bi-polarity and changes in the

grids. In the case of the bi-polar requirement, the students had no trouble in generating and ranking constructs with labels at each end of the scale. In some cases the labels assigned to the poles of the construct were in the form of negatives or opposites and in some cases they appeared to be quite different concepts which were only related in the way that that particular postgraduate thought of them.

It is almost redundant to state at this point that the confusions which arise out of the variety of changes that are possible from one grid to another (Humphries, 1973) were not in any way a problem to be overcome during the course of this study. As the research was primarily concerned with changes over time, the fact that a variety of changes are possible and that the grids revealed what they were and when they occurred, led not to confusion but to understanding. In fact, the repertory grids helped to identify precisely how the postgraduates felt about certain aspects of doing their higher degrees at particular times during the three years of their registration. It was not necessary therefore to rely only on the author's observations and the interviews.

The Repertory Grid: Theoretical Considerations

The most disappointing outcome of the repertory grid part of the study was that based on the differentiation scores and concerned with degree of cognitive organization. The method of calculating the differentiation scores is reported on page 89 and was devised by McKnight (1981). The author has shown the results of these calculations to McKnight, who is reluctant for any statement to be made on the basis of the small differences reported on page 175 (personal communication). The lack of differentiation at the 40% cut-off is also visible merely from looking at the grids.

It could be that either the 40% cut-off point should be reconsidered, or that the interpretation of the theory set out on pages 56 and 57 of this thesis is wrong. What is more likely however is that information is integrated (or learning occurs) over a shorter period of time than six months. Suppose the loose constructs were tightened up and then relaxed to permit assimilation of other information in rapid succession. If this were so then the six-monthly intervals between grids in this study would be too great to reflect the degree of organization that had occurred with regard to the information being assimilated at the time of the earlier grid.

McKnight is currently working on the scoring calculation, in case it is incorrect as it stands. The author also calculated the differentiation scores as described, but took a cut-off point of 75%. The scores resulting from this calculation are not reported as there is no theoretical base to give credence to the use of such a cut-off point. However, at this cut-off point, the unreported scores gave patterns for each student that showed a cycle of first more and then less differentiation. However, although to date nothing has been published in this area, using such a cut-off point would leave the author open to accusations of adjusting the figures to fit the theory! This is primarily because no meaningful interpretation may be made until such time as an acceptable theory concerning the use of a cut-off point of 75% is developed.

The Repertory Grid: Administrative Considerations

The supervisors all gave qualities that they considered to be important for doing research. These are listed on pages 139-41. At the time of

eliciting these elements from the supervisors, during their second interview, it had been intended to obtain constructs from them too. The idea of obtaining a repertory grid a year from each supervisor had to be discarded in order not to jeopardize the research. This was because it is both arduous and time consuming for the individual who is generating and ranking elements and constructs.

It became clear during the exercise of generating the eight elements (qualities needed for doing research) that the supervisors were beginning to feel uncomfortable. One said that he felt as though he were undergoing a viva, another that he would have liked some warning that he was to be asked to participate in this particular activity. Therefore, in order for the research to continue for three years with information from all six supervisors as well as their postgraduate students it was decided to sacrifice the potential information that the supervisors' repertory grids would have provided.

The Interviews: Participants

It is acknowledged that the populations sampled here result in case studies of people who are more likely than the general public to be able to 'give the researcher what she wants'. To counteract such a possibility was their sincere enthusiasm for the project. It was a study that they all felt to be overdue and from which they hoped some results would occur. Therefore, the author is convinced that the confidential interviews revealed areas of concern for the participants and that they discussed these areas quite frankly.

An example of major themes which arose during the early, unstructured interview sessions, was the relationship between the students and their

supervisors, which would not otherwise have been introduced. This came about as a result of all seven of the postgraduates making long digressions from the area being discussed in the early stages to comment in great detail on this aspect of their postgraduate experience. In the final stages, too, mainly because of the flexibility of the semi-structured approach, the detailed introspections about the role of writing were drawn from the postgraduates. This was due to following up what seemed to be a recurring theme on the delay to the real work of research which was caused by writing.

The Interviews: Interpretations

Given the assumed reliability of the interview information, based on the involvement of the participants, it is still difficult to be certain how much credence should be given to specific interpretations. For example, it appears from the data, that each student is mismatched with respect to their supervisors. Not a single pair are similar. Yet it could be that the students were all reacting to their own supervisor's methods, in a manner similar to that in which adolescents react against parental authority. If this is true then the interview information, while true for the respondents, is biased towards particular variables while being relatively insensitive to others. In this way such things as Freddy's 'need' to work unhurriedly (p.120) may be merely reaction to what is happening or against unfulfilled expectations rather than a deep rooted need for a particular style of working.

Influence of the author on the postgraduates

At the time of the final interviews the students were asked how they had

felt about coming for an interview every month during their three years
as postgraduate students. What follows are verbatim excerpts taken from
the responses of Freddy, Ewan and Bradley. These three have been selected
as they provide a comprehensive summary of the comments made.

Bradley: 'I think it's encouraged me to plan the thesis in the fairly

exact way I have. I think seeing you has been part of the general

atmosphere of order in which my research has by and large existed.

Also I think you've been a bit of a moral watchdog. The shame of

coming to you month after month and saying "I've done nothing or

I'm still battling with the same problems". I feel there's a sense

that not coming to see you would have been the final admittance of

defeat, not due to any content of the interviews but as a structural

linchpin. I think I would have kept to the schedule I devised even

if I hadn't seen you. It doesn't seem as if coming to see you has

been a crucial part of the Ph.D. I got a degree of fulfilment from

completing the targets I gave. you. It was nice to come in and you

say "have you done such and such" and I could reply "yes, I have".

It's possible that if I hadn't been seeing you I might have demanded

more of my supervisor. It's more a structure I needed, than the

content. I'm reluctant to discuss work, so seeing you was a kind of

supervision without supervision. I don't want to mislead you into

thinking I looked forward to these interviews. I saw them as more

and more of a task, but for me that was the point. Making myself

come and talk seemed part of the process as making myself write up ...

... and oh! those wretched grids.'

Ewan: 'The grids I didn't like, and coming to see you about the project

hasn't clarified anything. We never have any scientific discussion,

I talk in this way to my friends but it's not an ordered programme like you. What I've gained is learning how to bring things into consciousness like relationship with supervisor and the importance of different aspects. If I hadn't talked to you about it I'd have had to think what to tell a student I was supervising, but now I think I know what points to bring up. Because I'd talked to you I played down or up situations that might have upset me, in order to establish a good working relationship as it would be stupid to talk to you about it and then do nothing when the opportunity arose. I knew I'd have to tell you whether I'd done what I said I would and so I'd try to get it done on time but if I couldn't I said "no", it didn't bother me. My supervisor might ask me if I'd seen my psychologist woman and ask how she's getting on, but that's about it. I don't think it's completely a rubbishy waste of time.'

Freddy: 'I think it's been useful and there aren't many negative aspects. I've had to put my science in a more personal, simpler way. It's been useful in job interviews. They don't know anything about my work so I've been able to explain in a more easy-to-understand level. I think overall it's prevented me being completely lost in the forest of science. It's also helped me to look at my supervisor relation- ship in a different way. On the negative side, it's been difficult not being able to tell you the exact detail of what I'm doing. Usual- ly you don't have a chance to explore things like the student role. It's a good idea to have someone to report to.'

Paragraphs

The requirement from the author that the students write about their in- tended and actual work, probably had an effect on the planning of their

projects. One student refused to write paragraphs for a term and, during that time, he made it clear that he thought the author was disappointed with his lack of progress. One of the other students said that he would never have organized his work schedule in such a structured way if it were not for participating in this study.

This is an important point, and one that is relevant to all other aspects of the research being reported in this thesis. Namely, that there is a probability that some of the factors noted during the study might be due to a very definite 'Hawthorne Effect' (Roethlisberger and Dickson, 1939). The Hawthorne Effect has to do with the fact that, in some cases, people being studied feel privileged and are consequently motivated to perform better. To counterbalance this however, it must be remembered that the effect does not continue indefinitely and three years should be long enough for it to be kept to a minimum.

In addition to the difficulty of knowing the extent to which the requirement to write paragraphs influenced the planning of work there was another problem. This has to do with the source of the plan for work. In some cases it was the students' own plan, while in others the plan had originated from the supervisor. The status of the theory resulting from this part of the work must, therefore, be very hypothetical at this stage.

Rating Forms

Both students and supervisors completed these forms but there is no way of knowing if they interpreted the rating scales in a similar way. Of course, this is also true for the same person at different times as well as for different people.

The effects of this ambiguity were modified to some extent by the fact that the scales were completed during the course of an interview. The respondents were able to talk about the ratings they had assigned, and the author was able to establish the sort of criteria they had had in mind at the time. For these reasons the results based on the scales are considered to be relatively reliable.

This thesis now continues with a more detailed look at the questions being asked.

CHAPTER 7

DISCUSSION

Introduction

Although it may be difficult to make any definitive statements on the basis of seven case studies, they have generated a number of interesting and relevant hypotheses. This chapter considers the results of the research in the light of their possible theoretical explanations and looks at how they fit existing knowledge. The hypotheses are concerned with why the postgraduates behaved as they did.

The study is based on the theoretical position of Kelly that there is no absolute truth. Therefore, the chapter addresses the questions being asked in this thesis concerning the changing perceptions of the postgraduates from the point of view of personal construct psychology. The student and supervisor relationship, planning work and writing about it, are all discussed with regard to the contribution they make to the Ph.D. as a learning process.

What is the effect of the student and supervisor relationship on the outcome of research?

Some of the ideas about to be presented are no longer new, but when the first two papers which came out of this research were published (Phillips, 1979; 1980) the significance of the relationship between the student and supervisor in conducting research for a higher degree was not fully appreciated. The main point to come out of this research is that it is the relationship between the pair, not the supervisor per se, that is important. This point has now been noted independently by the Science and Engineering Research Council who have recently published a booklet devoted entirely to this topic (1982).

My own research has shown <u>why</u> the relationship is important. This was referred to in the results chapter and is related to:

(a) differences in perception of the role of student and supervisor

(b) level of involvement of students in their work and their ability to derive feedback from it

(c) the amount of direction given by the supervisors.

The interaction of these three factors directly affected the students' rate of development into autonomous researchers. It will be recalled that the definition of 'autonomous research workers' being used in this thesis is 'being able to interpret the results of one's own actions without having to rely on the supervisor's assessment of the work'.

The case studies showed that, with two exceptions, the postgraduates gradually developed more autonomy throughout the course of their research. Their work strategies reflected the different level of autonomy each had developed. This, in turn, seemed to be due to differences in the amounts of information provided by the supervisors. Eventually most of the post-graduates became sufficiently independent to proceed without direct in-structions from their supervisors. The two exceptions were Charles, who dropped out after two years and Ewan, who was still relying on his super-visor at the thesis writing stage of his research. Sooner or later in the three years the other five students recognized that they needed to evaluate and interpret the results of their own efforts and to incorporate this information into their future work.

Divergent Perceptions of Students and Supervisors

It was clear that the students and their supervisors often differed in their perceptions of a shared situation. Examples of double vision be-

tween the pairs have been given throughout the results section. These

include Adam and Professor Andrews in both the first and the second

year (pp.106,123). Freddy and Professor Forsdike (p.120) are also given

as examples for the second year. The following quotation was not given

in the results:

> Charles: 'The supervisor gets all the credit for the students'
>
> work and my supervisor should realize he's lucky I've got this
>
> far, given the way he supervises.'
>
> Dr Chadwick: 'There's a slight indication of a lack of original
>
> thought shown in an obedient attitude which results in his doing
> whatever I say.

This was during the second year and illustrates, together with those

given earlier (a) how supervision is experienced at different times during

the process of learning to do research and (b) how supervisors interpret

the changing behaviours which result from these subjective experiences of

their students. It was divergent perceptions such as this that formed

the basis for many of the misunderstandings that arose between the student

and supervisor pairs. They all managed to perceive situations in such

discrepant ways that serious misunderstandings developed between the

students and their supervisors. These breakdowns in communication re-

sulted in students feeling frustrated and/or neglected, and supervisors

feeling at a loss to know how to proceed. This was particularly true of

supervisors who had students whom they perceived as being too dependent.

One way of accounting for the double vision would be through a

simple explanation such as that relating to 'opportunity' and 'definition'.

By 'opportunity' is meant the possibility of the supervisors being

kept informed of the students' progress without direct contact. The

reader will recall how differently the two supervisors, Professors Andrews

and Forsdike, interacted with their respective students. This may have been because Adam operated mostly through writing and his supervisor could spend time reading the work and, only after having become familiar with it, need he have a meeting with the postgraduate. Freddy, on the other hand, operated mostly through experimentation. In this case his supervisor had to visit him in the laboratory in order to retain familiarity with what his student was doing.

It may be that the methods of supervision used by these supervisors were the result of working in their respective disciplines in the Arts and Sciences; it might be merely a habit into which each of them had fallen regardless of student need; or it might be that one of them developed a way of supervising that he thought would work for this particular student while the other had developed a way of supervising that usually worked for him and the students assigned to him.

By 'definition' is meant the way in which students and supervisors interpreted certain situations. On page 105 it was suggested that Freddy counted every encounter with his supervisor as a meeting, while Professor Forsdike counted only the formal meetings to discuss the work which took place in his room. In this way Freddy considered that he met his supervisor twice daily and the professor considered that he met his student only once a month.

Another form of misunderstanding arose because both participants to a meeting thought that the other was aware of how they felt about it. The encounter between Adam and Professor Andrews, also described on page 105, is not untypical and if both parties to such an encounter continue to remain ignorant of the communication breakdown that has occurred it is not surprising if the situation between the pair rapidly deteriorates.

Kelly (1955) provides one way of accounting for such misunderstandings. He saw man as a scientist in the sense that everybody holds theories about their world and the particular hypotheses or expectations they have, based on these theories, are either fulfilled or not fulfilled. The person's views are often modified as a result of the outcome of their experiments (or ventures). Kelly's personal construct theory, based on the assumption that people are perpetually seeking to try and guess what happens next by construing and reconstruing their situation, offers an explanation of why people perceive situations in different ways. An explanation of how people come to perceive their situation as they do, is offered by Jones and Nisbett (1972) and Kelley (1967). Working from within the context of attribution theory they suggest that there is an 'actor and observer' dichotomy which affects the way in which an individual perceives what is happening. They say that an individual's role is an important influence on that person's definition of a situation.

The Role of Feedback in the Learning Process

The supervisors' role in providing feedback about the research was an important part of the relationship between them and their students. All students had to be upgraded from their original registration for M.Phil. to registration for a Ph.D. They treated this as an interim assessment; if they were not upgraded after a year they began to wonder whether they were on the right track; if they were upgraded, they expressed the wish that their supervisors had informed them earlier that their work was satisfactory and so saved them anxiety.

Some students used their colleagues as a supplementary source of information regarding their progress. This was particularly helpful to

those who felt they needed firmer supervision; for those who were working in isolation and had little contact with other students, this was another problem area. As the postgraduates developed confidence in their ability and their dependence on their supervisors became less, they learned that knowledge came from actively seeking out information. In the same way, they developed the ability to use their own work as a source of information rather than looking to their supervisors for it.

Radley (1977) says that students' definitions of a situation and the assumptions they make about what they are expected to do will affect the way that they behave. If this is true of undergraduates in a seminar it may also be true of postgraduates in research. When postgraduates think that how they approach their topic is important for (a) assessment, (b) upgrading from M.Phil. to Ph.D. or (c) their supervisor's approval, they are probably more likely to follow a conventional path, doing what they feel is expected and taking few risks or imaginative leaps. When, on the other hand, they consider research allows them freedom to experiment with knowledge, skills and ideas, they may be more likely to question, criticize, and consider alternative explanations. From this latter approach to research, there is a higher probability that the ability to look at the problem from different points of view and eventually to redefine it, will develop.

If postgraduates' behaviour is a direct result of the meaning which they attribute to the process of learning to do research, then the way in which they perceive their role, as postgraduates, will have important implications for the intellectual approach they will adopt in their research. This, in turn, will affect the supervisor's perception of that postgraduate as a research worker and the results of that research. For example,

Charles spent the whole of the first year trying to locate a minor but important fault in a computer program, as a result he was perceived as lacking in ability and eventually dropped out. Bradley, on the other hand, kept bringing up different and unrelated ideas, wrote a short paper on a topic he later rejected and was perceived as very bright.

Just as a teacher's perception of a child's I.Q. score will affect that child's school performance (Rosenthal, 1968) so the supervisor's perception of the postgraduate's ability will affect the postgraduate's performance in research. This will, of course, affect the students' view of their own progress in the form of a greater or lesser development of self-confidence. In addition, although working independently with no formal competition, the postgraduates measured and compared their progress with other postgraduates. This too influenced the rate of growth of their confidence in their own ability. Consequently, their view of their progress, according to the feedback received from the results of their work, will be given the amount of importance that they feel their own judgement of their efforts merits.

On page 33 it was explained that Thomas (1977) believes that when students are asked about either their anticipated or their current projects they will describe them differently from the way they describe them after they have been completed. If Thomas is correct it would mean that it is the degree of change in the way students perceive their projects that is the measure of what they have learned; only if no learning had taken place in the interim, would students retain the same perceptions of their work from the start to the end of their projects.

Therefore, the changed view of their Ph.D. which the students in this study demonstrated over the three years research, is consistent with

what one would expect if they were learning more about how to do research on their specialized topics.

The length of time it took for the postgraduates in the study to become autonomous researchers i.e. students who were able to interpret the results of their own actions without having to rely on their supervisors' assessment of their work, was determined by the kind of supervision they received. When it worked, it was from the relationship between the postgraduates and their supervisors that the research developed and the autonomous research worker was created. When it didn't work, either the student dropped out or they were unable to develop the self-confidence in their work that was needed to complete the thesis on time. Once the students managed to assert themselves, as Freddy finally managed to do, they discovered that they had become the autonomous research workers that the supervisors wanted them to be. Often, though, it was the supervisors themselves who had prevented this happening earlier by giving too much of their time and attention to the postgraduates.

The reason that the postgraduates who had to survive frequent requests from their supervisors for information and results took longer to become independent, was that it was necessary for them to re-define their own roles as postgraduates. An explicit statement to the supervisor had to be made to the effect that the students were now able to get on alone, doing what they wanted to do rather than what the supervisors had told them to do. From the start the supervisors had held the students responsible for their own work, but it was left to the students to learn how to acknowledge and assert this responsibility.

If this analysis is correct then it would follow that once the postgraduates were able to change their goal there would be less need

for support from external sources, such as their supervisors. This is because they would be able to mediate for themselves between their efforts and the results, by comparing what had happened with what they expected would happen. According to these explanations, although the constant concern of the postgraduates in the study was lack of feedback about their progress, they would be continually receiving feedback from the results of their work.

Once the students acquired the confidence to rely on their own judgement about their work, they could change their behaviour towards their supervisors. In the words of Freddy 'I'll have to be very firm and say "now we're finished". I hope I'll be firm, it's so difficult to be that with a supervisor.'

The Role of Direction in Supervision

In the previous chapter it was noted that those students who had supervisors who left them alone for long periods tended either to become independent relatively quickly (after about 15 months) or else, as was the case with Charles, to drop out of the higher degree course altogether. This does not mean that student neglect is shown to be an effective method of postgraduate supervision. On the contrary, it must be emphasized that these students suffered considerably from the apparent lack of interest in what they were doing. At first they felt neglected, isolated and convinced that nobody was at all concerned about them or their work. Those who survived this anomic period had to learn to cope with lack of structure in both their work and their time, in a comparatively short period.

The reverse was also true and supervisors who kept themselves con-

stantly informed of the progress of the postgraduates, had students who continued to be dependent upon them for ideas and information well into the three year period of the Ph.D.

A criticism of the present study is that the results of this research do not give clear evidence of the quality of supervision or even the precise amount of time spent on the student by the supervisors. It may be that the supervisors spent considerable time thinking about the student or reading some work handed in by the student. It is a weakness of this research project that none of this information was available from the interviews.

Part of learning to do research is concerned with acquiring the ability to work without direction. This ability, which for some of the students was a function of the relationship between them and their super-visors, had to become internalized. Part of the process which the post-graduates were experiencing was that of becoming conscious of this ability by defining their own roles, setting their own standards and imposing their own deadlines.

The way in which this came about was a function of the way in which they were supervised. It was to the supervisor that the students looked for feedback and information when they started their course, and differ-ences in the way that supervisors responded to this had direct effects on the students' behaviour.

All supervisors at the start of the three years, believed that so long as they extended a social and friendly hand to the students, the new postgraduates would have no problems. The attitude of the supervisors in this respect coincided with the original expectation of the author, that the incoming postgraduates knew what they were going to be doing.

However, this was not the case. At this early stage, the students were confused and unable to determine precisely what was expected of them both in their role and in their work.

At first the students expected to be told how they were getting on and whether their work was of the required standard. In fact their expectations were identical to those of a final year undergraduate student. The supervisors at this stage preferred to suggest an appropriate experiment, or reading material, and then to leave the students to their own devices, or else to check up on their progress at frequent intervals. They usually expected to provide guidance - 'a prod in the right direction' - but were not prepared to go into an assessment of the students' progress.

Students at different stages of dependency coped differently with setbacks and also attributed blame for them in different ways. On pages 148 and 149 it was noted that students attributed problems and delays that occurred during the course of their work either to external or to psychological causes. These attributions were not always directly related to events in the real world but did appear to be related to the students' perceptions of supervision as either direction or guidance. The difference between direction and guidance was referred to on pages 127 and 128 and is primarily 'spoonfeeding' versus 'gentle prodding'.

Walford (1981) referring to research in experimental physics draws a distinction between the concepts of power and control. He considered the relationship between students and supervisors and concluded that there was no ideal method of supervision. What is important, he says, is that there is agreement between the students and supervisors regarding the degree of power and control that each of them exercised over the content and pacing of the project.

It is true that there were only seven pairs of students and super-
visors being studied in the work reported in this thesis but there were
no clear differences with regard to the notions of 'direction or guidance'
and 'power or control' in either the content or pacing of their work.
This was true of students in both the Sciences and the Arts and the two
different types of universities in which they were located.

It was noted on page 119 that the science students were likely to
be part of an organized and extensive programme of research work. In the
Sciences whether the programme was concerned with anti-cancer drugs or
astro-physics, the students and supervisors had to negotiate a specialized
topic within the prescribed area for the students to concentrate on and
make their own. The arts students were usually expected to work alone
and to decide for themselves the precise nature of their area of research.
In the Arts, a particular research problem was less likely to be so close-
ly bordering the next person's research and, therefore, the students and
supervisors had the advantage of a much wider area of choice, while at
the same time having the disadvantage of not knowing how much of the
area to research.

The author's expectation was that the more isolated arts students
would be suffering from a measure of disorientation and confusion while
the science students would proceed step by step, relatively comfortable
in their co-existence with others in the laboratory or department. This
expectation proved to be quite incorrect. It was the relatively struc-
tured science students who were intolerant of ambiguity and lack of feed-
back and the more isolated arts students who managed to cope with these
things and become more autonomous. Typical examples here are Charles
who was seriously considering changing to a course in a related department

because 'there is an examination at the end of each of the first two years and so you can leave with a Diploma or a Masters if you want to stop before the Ph.D.' and Adam who said that he was really excited about the direction in which he was going but 'I have more enthusiasm than organization and I hope my supervisor will help me to decide what to do next'.

Some arts students learned very quickly to use their supervisors for guidance (Adam, p.123; Bradley, p.133), and science students continued to demand the attention that all the students expected when they first started the higher degree course (Ewan, p.120; Charles, p.128). Counter examples here are Greg (p.129) in the Arts and Diana (p.130) and Freddy (p.120) in the Sciences.

This suggests that dependence on the supervisors by the students may be directly related to the amount of direction (as opposed to guidance) that the supervisors were prepared to give. Further, if the supervisors are supervising their students as they themselves were supervised (this is not an unreasonable assumption and may well be part of what Ph.D. students learn during their course), then it might be the case that Ph.D.s in the Sciences and the Arts should be considered as quite separate training procedures for quite separate approaches to research. If this is so, then the question concerning qualities needed to attain the Ph.D. may have to be considered separately for science and arts people. But it can be seen from Table 11 that supervisors from the different disciplines did not generate lists of qualities that were significantly different.

All seven supervisors, whether in Arts or Sciences at the traditional or the campus university, expressed some difficulty in generating their lists of eight items. The supervisors explained that this difficulty was

due mainly to the fact that, although it was simple to list items for experienced researchers, it was very difficult to do so for potential researchers. What was needed was that embryonic qualities be identified. Yet, in many cases, the items mentioned by the supervisors do in fact coincide with important aspects of learning to do research that have been identified during the course of the present study.

The qualities listed on pages 139-41 were given by the supervisors in response to the question 'What do you consider are the essential characteristics necessary to successful completion of the Ph.D. degree? These items can be either personal qualities or acquired skills.' As pointed out in Chapter 5, the supervisors' lists were composed mainly of abstract qualities. They included many of the things which the present research has shown to be important in developing the skills needed to conduct research successfully. Such items as 'planning', 'enthusiasm', 'determination', and 'a willingness to expose one's ideas to others', were considered to be important by supervisors in both Sciences and Arts. Also mentioned by them was the need for postgraduates to avoid loneliness and isolation by being able to interact socially with their peers and colleagues.

These types of elements were only added by the postgraduates towards the end of their three years as research students. Their gradual awareness of the importance to them of other than merely practical skills for successful completion of their Ph.D. had not been predicted. Equally unexpected was the resulting congruence in the elements of the students and their supervisors by the end of the three years.

Students and Supervisors

Part of what the postgraduates learned as they went through the process of doing a Ph.D. was to internalize some of the skills that they saw being exercised by their supervisors. On page 130 it was noted that instead of turning to the supervisor for approval and encouragement, Diana used her colleagues to sound out her ideas, while Bradley expressed surprise that he had managed to do so much on his own. Gradually, the constraints which had at first been imposed by the supervisors became self-imposed, as the students accepted responsibility for their handling of such external constraints as a time limit and completing the task it-self. Just as a child at primary school goes to the teacher after reading half a page and a comprehensive school pupil completes a story before re-sorting to the teacher, so a postgraduate student will initially turn to the supervisor for support more frequently than at a later stage of the higher degree programme. This is because of the learning that takes place during the process of planning and carrying out a programme of research.

It was noticeable that the postgraduates underestimated their pro-gress compared with their supervisors' assessments. It was from the rating scales that this surprising finding emerged. This was an aspect of the student and supervisor relationship that had not been expected and which came to light as a result of the related, but different, methods of investigation used in this study. At the same time that the students were underestimating their rate of progress, they were having difficulty in estimating the amount of work that they could complete in a given period of time.

As the students learned to do research they began to monitor their

own work and use the information they derived from it to evaluate their progress themselves. They began to make decisions concerning what had to be done and when to do it.

During this phase (about two years into their research degree) the way that the postgraduates perceived their situation was determined by external factors such as their supervisors' comments or, to a lesser extent, their own responses to them. Their supervisors' perceptions were determined by how the students responded to the situation in which they were placed. The supervisors then decided how appropriate were the students' responses and encouraged them with more or less prompting towards the final stage of reporting their work. (Compare Mrs Briggs and Dr Eustace on page 174.)

How the student and supervisor pairs conduct their respective roles will, to a large extent, affect the relationship between them. For this reason it is important to consider possible influences on their behaviour within the context of learning to do research and helping this learning to occur.

Perceptions change over time, so that how individuals construe a situation would differ not only according to their role but also to the time of the construing. Students would therefore be expected to perceive the research situation differently as they learn to do research.

The supervisor would be expected to construe the student's research situation in a similar way both at the beginning and the end of the training period. This is because the student's progress on the Ph.D. is only a very small part of the supervisor's total work activity, rather than the whole of the work situation as it is for the student. The supervisor is most likely to have already the skills the student is learning. For the

students, the changes in their perception of the Ph.D. before and after the training period constituted a measure of what had been learned by them during the course.

As the postgraduates gradually learned what criteria to use in order to form an evaluation of their progress, they developed the skills necessary to become 'their own supervisors'. For example, Bradley said at the end of his second year: 'I've concentrated on four works and read them thoroughly and carefully, rather than following up a lot of leads at the same time.' He had not discussed this decision with his supervisor but, rather, informed her of the work he had been doing through writing a rough draft of the part of his thesis that would include reference to the Romantic literature.

The students saw themselves as researchers while the supervisors saw the students as potential researchers. The supervisors' relation to the projected Ph.D. was one of imposing external constraint upon over-ambitious or unrealistic projects while the students' relation to the Ph.D. gradually evolved into one of having to complete something they had started, just as with any task of a practical nature. As the students learned how to evaluate their work for themselves, so the supervisors' role gradually changed from one of supervisor to one of examiner. For instance, the supervisors prepared to examine the completed article and their relation to the students' Ph.D. became one of assessor and evaluator. They began to consider the students in terms of the degree of competence they had acquired in learning

(a) how to bring order out of chaos and

(b) how to behave autonomously through handling problems in an appropriate way.

How the student and supervisor pairs defined their own and each other's
roles was an important factor in the way that they behaved towards each
other. The work of the postgraduates had always been a potential source
of feedback regarding their progress. The important lesson they had to
learn was how to interpret the results for themselves, instead of relying
on their supervisors to do the interpretation for them.

During the three year Ph.D. programme, the students were receiving
training in their attitude towards, and development of, a product by
interacting with their supervisors. The form of these interactions varied
over time. At first, the students were simultaneously excited at the
thought of doing their Ph.D. and dependent upon their supervisors for
assistance. They expected this assistance to take the form of direction
towards specific goals and evaluation of their performance in the pursuit
of these goals. They were dependent upon the supervisors for information
concerning

(a) what they should be doing and

(b) how well they were doing it.

First, supervisors guided the students through their research pro-
gramme by giving assistance when necessary, monitoring progress and
making suggestions about the direction the work should take. Second,
the supervisors assessed the outcome of this work by becoming the internal
examiners of the students' efforts and evaluating the written thesis. In
the beginning the supervisors considered that the students needed time to
settle in and, possibly, some guidance concerning practical work; towards
the end the supervisors expected the students to co-ordinate the parts
of their work into a coherent whole for the thesis.

Because supervisors were responsible for evaluating the quality of

the finished product as well as for guiding the postgraduates towards their goal, they were at different times, teachers and examiners for their research students. As such they are crucial to the outcome of the students' work, and the relationship between the students and their supervisors is an important variable in the process of learning to do research. This is because it gives postgraduates the opportunity to test their self-confidence by discussing their point of view with an expert. The extent to which the students were able to do this, instead of merely accepting the supervisors' point of view, is a measure of the degree of autonomy they had achieved. The processes involved in the development of research students into autonomous researchers include that of planning work. It is to this aspect of learning to do research that we now turn.

How do postgraduates plan their work?

Introduction

Psychological planning ranges from the complex, planning a research project for example, to simple everyday plans such as going shopping to the local supermarket. The significant difference is that concerned with the time scale of the plan.

In the present study the postgraduates had three years in which to design, conduct and complete their projects. In order to try and understand the processes involved in the planning and execution of plans for a three year period the students' progress was monitored in some detail and the results reported in Tables 12,13 and 14 on pages 145,152 and 156. The data from the paragraphs, from which these tables were constructed, represent how the students articulated what work they would carry out once they had their attention directed to this question.

The focus of interest for this study was to discover if the students had some idea of what they would be doing during the three years, or if they merely thought about what to do next as and when it was necessary do so. In order to realize such an aim it is of little importance ____t the seven postgraduates had a raised awareness of the planning aspect of their work. On the contrary, the data acquired from such a source permits the formulation of a more reliable hypothesis to be tested than if it had been derived from a less conscientious group of people. This is because the postgraduates were either setting their own deadlines or predicting their progress in accordance with a programme set out by their supervisors. The accuracy of their predictions was taken as the most significant indicator of their ability to plan their work realistically.

Berger and Luckman (1971) point out that knowledge of the limited time available for the completion of a project affects an individual's attitude to the project. If this is so, then it may be assumed that the postgraduates' awareness of the time constraints on the various parts of their projects would result in better than average predictions of what they could do in a limited period of time. Writing the paragraphs did little more than show that it was not difficult for them to assess what they thought they would be doing over a given period. They had certain expectations of what could be achieved and they aimed towards making that expectation a reality.

The relationship between time and goals

Students initially brought with them some ideas of the topic on which they would be engaged for the next three years. But it was not very long before they realized that they did not know what their research topic was

going to be after all. The problem of getting started was encountered by all the postgraduates in the study. Some were handed a piece of work to replicate, others told to read various books and articles, but all of them seemed to experience difficulties of some kind at the very beginning.

The main problem was one of cutting down on over-ambitious projects. By defining boundaries and clarifying their area of interest, the students began to isolate a particular problem on which to work. This happened in a variety of ways which were revealed by both the interview and the grid material. The paragraphs, together with the interviews, identified the kinds of plans that the new postgraduates were making in conjunction with their supervisors. Sometimes they took the form of a general overall plan for the three years and sometimes a series of more detailed short term plans with specific deadlines, sometimes both. The general plan involved an idea of what would happen throughout the whole of the higher degree period and usually looked something like this:

Overall General Plan

First year   - reading, thinking, experimenting.

Second year - activities based on results and discoveries of
                        first year.

Third year - collating results and writing thesis.

The more detailed plan was concerned with precisely what steps should be taken in order to reach a specific goal approximately a month or a term ahead. It looked something like this:

Detailed Short Term Plan

Decide what to read

Design experiment

Adopt strategies for obtaining subjects, micro-film, anything

else needed for research

Each piece of the plan was roughly time targeted and different
time scales were involved in the general and the detailed parts of the
plan. By continually reviewing the action taken in relation to the de-
tailed plan it was possible to discover how these time scales interacted.
Any modification of the overall general plan could be directly traced
back to discrepancies between expectation and achievement in the outcomes
based on the detailed plan.

To put this into more concrete terms, it was reported on page 153
that Greg had originally decided that his thesis should be a detailed
history of the life and times of a particular individual, but he experi-
enced long delays in obtaining essential documents. As a result he de-
cided to create a systematic bibliography of the individual's work for
the thesis and stopped at that point. In this example, frustrations and
setbacks which occurred at the detailed level of the plan fed back into
the general plan and modified it. The modification occurred due to the
discrepancy between expectation and achievement in the timing of the de-
tailed plan. The actual time needed to collate documents became apparent
as the detailed plan was constantly retargeted, leading eventually to
alterations in the overall general plan.

It appears that this interaction is important because, as each short
term piece of work related to the detailed plan is fitted into the time
targeting of the general plan, the general plan is adjusted to accommo-
date it. Further, it seems that it is from the information gained as a
result of deciding precisely how to put into action each part of the de-
tailed plan that the students learned whether it would work at that level.
If it did not then they had to try something else. If it did they moved
forward to test out what happened when they attempted to make the next

part of the plan into an operational activity in the physical world. This process continued as the overall plan was broken down into smaller and smaller components and each of these component parts of the overall plan became whole, short-term, detailed plans.

It will be argued that acquiring the skill to perceive the relationship between planning work and the results of putting the plan into action by operating on the problem is important in learning to do research. If the feedback is interpreted accurately, then correct action may be taken towards achieving the goal.

The two criteria by which progress may most easily be judged are the time taken and the product which results. As long as the postgraduates concentrated on what was happening at the general level of their plan, they received very little information concerning progress towards their overall objectives. This is because the middle of the plan is fuzzy and it is much more difficult to interpret the results of efforts aimed at the long term goal, due to the relative lack of structure in both time and task. When it is action on the detailed plan that is used as a potential source of feedback, the students find it less necessary to rely on external sources of information, such as their supervisors. This is because it is the far distant part of the plan that is fuzzy while the step-by-step structure for the short term is clearly defined. For example, Ewan had a very vague general plan when he started his research. At the time he said: 'I hope eventually to come up with the shape of the molecules in solution' but was unable to be more specific.

He quickly discovered that before he could proceed, several steps had to be taken. First he had to calibrate the viscometer in order to measure the compound; he discovered that in order to do this he had to

read the literature on viscosity to see how such calibration had been done previously. Once he started to read, he realized that there was a confusion in the literature which had to be sorted out. In order to do this he had to check the calculation of equations reported in the journals; this involved engaging the help of a mathematician. Therefore, his general plan could more accurately be described as: 'to find the shape of the molecule in solution by measuring with a viscometer, calibrated according to verified equations'. This more sharply defined general plan, was gradually formulated as Ewan thought about what he had to do and attempted to begin work.

Adam, on the other hand, said that his thesis would deal with the problem of 'how to transmit the building rule system of a culture in a way that can be used to accommodate change'. His overall plan was less vague at the start than Ewan's had been and he said early on in his interviews 'I already know which books I'm going to have to read, there's not much done on this so there'll be only about five or six and none of them are in architecture - plus excerpts from about another ten.' His reading led him off at a tangent to study a structuralist approach to social anthropology and cognitive development. His thesis eventually became a contribution to the controversy raging in Design Education, i.e. whether the designer is a tabula rasa and 'creates' according to inspiration, or whether there is a starting point which includes an existing lexicon of known forms together with the constraints operating on the project in hand.

These two examples are used to show that feedback from working towards the short term goals may necessitate the alteration of the general plan. This interaction is important for the progress of the research, allowing

a balance between retaining sight of the overall aims of the research and maintaining noticeable progress in the short term.

By continually reviewing the action taken in relation to the detailed plan, it is possible to discover how the time scales interact. Any modification of the overall general plan can be traced back to events which occurred during the implementation of the detailed plan.

As the plan is put into operation, it is possible to observe how it is working out. This information can be used in decisions concerning how quickly or slowly the rest of the plan may be put into operation, how much more needs to be done, and how long it should take.

It is suggested that this is the process by which it is possible to make any adjustment in behaviour that is needed to achieve the goal. If necessary, the goal itself can be changed as a result of information received from operating on the plan.

If this analysis is correct then it would follow that once the post-graduates were able to adjust their plan there would be less need for support from external sources, such as their supervisors. This is because they would be able to mediate for themselves between their efforts and the results by comparing what had happened with what they expected would happen. According to these explanations, although the constant concern of the postgraduates in the study was lack of feedback about their progress, they would be continually receiving feedback from the results of their work on the detailed plan.

It appeared from Tables 12 and 13 that the students learned how to structure their time and experience after spending two years in the higher degree system.

Table 12 showed that, during their first year, the students were

unable to estimate the time needed for them to complete a piece of written work. Either they abandoned it completely, took up to a year to finish something they had thought would take a month or two, or else worked at it for an additional period of from four weeks (Bradley) to twenty-eight weeks (Freddy). In contrast, Table 13 showed that, during their second year, the students' estimates were far more accurate. The longest period of underestimation of time needed was fourteen weeks (Bradley) and both Diana and Freddy completed each of their experiments in exactly the time they had allowed originally. But it is difficult to know whether the second table is describing an improvement in the level of skill attached to planning a programme of work or merely reflecting a difference in the level of complexity between practical tasks such as experimenting, programming and preparatory reading and the more abstract, co-ordinating task of writing something more than a report of a single experiment.

When considering only the <u>discrepancies</u> between expectation and achievement in the amount of work they thought they could accomplish in a given time, it appears that the students did not learn to correct their estimates any more than they had done in the first year. The reason for improvement in estimating time needed to complete a prescribed piece of work from year one to year two was due either to (a) the differences in the tasks or (b) having learned how to manipulate estimates. Whichever of these reasons applied the students should have been able to integrate the plan for their work into a unified framework by the third year. This means that, regardless of <u>reason</u> for improved judgements - learning from experience or reduced difficulty of practical work - improved judgements there should have been at the time of the third estimates tabulated for analysis. But this was not so. The students in this study needed to

acquire the ability to perceive, interpret and act upon the information contained in the feedback from operating on the parts of the plan. At first, they were not able to do this, neither did they always carry out their plans as originally intended. This was mainly due to the fact that they did not complete what they had expected to do in the time anticipated.

Planning Work: Discrepancies between Expectation and Achievement

It is clear from what has already been written that the author believes that every alteration at one point of the plan gives rise to a modification of the whole system of interacting plans. The mechanisms that allow this to happen are something like those which come into operation when a tin is removed from the bottom row of a display. All the other tins move and change their position as the next line down changes its structure. It is the way that the author believes these interactions occur, and the mechanisms which operate at the psychological level, that will now be described. In order to look at the mechanisms in more detail some of the evidence given on pages 143-63 of the previous chapter will be considered.

The paragraphs showed that the students planned the work for their research, but the interviews showed that very often they did not complete the expected amount of work by the time they had predicted. Replies to the questions 'What work will you have completed by this time next month?' and one month later, 'Have you done what you intended?' show that there was very often a discrepancy between the plan and the behaviour.

Reasons given for the discrepancy between expectation and achievement in the plans of the postgraduates were varied and were attributed to either

external or psychological causes. Examples may be found on pages 148 and 153; they refer to such things as special equipment needed for an experiment not being available when expected and material to be read being difficult to obtain. These are examples of external causes of difficulty, examples of psychological causes are (i) a greater degree of complexity in texts to be mastered than had been anticipated and (ii) an inability to organize the results of work into written form.

Whatever the source of the delay, the gradual realization that progress was slower than had been expected, eventually led to a re-evaluation of what might realistically be achieved. As this happened with short term goals, so were the more long term goals affected through constantly changing deadlines. Some examples of this happening are given in Tables 11,12 and 13. It can be seen that time extensions were used by the post-graduates as a strategy for completing unfinished work. This meant that overall general plans were gradually adjusted in order to accommodate the changes in the more detailed, short term plans.

Whether the deadlines were imposed by the supervisors, or internally constructed by the students themselves, it was usually the time targeting of the plan that needed to be adjusted. The work not undertaken during the stated period was often included in, or substituted for, the plan of the following month.

However, there is a significant difference between a plan to achieve something, and a plan to achieve something within a defined period of time. Therefore, the plan has to involve two distinct, and equally important factors. These are:

(1)   the promise of some end product and

(2)   a given time limit.

The first of these two requirements may be thought of as similar to McClelland's (1955) idea of the need for a specified goal to be included in any theory of motivation to achieve. The second requirement is relevant to results noted on page 159 of this thesis and is reminiscent of Jaques' (1976) notion of time-span. He says that the ability to plan and to work within an extended period of time involves processing more information, attending to more detail from start to finish, and organizing more integration of sub-goals than does the ability to plan and work within a short period of time.

During the final year of the Ph.D. course the disparate but related pieces of work, undertaken during the period of research, have to be organized into an acceptable format for the higher degree. It could be that part of what the postgraduates are learning, with varying degrees of difficulty, is how to handle a mass of information without missing out important details as they strive to achieve a series of short term goals in order to realize their overall aim of successfully completing their research degree course. If this is so then it is the completed thesis itself which shows how successful they have been in acquiring the ability to juggle information while aiming to integrate it into a coherent whole. This will be considered in the next section, but first it is necessary to mention the results shown in the tables for the second and third years. It is difficult to disentangle the learning that had occurred regarding structuring work over time, from the levels of difficulty involved in estimating time needed for two different kinds of tasks. Comparison of the tables (13 and 14) shows that it is easier to estimate accurately the time needed to complete practical work than written work. Bradley, for example, was so inaccurate in his estimation of the amount of time

needed for writing in the final year that it is difficult to ascribe the discrepancy to anything other than the probable differences between the activities being estimated.

This might be because the time scale is related to the level of complexity contained in the plan. More complex plans need to be broken down into a greater number of short term plans and roughly time targeted. The students had to learn to do this and before they did so they attempted to estimate the time for a complex, abstract task in the direct way that had been successful for them with a more concrete task. But different time scales are involved in the general and detailed plans and the difficulties experienced in trying to estimate written work may have been due to the postgraduates not having sorted out these different time scales.

Nevertheless, it does seem that plans for conducting the research and writing up the results are modified and changed as a result of the feedback which is received by the individual after having put a part of the plan into action. By planning their time and behaviour towards a particular goal, the students needed to involve self-imposed deadlines for specific tasks. Once a discrepancy occurred between the plan and the outcome, whether in time or performance, it was necessary for them to rethink the plan. In addition, it appeared that when the students had a detailed plan, regardless of whether this originated from themselves or somebody else, they needed less support, guidance, and feedback from external sources such as their supervisors, than when they had only a general plan. This relates to the evidence given on page 154 concerning Charles and Diana both of whom expressed the opinion that they were receiving less contact with their supervisors than they would have liked.

A Model of the Planning Process

As a result of the data collected during the course of this study, a tentative model of the planning process has been developed. One criticism of the model is that it leaves some important questions concerned with the psychology of planning unanswered. The principal one is 'When is a plan not a plan?' For instance, when an individual engages in a series of tasks at the instruction of somebody else, to what extent is that individual behaving in accordance with her own plan and to what extent is she merely executing the plan of her supervisor? Similarly, how far is acting on impulse acting in accordance with a plan? Impulsive behaviour is not completely random nor yet has the person acknowledged any intention to behave in a particular way at that moment.

The closest the model comes to answering this question is that, regardless of the significant differences between the impulse and the externally directed behaviour, by the time the individual has engaged in some action in the real world, she has also engaged in a certain degree of planning consistent with the definition of planning being used in this thesis.

In order to explain the model of planning in precise terms the Ph.D. thesis will be used as an illustrative example. The thesis is a clearly defined end product towards which at least three years of physical and psychological activity has been directed by the postgraduate research students.

A plan is defined here (p.38) as 'a strategy designed by an individual to achieve a specific goal in a given period of time'. McKnight (1972) found that undergraduate projects were planned at a variety of levels ranging from the microscopic to the global. This is probably also true

of the Ph.D. thesis. These levels involve shorter and longer time scales which continuously interact. In order to understand how the model works, only two levels of planning will be discussed here.

It is suggested that how the interaction between shorter and longer term plans occurs is through a continual process of reviewing actions taken in accordance with parts of the plan on the shorter time scales and feeding back this information to the plans at the longer time scales.

A diagrammatic representation of planning at two levels, involving plans at shorter and longer time scales, is given below:

Overall plan   Long (3 year) time scale

Detailed plan   Shorter time scale   Review

Act
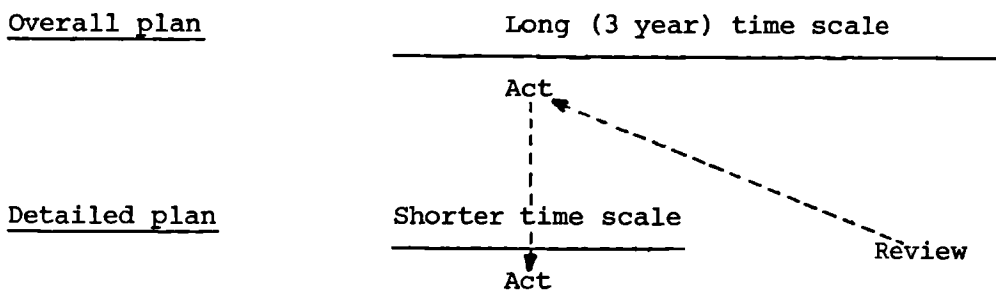
This example includes an action component which permits review upon completion. The review is essential to the model of planning being formulated here. The review, after completion of any act in accordance with a part of the plan, is fed back into the long term plan which is adjusted to accommodate this new information.

Of course, the plans fall into ever shorter time periods, all of which feed back information from the results of actions into a slightly longer term plan. The conceptual representation would be something like this:

Overall Plan

Detailed Plans

3 years

1 year

1 term

1 week

and so on.
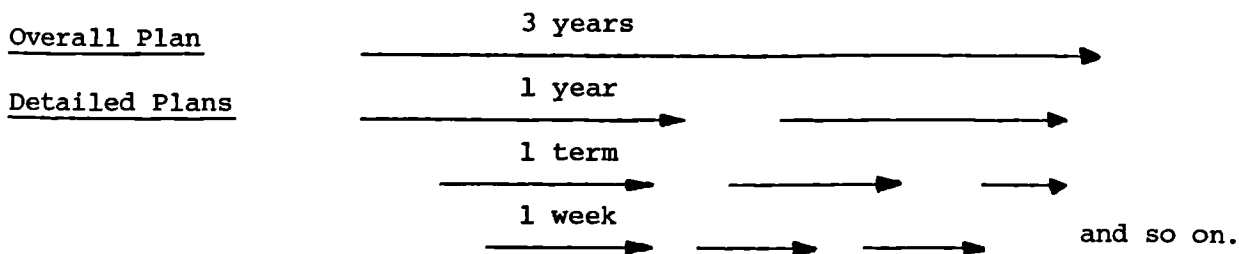
One source of feedback, exceptional to this study, was contained in the paragraphs which the students wrote each month. It became apparent that some of the postgraduates used the paragraphs to judge the amount of progress they had made. When they were wrong in their estimation of what they could achieve in a given period, the students adjusted their predictions in order to arrive at an intermediate goal within the next few months.

In addition, the repertory grids showed that the postgraduates were able to use their own work as a source of feedback. Where this was done effectively, the students were able to proceed independently of their supervisor. For most students, this happened during the second year of the Ph.D. For one or two, it never happened and they remained dependent on their supervisor. The repertory grids showed a link between the degree of dependence upon the supervisor and degree of involvement with the work itself. Once the students stopped looking to their supervisors for information they discovered that they could start using the information from their own work as feedback. Comments regarding decreased output (Adam, p.114) and increased understanding (Ewan, p.   showed the students' growing awareness and use of information contained in the results of their efforts.

The grids had shown that:

(a)   feedback was present in the work and

(b)   students were unaware of this at first.

It has been suggested that the function of the supervisor may be to
mediate information from the work to the students until they learned
how to evaluate their work for themselves. In this way, as the students
became more involved with their work, so the supervisors became less im-
portant to them as a source of feedback and approval.

As they learned to evaluate their own work the students also became
able to set their own research targets and deadlines without recourse to
their supervisors. This feedback was potentially available to all the
postgraduates in the present study, but not all of them were able to
interpret it. In fact, the interviews made it clear that at first the
postgraduates were unaware of, and unable to use, the information available
to them. This information came from the discrepancies between what they
had expected to achieve and what they did achieve in a stated period of
time. Their inability appeared to be due to dependence on external sources
for measuring the rate of their progress. The amount of time it took for
postgraduates to use the feedback contained in the results of their ac-
tions was a function of the relationship between the student and super-
visor. Students did eventually learn to decide for themselves what ac-
tions to take. This came about as a result of attending to the decisions
made by their supervisors concerning which actions were appropriate for
them. They then set themselves short term goals so that they knew what
they would be doing in the immediate future. This was the case even when
their overall plan for the three years was rather vague.

It appears that it is very important indeed for the students to learn
to interpret and use the feedback which is contained within their own work
and of which they are initially unaware. This is because it is from the
information contained within their own work that new knowledge may be ob-

tained and used to further modify and develop their plans.

Popper (1973) discusses the growth of knowledge as the result of interactions between the physical world, the social world and the world of ideas. He describes his World 2 as the 'world of states of consciousness or mental states or behavioural dispositions to act' (p.106) which Jaques (1976) interprets to be 'an activity in the psychological or second world which produces an output in either or both the objective worlds - the first world of material objects or the third world of cultural objects' (p.113). However, the action component is not included in Popper's 'world two' although the act which results in some output could not occur without the predisposition to act which happens in that psychological world. It is this inclusion of action which differentiates the author's concept of 'planning' from Popper's conceptualization of world 2.

Popper includes a feedback effect from his third world upon his second world, which he stresses is vital to the growth of knowledge. His idea of the interaction between the inner and outer worlds and the way that knowledge develops is consistent with the description of psychological planning as a continuing interaction between plans at the different time scales. In the case of planning, however, the composition includes both action and review components within the psychological mechanism.

In the proposed model every plan has a similar structure which, as well as an action and a review component, also includes a link to the adjacent levels of planning for the exchange of information. This information is in the form of instruction concerning appropriate actions to be performed at the shorter time level and feedback on the results of that action at the longer time level.

Interaction between the different levels of planning is vital for the modification of time targets. Plans have to be flexible enough for the interaction to occur but stable enough to permit action at a given time. A flexible plan is one that can be modified as a result of information received from operating on parts of it. It is through the interaction of plans that exist at the same time but on different time scales that plans are revised once they have begun to be executed.

In order to show how the different levels of planning interact and contribute towards the goals of each time scale, a short detour will now be made into the experience of a scientist who took the time to write about the way in which he structured his work.

In his autobiographical novel The Search, Snow (1958) talks about plans for developing his scientific career. At the same time, he is planning to work, as soon as possible, on a complex problem that would interest him more than the acceptable problems necessary for recognition and progression in his chosen field.

> 'I could not expect the authorities to take me as a rising
> scientist on trust. I had to prove myself according to
> their lights. After that I was going my own way, and I
> knew what that way was going to be. To begin with I was
> going to work on a safe problem. It was not exciting,
> but almost certain to give me some results. ... I wanted
> to get at a big problem soon ... But I had to wait my
> time. To suggest my real plans now would be idiocy.'
> (p.55)

Here is an example of simultaneous planning at the detailed and general levels. Later in the same book the reader is given a glimpse of how the plans are working.

> 'With the future temporarily assured - I turned eagerly
> once more to the problem which had enticed me for so
> long. Now, however I was in a very different mood to
> tackle it. I had done enough for place and reputation,
> and I could afford to gamble on what might be a barren
> chase. ... I had gained a good deal of experience and

technique in research; I had sharpened my mind on Lüthy
and the rest, and broadened it on Macdonald's meta-
physical schemes; and, perhaps more important, I was
full of confidence. If I had an idea, it would stand a
chance; even if it seemed improbable, it would be
looked into' (p.91).

Snow shows the positive way in which his detailed plan for immediate

advancement in his career affected his longer term plan to work on a

professionally suspect problem. Implicit in these fragments, however, is

the information that his desire to work on the particular problem he was

aiming towards affected what he did in the short term. He needed to

become familiar with specific procedures, calculations and approaches to

his topic in order to be able to transfer his skills to 'work which no

one dared to touch'. For this reason the 'bread and butter' problems on

which he regularly worked were all selected to contribute to the store

of knowledge he would later be able to utilize in a related, but differ-

ent context.

In a similar, but different way, the students in the present study

show how their longer term plans were affected by what happened in the

short term. They first had to plan the work for their research and then,

having made a plan, it was necessary to put it into action. The action

sometimes resulted in the discovery of some unexpected obstacle which had

to be overcome. The way to overcome the obstacle might be merely to modify

the original plan. The original plan might also be modified due to actions

taken in connection with more immediate plans even when no actual obstacle

had been encountered. Examples of such modifications have been given in

the previous chapter. The change in Greg's general plan has been referred

to above (p.217). Bradley's general plan was changed as a result of action

he had taken towards realizing his detailed plans (p.157) while Diana's

longer term plans were quite explicitly dependent upon the results of actions taken in connection with her short term plans (p.160).

Of course, using only seven postgraduate students it is not possible to make categoric statements about the cognitive processes involved in the planning of work. What can be done is to postulate a hypothetical mechanism which may account for what happens when people make plans, based on the evidence of the cases in this study. Extrapolating from these particular instances it is then a straightforward step to describe what might be happening in order to be able to test the accuracy of such a description.

The model that is being put forward here has a spiral element and is that

(i) Postgraduates have an overall general idea of what they will be doing during the next three years.

(ii) They have a somewhat clearer idea of what they will be doing during the next year, term, month, etc.

(iii) Once they begin to work on this more detailed plan they discover things that help to clarify the general plan, e.g.

(a) the work takes longer/shorter than expected

(b) equipment/materials are unobtainable

(c) problems encountered 'en route' result in detours into areas of work that had not been considered

(iv) As a result of these experiences they are able to modify the general plan,

(v) which in turn changes their more detailed plans.

Such a model is based on extremely thin evidence and is, therefore, very hypothetical. In fact, the main question is whether the postgradu-

ates would have planned their work in the manner described, if they had not been required to write the paragraphs. It is difficult to know how far the methodology used in this part of the research interfered with what was being studied.

But there is some foundation for believing that the interference did not result in a situation that was totally removed from what would usually happen. The reason for this is that Welsh (1981) has made similar observations. She refers to effective planning, and the carrying out of plans, as important to successful completion of the Ph.D. In her research she did not use paragraphs but merely enquired into the work activities of postgraduate students at regular, but infrequent, intervals during their research degree course.

Welsh discovered, from her study of thirty-seven science students at one university, that it was primarily the unsuccessful students who did not organize their working hours effectively. She acknowledged the importance of motivation and self-confidence, as well as the ability to plan ahead and to carry out those plans.

The question left unanswered at present is whether all behaviour is planned and if not, what determines those which are from those which are not. Another important point that was not considered at all was that concerned with how many levels of planning are possible, i.e. how far up and down the time scale do people fit their actions to accord with other, related behaviours in order to achieve a series of intermediate goals which together will result in attaining some superordinate goal. Finally, an important criticism of this part of the research was that the normal, or usual, planning process was not explored at all. It would have been very difficult to do such a study in any controlled way without first

having some hypothetical structure which could be set up as the object to be investigated. It was towards this, preliminary step, that the present research was aimed. Any development of this project might set out to test the hypothesis that plans for work are modified as a result of action on parts of the plan by the individual.

Before commencing this research into the Ph.D. I had anticipated that the students would plan their work in a way similar to that described. What had not been expected, however, was that they would not learn how to improve their estimates of the time needed to carry out specific pieces of their work. Estimating the length of time needed to complete a piece of written work may not be the most accurate measurement by which to assess postgraduates' ability to plan their work over time. This is because writing appeared to be one of the more difficult tasks that postgraduates undertake during the course of learning to do research.

What is the role of writing in learning to do research and to report it?

Introduction

It had originally been assumed that the students would plan more easily and with more accuracy as they moved deeper into their projects. The probable reasons why this learning appeared not to occur is now discussed in respect of the above question.

Regardless of the activities on which they had been engaged during the information gathering period of their research degree, eventually the postgraduates had to write up their work. Since the award of a doctorate hinges on the presentation of a written thesis, this part of their work is very important indeed.

Yet it appeared to be more difficult for the postgraduate students to estimate the length of time needed to complete a piece of written work than accurately to plan a piece of practical work. Why was this? Was it because of the differences between the two tasks, and if so, what are they? Was it more to do with the students' concepts of a Ph.D., than with the actual writing of the thesis? Could these postgraduate students have been more accurate in their estimations if they were estimating time needed for some other written work, not involved with their Ph.D.?

It may be that there are both similarities and differences between the activities of writing and of doing research - at least at the level of learning the necessary skills. Such similarities and differences only become apparent when the object of study is the process of acquiring the relevant skills.

Similarities and Differences between learning to do research and to write

It was noted in the previous chapter that the seven students fell into two writing types but both types had difficulty in expressing the results of their work in written form. Whether they built up the work piece by piece or expressed all that they wanted to say and then went back over it, all of them experienced some degree of discomfort or difficulty while trying to formulate clearly in writing, ideas which would be new to the reader but which had become very familiar to the writer. Their awareness that they were aiming to give information and knowledge that they already possess, to others who do not yet have it meant that assumptions had to be made explicit and ideas expressed clearly. The thinking that links one idea with others, or that emerges from a particular assumption, had to be translated unambiguously into the written language.

Remarks such as 'good writing can't cure bad thought' and 'I can't clearly express in words what I have in my head' from Bradley and Adam respectively, were not dissimilar to comments made by university staff members in the Lowenthal and Wason (1977) study. Yet the work had been done and all that remained was merely to report what had already been discovered ... or was it?

The results of both the grids and the paragraphs showed that the postgraduates experienced particular difficulties with writing. This is reflected in Tables 12 and 14 which show the very low degree of accuracy in the students' predictions concerning the time needed to complete a piece of written work. Their inability to give accurate predictions might have been due to the fact that writing was the least structured activity of all those undertaken by the students and the one which embraced more of the diversity of research than any other single task. It might be that the skills needed for writing up work which has been completed are different from those needed to do the research itself. If so the difference may be mainly due to the necessity to integrate the sometimes disparate stages of the research into a coherent form.

Earlier in this thesis (p.43) theorists interested in this area were reported as saying that writing is important for advancing thinking and for discovering new knowledge. More recently Wason (1982) has suggested that it is not new facts which one discovers through writing but the critical relevance of old facts. He says that what happens is that through writing about what one has done - as opposed to thinking or talking about it - one begins to see it in a different way or to re-interpret it. If this is so then it would account for the difficulties experienced by the postgraduates at this stage of their work. The results of the present research indicate that it is a real possibility that as

well as being 'part of the process of psychological discovery' (Cohen, 1977) writing is itself a part of the psychological process of discovery.

Through refamiliarizing themselves with their results, collating the notes they have made and cross-referencing with other people's work on the topic as well as their own, the postgraduates rediscovered and re-interpreted what it was that was significant in their data. Even Charles, who had thought that he would 'leave writing the dissertation until the end as it can be done in less than three months' said at the end of his two years: 'Writing has made it clearer, things are more precise now. Perhaps I should have started writing earlier.' Adam also changed the way he thought about writing during the course of his research degree. On page 170 it was reported that he was frightened of writing; but once he was sure of what he wanted to say he found writing a pleasurable ac-tivity. This came about as a result of:

(a) attempting to write,

(b) discovering that he did not know how to express his ideas and then

(c) becoming comfortable with his thoughts by organizing them into a coherent form through writing.

The example given on page 44 of the way that Pirsig attempted to teach writing, is analogous to the way that the supervisors attempted to teach their students how to do research. First, the students had to con-centrate on a well defined area that had not been explored before by cut-ting down on overambitious projects. Second, they had to look for the meaning of their work in the results of their efforts instead of relying on their supervisors for this information.

Regardless of whether or not writing involves different skills from

those needed to do good research, the postgraduates had no alternative but to communicate the results of their efforts. If they are not certain of the meaning of what they had discovered then the difficulties of this stage are understandable; but by trying to write the thesis it seems that they will discover the meaning that is eluding them.

The grids had shown that writing, in addition to being used to help the students to see the meaning of the research, was perceived as being closely linked to thought. This link involved both organizational and creative aspects of thinking.

In the present study Charles had revealed a relatively uncreative view of writing by drawing an explicit dichotomy between writing letters and writing scientific papers (p.172). In contrast, Adam's dichotomy gave evidence of a more creative view. He defined his early writing as being creative but the thesis writing as having to integrate these creative ideas. In this way the organizational aspect of writing was revealed during Adam's grid feedback sessions. In addition, Freddy referred to the diversity of his research which 'only came together' when he 'tied the bits together' for the thesis. By re-creating the problem in order to communicate it in the thesis the students may also have been re-creating parts of the process through which they had so recently passed. The way that this happens is through the sorting and selecting of the material they have collected during their research training.

The concentration and determination needed to write and rewrite results of the research for the thesis, is equalled only by the concentration and determination needed to continue working on a specific problem for an extended period of time. Boredom and isolation are inherent problems with which the student must learn to cope. In addition to these in-

herent difficulties, Table 11 on page 139 shows that when writing was used for assessment purposes by some of the supervisors it was even more difficult for the students to complete that piece of writing. For example Adam had been writing an early report of his work when his supervisor, considering it to be of a very high standard but not telling the student this, suggested it be used for upgrading from M.Phil. to Ph.D. when it was finished. The thought that his report would be studied by the examining board was sufficient to delay Adam's progress with the writing by many months. Greg experienced similar difficulties once he had been informed that the head of department, as well as his supervisor would be reading the paper he was preparing at the end of his first year.

It is not surprising therefore that the students found it difficult to learn how to estimate the length of time they needed to complete written work. This difficulty was intensified when the writing was to be used for assessment purposes. Yet an integral part of writing the actual thesis was the knowledge that it is to be used for examination and the award of the doctorate. It is the thesis alone which has to stand the test for the Ph.D. degree and the thesis is the written testimony of the student's ability to plan, conduct and report a programme of research.

This final stage of their training involves presenting their ideas within an organized framework. It is possible that it is the very activity of organizing the parts of their work into a coherent whole that accounts for the differences in the way the students see their projects as they get nearer to their goal.

Learning to do research incorporates learning to write up that research for assessment purposes as well as for communication purposes. Therefore, the similarities between learning to write and to do research

are as important to the postgraduates as the differences between them.

The students are not told what skills and abilities are needed in order to succeed in their research degrees, neither are they told what is needed in order to express themselves clearly in writing. They have to use the time available to discover for themselves what things are relevant and important to their research. They also have to learn for themselves what attributes are needed in order to communicate these discoveries to others. In these ways, learning the activities are similar. During the three years as postgraduates the students learn how to sort out chaotic ideas. One way of achieving this is through writing. Therefore, writing may serve several functions at once.

These functions would have to do with:

(i) how parts of the problem relate to each other

(ii) how to re-assemble the parts into a coherent whole

(iii) how to present their thoughts and their data in a comprehensible manner.

If this is so then it may account for the difficulty the students had both in accurately estimating the time needed to complete a piece of written work and with the writing itself.

These different characteristics of writing, which are not present in other parts of the postgraduates' work, combine to make writing a special activity. It appears that it is during the process of writing that the students discovered what it is that they have learned in order to do good research. This occurs through having to ascertain that all the parts link together into a continuous and coherent format. This involves more than just writing; it is here that the organizing, sifting and thinking about what they have done really happens.

The Place of Pre-writing in the Learning Process

In his work on learning to learn Thomas emphasizes the importance to the students of taking responsibility for their own assessment of their performance. The assessment is based on the learner's own previous performance and not restricted to existing norms or future aspirations; neither is it relative to outstanding performances of more experienced people. The whole idea of learning to learn is that learners develop at their own rate. Any plan of what they will accomplish during their programme of study is based on the point from which they start. Any evaluation of progress derives from where the students had got to at the last assessment point and any value attached to such progress comes from the learners and not merely from their teachers. The learning contract, negotiated between learner and teacher however, does include exploration of how the learners' ideas match those offered by their teachers. Thomas and Augstein (1972) define learning as the processes by which 'not understanding' or 'not agreeing with the teacher' leads to revision, differentiation and development of the learners' ideas.

Although the students in this study changed their perceptions of doing a Ph.D. no pattern was found with regard to their differentiation scores. These scores are given on page 176 and have been considered in terms of both the theory and the method used to arrive at the scores. According to work described by Runkel and Damrin (1961) and Bannister & Mair (1968) and reported on pages 34 and 35 of this thesis, it would have been consistent with the ideas contained within Personal Construct Theory for a pattern of low differentiation at the start to be followed by an increase in differentiation as the postgraduates became more involved with their projects. But individual trends varied during the course of this study.

The most significant factors that contribute to the process of
learning as described by Thomas and Augstein have been identified by
them as:

(a) the learners' formulation of the learning task and their ability
    to operationalize it. This formulation is not necessarily that
    of the teacher.

(b) The density of information and how it influences the learners'
    interaction with it.

(c) Assessment of the outcome, i.e. learning is properly described
    as 'before to after change' in the total organization of the learner.
    This includes the uses that can be made of the new knowledge and the
    learner's readiness for further learning.

This analysis is different from that of the 'loose' to 'tight' con-
struing referred to on page 56. The difference is one of emphasis.
Thomas and Augstein refer to what students do about the new information
to which they are exposed while Kelly is more concerned with the amount
of cognitive organization that is involved in assimilating the new infor-
mation. In other words, it is the difference between what has been
learned and how this learning is used.

In the case of the postgraduates it appears that what they learned
was not being used to tell others, in writing, what they had learned.
This might have been because the amount of cognitive organization neces-
sary to co-ordinate this new information into written form had not yet
occurred or it might have been because of the stage they had reached in
the process of learning to do research.

Getzels and Csikszentmihalyi (1977) have suggested that creative
people are not born with inherent characteristics of originality, as has

been suggested in most work on creativity in the past. They say that creative people are 'made' and the way that they are made is dependent upon their early environment. The definition of 'creativity' that I am using here is 'in novel ways' which is not too far removed from Bruner's notion of 'effective surprise'.

Getzels and Jackson (1962) suggest that a child who is given puzzles and helped with their solution, or encyclopaedias to help with homework will probably become an adult with a high I.Q. Similarly, a child who is encouraged to seek out novel problems and to discover the solutions on his own or to locate sources for gaining further information on work set by the school will probably become a more creative adult.

Although this assumes that anybody can be a creative thinker, given the right set of circumstances, the approach of Getzels et al. looks at the individual rather than the context in which the individual is oper- ating. The present suggestion is that intellectual development is a topic for cognitive social psychology.

Cognitive social psychology is concerned with mental events of indi- viduals in their social environments. Kelly (1955) based his theory of personal constructs on the interaction of these two factors, i.e. mental events and the individual's social context.

In the present study it appeared that a number of factors contributed to the development of the postgraduates themselves and to the development of their work. These factors were:

(a) their own mental efforts

(b) the social context of the university system

(c) their interactions with the research problem

(d) their relationship with their supervisors

(e)   their relationship with other postgraduates

(f)   the system adopted in their discipline

which include both cognitive and social elements.

In an ideal environment, individuals are encouraged to become more creative in their approach to problems and the handling of information. My research has shown that the postgraduate system in the two universities being studied did not provide such an environment.

The results indicate that the postgraduates in the sample grew disillusioned and bored with their Ph.D. research and that this was due to the repetitive nature of the work.   When the students were completely absorbed with the work, there had been an abundance of enthusiasm.   In most cases, this was only at the beginning of the three years programme.

It was mentioned on page 131 that Hudson (1977) said, during an interview that boredom is often a prelude to creative activity: 'I sit around bored or irritated until something hits me - frustrated, fed up with the research you've been doing, fed up with the techniques or people you've been doing it with, and then something strikes you.   Usually a conversation starts it or someone new you meet.   It doesn't have to be much, just a detail that sets you going.'   (p.164)   Indeed it may even be that such a 'getting nowhere syndrome' is a necessary requirement for doing productive research at a later stage.

In fact the writer Borne says that the true art of self-education lies in making oneself 'unwitting'.   He suggests that to write down anything that comes into your head for three days will result in such 'novel and startling thoughts' that you will be well on the way to becoming an original writer (quoted in Wason, 1982).   Milner (1969) agrees with this advice, having tried it.   She concludes that a part of her mind could

solve problems that she, consciously, could not; also that that same unconscious part of herself could cause blocks and make her act stupidly.

This would certainly be consistent with Erikson's (1950) theory of development. He says that doing nothing at all is an important part of growing up; and that if an adolescent 'accepts work as his only obligation and "what works" as his only criterion of worthwhileness, he may become the conformist and thoughtless slave of his technology and of those who are in a position to exploit it.' (p.252) During negotiation of the fourth of his eight developmental crises, a struggle to complete a task, or even to start one becomes a crucial issue. According to Witmer's (1960) interpretation of Erikson this does not demonstrate any lack of ability, as some highly gifted people suffer most of all from an apparent lethargy.

If, as has been suggested by Wason (1980), invention is a function of writing, and especially of re-writing, then writing a Ph.D. thesis is no less a creative act than writing poetry.

By this reasoning it should be no surprise that the postgraduates slowed down significantly when the time came for the thesis to be written. First, they had to allow themselves sufficient time for the results of their work to become organized into a comprehensible form. Second, they were relatively incapacitated by having spent so long on their projects. Third, they needed to complete the 'getting nowhere syndrome' in order to be able to engage in the activity of organizational writing. Fourth, they had to arrive at the 'job of work to be completed' stage of doing a Ph.D. Finally, they had also to develop the confidence needed to write the thesis. Once they had achieved all of this they were able to proceed, which they did at different times after the end of the three year period.

The Place of Writing in Learning to do Research

To consider the questions asked about writing in relation to the rest of the activities undertaken for a Ph.D. is now a relatively simple, if somewhat hypothetical, matter. Let us conjecture a little. First, why is writing different from all other tasks within the context of learning to do research? Answer: because it organizes disparate parts into a cohesive whole and gives form to the thought processes of the student. Second, is the difficulty in time estimation more closely related to the meaning of doing a Ph.D. to the postgraduate than it is to actually writing the thesis for the Ph.D. examination? Answer: yes, insofar as the student is afraid of falling short in certain areas of creative thought, quality of work, or originality of explanation. Next, could these students be more accurate if asked to estimate time to write something not involved with their Ph.D.? Answer: probably, although not systematically and specifically asked of all six remaining students, there are data from some of them and these tend to be rather more accurate than the thesis estimates.

Bradley had to rewrite an article submitted for publication and took time out of his thesis writing time to do this. He allocated himself a month and finished it (in a form that was eventually accepted by the journal) in six weeks. Freddy and Adam both had to write conference papers. Freddy's was in collaboration with his supervisor so he gave himself a week to get down all the information and then passed it to Professor Forsdike to 'pull into shape'. The Professor reported that the paper was 'of a very high standard'. Adam said that he wanted to finish the paper in good time for the conference but was still working on it the night before presentation. There is no information available for the other postgraduates,

but Bradley and Freddy certainly were better at estimating these related but separate items of written work than they were at estimating time needed to complete parts of their theses.

So, now there is a tentative answer to the question 'Why was it that the students found it more difficult to judge the time needed for writing than for practical work?' The answer may be that all the postgraduates had their own conception of the standard necessary for a Ph.D. and of the quality of writing required in the thesis. A testable hypothesis arising out of this interpretation would be that, in order to settle down to writing the thesis, postgraduate students need to be sure of their abilities to (a) do original research, (b) realistically assess the outcomes and (c) co-ordinate them into a structural whole. Perhaps, once they were able to achieve the self-reliance necessary to do these things without undue anxiety they would also be able to make more accurate estimates about time needed for written work.

The ability to evaluate what they had done, developed as they learned to use criteria such as the amount of time taken to produce the result, and the quality of this result. With writing, the feedback received from reading what had been written helped towards the development of the work as a coherent product which was able to stand alone. The way that this happened was typified by some of the comments given on page 173.

Both serialist and holist writers, arts and science postgraduates, reported that writing forced them to co-ordinate their work and organize their thinking. By re-examining what they had done after they had completed the practical part of their research, the postgraduates had to face the relevant and irrelevant parts of their work. As they identified those parts that were redundant, those that were relevant to the thesis and those

that might be developed at some future time, they were discovering the meaning of their training.

It gradually became apparent, from the grid and the interview data, that writing was playing an important part in the process of doing a Ph.D. In the early stage of their work writing helped to clarify thought and enabled the postgraduates to 'see where they were going'. It was primarily a creative activity. Later, it helped them to organize their ideas and unite divergent aspects of their work. Also, it was more difficult to 'get down to it' than to practical work and was perceived, at least by the scientists, as less directly relevant to their aims. Nevertheless, the time did come when even they changed their perception of the usefulness and relevance of what they were doing.

Baddeley (1979) puts down the changed perception of the Ph.D. to the students' boredom with the topic they have been working on for so long. This boredom is due to the repetitive nature of the work and the need to concentrate on a single problem for an extended period of time.

The idea that research work at postgraduate level could be described as 'repetitive' was not something that had been anticipated, yet it was a theme that recurred. In Chapter 5 it was reported that one of the most significant features of the process of learning to do research were periods of boredom. This boredom was associated with the 'mechanical process' (Greg) of some of the work. Diana talked about the 'time consuming and mindless' aspects of doing experiments (p.167), Freddy said that 'a chimpanzee could do a better job' (p.161) and Adam summarized it by saying that there was 'no challenge' (p.133). But there is more to the change in the students' view of their Ph.D. than boredom. The significant feature of the change is that it becomes a practical task that has to be

completed in the same way that any other practical task has to be completed.

This is a very important change as it is a more realistic perception than the original one that included a strong element of the 'specialness' of the Ph.D. This research has shown that the greater the feeling of 'specialness' of the Ph.D. experienced by the student, the less the probability of completing the thesis. This was suggested by the increasing desire expressed by the postgraduates to get the thesis out of the way as they got more and more bored with the monotonous and repetitive aspects of what they were doing. As they realized that it was determination and application, rather than brilliance, that was needed to complete what they had started, they seemed to come to the conclusion that they were capable of attaining the goal after all. For some time they had lacked the confidence in themselves that they were working at the right standard and tended to consider it presumptuous to expect that they were able to attain the Ph.D. degree.

Section Summary

Writing has been considered from the point of view of its role in organizing thought. Similarities, as well as differences, between learning how to write and how to do research have been discussed. The hypothesis relevant to this part of the research is that postgraduates are unable to complete written work on time due to an inability to organize their data into a coherent whole.

The students' inability to complete written work in accordance with the amount of time they had originally considered to be sufficient for the task appeared to be due to (i) lack of confidence in their writing

ability and (ii) the need to organize their thoughts (and their work)

in order to structure the written report. The particular difficulties

which the postgraduates encountered in trying to write were concerned

with (a) their written work being used for assessment purposes and

(b) the global aspect of co-ordinating their three years of research

into one document.

CHAPTER 8

PRACTICAL IMPLICATIONS

SUGGESTIONS FOR FUTURE RESEARCH

This thesis has reported the results of an intensive study of seven cases. It began with certain clear cautions about the exploratory nature of the research, these hold true, but there is nevertheless a compelling quality about the outcome which lends itself to certain firm interpretations.

The first has to do with supervision of postgraduate research students. The student and supervisor relationship was analysed in terms of the amount and type of interactions between the pair and the effect of these interactions on the development of the research. The results of this part of the work suggest that the length of time it takes for a postgraduate student to become an autonomous research worker is dependent upon the kind of relationship that exists between the student and supervisor pair.

A hypothesis which could be tested in future work would be that those students who have supervisors who are around all the time, tend to remain research assistants far into their postgraduate programme.

A way to test this hypothesis would be to establish two small groups of supervisors. One group would be the 'experimental' group and would agree to introduce a weaning process into supervision while the control group would retain close contact with their postgraduates throughout the period of the experiment. The weaning process would consist of an initial period of close contact and firm direction followed by a gradual decrease in frequency of meetings coupled with a change to a more supportive role on the part of the supervisor. Guidance would eventually be offered only when it was the postgraduate who took the initiative in seeking out the supervisor.

The two experimental and control groups could be monitored at, say, six monthly intervals so that all students and supervisors would receive the same amount of attention from the researcher.

Problems that might be encountered in this experiment would depend on the degree of flexibility with which the weaning process was introduced, as a certain sensitivity to student need could be a desirable, but confounding, variable. Similarly, the control group would be required to maintain a stable amount and type of contact. Such a requirement might, in certain cases, induce feelings of pressure in the student. Nevertheless, the difficulties might be less of a problem for postgraduates than those they experience in the more 'hit or miss' system that would normally obtain.

The present study has little evidence regarding quality, as opposed to perceived quantity, of supervision. By 'quality' is meant such things as whether or not supervisors treat all their students the same, regardless of their individual needs or the stage they have reached in their postgraduate career; or the amount of cerebral, rather than physical, time spent on a particular student. These aspects of supervision could also be topics for future research.

A feature that arose from the results of the discrepancies between expectation and achievement was a relationship between being able to predict accurately the time needed to complete experimental work and an inability to do the same for written work. It may be that future work in this area could include some investigation on this inverse relationship. Two questions to be looked at would be: is the relationship a significant one? and, do poor planners of experimental work find it easier to estimate time needed for writing?

Another recommendation for further research which arises out of this study is concerned with the aims of doing a research degree. There is a general assumption made by people who have commented on education for the

Ph.D. that the degree is awarded for an original contribution to knowledge after the student has completed a training in research. The things that are criticized and questioned are solely concerned with the methods of training, but an equally important question is being ignored. The question concerns the goals of the training.

The aims of the people involved differed from each other as well as from the aims of the system. It appeared that the educational system is geared to develop people who are able to think, have knowledge, and sustain a high level of independent work. The aims of the supervisors seem to be more related to the development of their discipline and a particular area within it. The aims of the students are to get the Ph.D.

The above are general impressions conveyed to the author over the three years, but it is desirable to get detailed information that would identify the goals of the training. These could then be specified and made explicit to supervisors and incoming postgraduates. The training could then be adjusted accordingly.

An important point in this connection was that in the first interviews with the supervisors they were all able to list what qualities they looked for in researchers, but not in potential researchers. On page 189 it was reported that most of the supervisors experienced considerable discomfort while generating eight qualities that they looked for when selecting students whom they thought would be successful in completing a course of study leading to the Ph.D. degree. This point was taken up on page 209 where it was noted that there was a need to identify at this stage the embryonic qualities required. That is, qualities that would gradually develop into more mature characteristics of an experienced research worker. In fact, some of the supervisors did succeed in pinpointing

such things as 'enthusiasm' and 'determination' which the present study has shown to be important. Perhaps a little more could be done in this direction by getting supervisors together in groups to discuss issues such as 'How to select research students' and 'Problems of supervision'.

Most of the literature about postgraduate recruitment points to negative information concerned with abilities that do not correlate with good research, rather than positive information which could be used as a guideline for selection. Hudson (1960) and Miller (1970) refer to the poor predictive quality of final undergraduate examination results and call for research into this area of education. Whitehand (1966) recommends tests of problem solving, rather than knowledge, for selection of research students. Even though this topic has been discussed for at least twenty years there continues to be a lack of any adequate concept of what constitutes the raw material of a good researcher. The lack of any reliable selection criteria results in confusion with regard to the procedures and goals of postgraduate education. By recognizing the learning process involved in completing the Ph.D. it may be possible, eventually, to distinguish the requirements for completion of a research degree and so identify differences between potentially successful and unsuccessful candidates.

Linked to the assumption stated at the start of this thesis concerning the original nature of the work for the Ph.D. is the notion of quality of research. The quality of research, like the degree of autonomy of the researcher, has not been raised as an issue by academics interested in postgraduate education. It is assumed that if the Ph.D. is awarded, it is awarded for work of high quality. But just as Francis (1976) has shown that there are several definitions of 'original' work which are

appropriate in this context, so too are there many possible interpretations of what constitutes an acceptable standard of quality in research for the Ph.D. Francis questions the concept of originality in the Ph.D. thesis, but he too stops short at the equally important question concerning the significance of the title 'Ph.D.' Does the title signify that the holder of this degree is somebody who is capable of independent and original research work, or merely that the holder has completed a research degree training programme culminating in the presentation of a thesis?

This question only relates to Britain as the term 'degree' would always be assumed to refer to the Ph.D. in America (personal communication, Wason, P.C.).

But in this country there is such variation in how the training period is spent that the question becomes one that should receive serious consideration. If all that is necessary is to complete a three year programme, then the goals of the training could be anything from competence in following instructions and reporting procedures to the ability to work autonomously and think creatively. If, on the other hand, the person is supposed to be an independent and original researcher, then all courses in which the postgraduates are presented with a problem, directed in techniques of approaching it, instructed on possible theoretical implications, and helped in the redrafting of their thesis by their supervisors, should be given careful consideration before they are included in the Ph.D. category.

The idea of a training in research to the level of the Ph.D., does seem to imply something more than competence to follow a prescribed programme. The original assumption on which this research is based was that the aim of the training is to produce an autonomous research worker, who can work independently and with a measure of originality.

Although value is placed on originality of thought within the system, most ideas are not original. They usually reflect a great deal of experience and examination of other people's observations and discoveries. Perhaps it would be advantageous for potential researchers to be aware that it is not necessarily the case that people either have, or do not have, the ability to generate original ideas and research them. The ability that is more likely to be needed is that involved in the constructive use of experience and social interaction. Perhaps it is this that the Ph.D. is examining. Both across disciplines and departments, and within them, there are indications that what is considered a suitable thesis for submission for the degree is open to wide variations. It is suggested that future research might seek to establish the range of these variations in order to eventually arrive at some consensus.

Practical Recommendations

The outcomes of this research have highlighted some of the observations made by Swinnerton-Dyer (1982) in the government report on postgraduate education. The working party observed that in the natural sciences the yardstick of a Ph.D. is the amount of research a competent candidate can be expected to do in three years. It is primarily the research, rather than the thesis which is assessed. In the social sciences they refer to a 'different and higher standard which it is natural to apply to a thesis' (p.81). The report states there might be advantages to awarding comparable degrees and so giving up the present connotation of the Ph.D. in the social sciences. The working party also recommend that regulations for submission of theses should be amended to take account of the tendency for 'real' research to be conducted in groups.

Recommendations Regarding Students

Postgraduates need to discover that they are not alone in feeling stupid, depressed, isolated, confused and uncertain whether what they have begun is worth finishing. Once they start to talk about these things, including general discontent with supervision, they also begin to discuss their research interests and current work problems. Therefore, it seems likely that postgraduate groups would have some role to play in the process of development into autonomous researchers.

In America the process of getting a Ph.D. is quite different from that described in this thesis. Graduate school is a more highly structured and less idiosyncratic training for research than is our postgraduate system. Yet although it appears that there would be more peer interaction and less uncertainty about what is required it seems that this may not be the reality for those immersed in the American graduate programmes. Vartuli (1982) talking about the doctoral programme in the States, looks at the process from the point of view of women graduate students. She describes it as follows:

> First year - Taking courses to discover what others already know
>
> Second year - Preparing for the stressful qualifying examinations
>
> Third year - Social isolation of the period of formulating a
>
> research proposal which extends into
>
> The final year - Lonely experience of writing the dissertation.

Graduation is said to be a time of ecstasy. The whole intense socialization process is seen as one that narrows the student's perspective on life and results in her becoming more egocentric. This, very recent, report may come as a surprise to many over here who imagine the American system as one that has solved the problems of which we are only now becoming aware.

In the present study peer interaction, or lack of it, showed itself to be a problem of which supervisors were as aware as their students. The recommendation here is for the introduction of a climate where post-graduates can become involved in an exchange of ideas.

Postgraduate seminars were always mentioned but rarely happened during the three years of this research in two universities. Equally surprising was the breakdown of intellectual exchange at the individual level.

The British Ph.D. system emphasizes the individualistic rather than the social aspect of knowledge, responsibility and competence. It is competitive rather than co-operative. However, it may yet be shown that activities such as learning, working, solving problems, and evaluation are social as well as cognitive.

Ph.D. students have supervisors because they need guidance and support, this relationship is the basis for a social approach to knowledge. The advantage of sharing others' knowledge and skills, not threatened by their own relative ignorance, or others' superior competence, could well be the basis for specific changes, while retaining the most positive aspects of the student and supervisor relationship.

Postgraduates must make sure, at the time of taking the decision to register for a research degree, that they have a realistic view of the undertaking on which they are about to embark. It should be an essential prerequisite for any potential student to ascertain precisely what it is that they are contracting to do during the coming years - not in terms of actual activities but in terms of processes, expectations and role. This might be achieved by discussions with postgraduates currently in their selected department and at all stages of learning to do research. Perhaps the university could supply them with some literature on what is

expected of them and some references concerning the present controversy regarding the British Ph.D. system. Postgraduate students spend a large part of their time in a state of confusion about what they should be doing. This confusion would probably be reduced if they set themselves short term goals and had discussion of long term aims with their supervisors.

The thesis has to be written and, in many cases there is no preparation for this in terms of earlier written work. Starting to write early in the course of a postgraduate career would be a useful aid to later thesis work. Writing the thesis is a very different activity to writing interim reports of work in progress, but writing interim reports can serve important functions during the three years.

The first of these is that progress reports from student to supervisor would give the supervisor an opportunity to consider the student's work without the need for direct contact. This would help laboratory based science students who were feeling oversupervised. It would also help isolated students to feel less neglected due to the communication, whether oral or written, between them and their supervisors as a result of the writing.

Another function of regular reports would be the practice the student would be getting in organizing the work as it proceeded. By summarizing and structuring activities and results, much of the organizational aspect of writing would become familiar. At the same time, the creative aspect would continue as the need for theoretical explanations of the current state of the work was satisfied. Although it is doubtful whether these progress reports could be usefully employed in the final stages of the work, they would then serve as aides memoires in the same way that they

had served earlier to give practice in presentation and communication. It is currently possible to avoid presenting any written work at all from registration for a research degree until completion of the practical work. Many intended written projects of the postgraduates in this study were never completed, some were never started. It is precisely this lack of deadlines, coupled with the feeling that nobody is interested in what they are writing that could be avoided by including written reports in the requirements for progress through the degree course.

It was apparent from Table 11 on page 139 of this thesis that Charles and Greg were in difficulties as early as the end of their first year. It might have been possible for the supervisors to identify that this was so and also to locate the source of the difficulty. If this had happened then the supervisors would have been able to talk to the postgraduates before the problem became any worse. However, as there are no in-built check points in the system at present the supervisors were unaware of anything that required their special attention. In fact, all of them indicated that they were satisfied with their postgraduates' progress; only Ewan's supervisor said that he was slower than had been expected.

This suggests that some kind of feedback loop might help students and supervisors to evaluate progress and discuss points of difficulty before it is too late. The kind of exercise that has been used in this study could easily be incorporated into the supervision system. The students could negotiate with their supervisors their own learning goals and develop their paths to these goals. In doing this they will experience a challenge in achieving the goals that stretch their present level of ability but they can also discuss at, say, six monthly intervals how they see themselves in relation to their stated goals. In this way the

students will be monitoring and evaluating their own learning but will

have the support of the supervisors in the discussions of what has been

achieved to date and what is expected to be achieved in the coming period.

Recommendations Regarding Supervisors

It is the lack of explicit instructions on modes of supervision, together

with the ambiguity of what the training is aiming to achieve that could

account for the state of confusion described by people who are concerned

with what is happening at this level of education. Not only the students,

but also the supervisors experience this confusion due to the lack of

communication between the people involved.

The results suggest that a process designed to 'wean' students might

usefully be adopted by supervisors. It would aim to give postgraduates

more direction at the start of their course and then gradually guide

them towards greater autonomy.

The form such a 'weaning' process might take could be:

Early direction by introducing short term goals and knowledge of results,

the supervisor to initiate contact.

Intermediate weaning involving support and guidance rather than direction,

and discussion of work with the student.

Later separation, to include exchange of ideas and critical evaluation

of work. The student to initiate contact.

The times at which the supervisors would begin to gradually detach

themselves from too directive a role would vary according to the developing

self-confidence of the student. The main requirement here would be for the

supervisors to recognize what stage students have reached in their need for

support. This could range from firm direction at the start to occasional

guidance later on in the postgraduates' research programme. Supervisors might raise their level of awareness of students' need for feedback on their progress and teach them how to interpret and use the information available to them from the work on which they have been engaged. This might be achieved by discussing with their students how the implementation of their plans have affected the plans they are making for further work. By making explicit the interaction between what they plan to do and what they have already done supervisors can teach their students to be more cautious and not to get carried away with overambitious projects.

Some negotiation might be required to determine whether any individual student was best suited to a course aimed at producing an autonomous re-searcher or a highly competent research assistant. External variables such as potential employing institution might need to be taken into con-sideration. Whatever the difficulties encountered that make aims less easily achievable, at least they could be discussed instead of remaining implicit. The discussion itself would result in a lessening of confusion and help to avoid the breakdown of communication which was so often found in this study. The emphasis would be on the process of the work; not just the content of the research topic.

CONCLUSION

This thesis has been concerned with what happens when people learn to do research. On the basis of seven case studies of postgraduate students and their supervisors it has been possible to collect detailed information from which to suggest some hypotheses about what happens, and to indicate the direction that future research in this area might take. It has also been possible to make recommendations of a practical, or applied, nature.

Although it has been stated that very little can be said with certainty on the basis of such a small sample, it <u>has</u> been possible to use the detailed information from these seven pairs to identify the most important variables encountered in the process of studying for a Ph.D. The students went through a process that included

(1) Early enthusiasm

(2) Increasing interest in their work

(3) Transfer of dependence from supervisor to information resulting from effort

(4) Generating their own ideas based on that information

(5) Frustration at not being able to develop these ideas

(6) Boredom with the original problem

(7) Determination to finish what they had started

This process seems to result in four main stages experienced by all the students. The stages are: (a) Enthusiasm (b) Isolation (c) Boredom and (d) Job of work.

These stages had not been expected although Baum (1979) and Baddeley (1979) had both referred to the system in rather negative terms.

The postgraduates may eventually discover, at the time of their oral examination, what they have learned during the preceding years in terms of what it is that is needed to bring a research project to a successful conclusion. However, at that point it is the end product which is being judged and upon which the decision concerning success or failure is taken. This study has been primarily concerned with the processes involved in the development of research students to the point where they are able to complete the end product.

At first the postgraduates had doubted their own ability. Gradually they realized that it was determination and endurance that was needed. This was shown by the additional elements which they added to their grids. Their initial ideas of making a contribution to their disciplines changed to getting the job that they had started out of the way. It was perceived as any other task needing completion was perceived, rather than as something for which they needed very special abilities that they might not have.

There are indications from the comments of the students that the continuing use of the grid throughout their period of research helped them to isolate precise problem areas. This knowledge was often used by them either to decide upon a course of action or to define and understand the source of irritants which they had previously been unable to locate. These results suggest that valuable insights can be acquired by both parties when series of grids are used as a tool to help understand changing attitudes and ideas from the point of view of the participants. This use of the grid technique permits straightforward negotiation of constructs that change over time between those being researched and the researcher. It may well be that it could be incorporated into the post-

graduate educational plan as an instrument to help students and supervisors identify problems and develop strategies for a more humane training in the skills needed for successful research workers.

It was suggested that some areas of difficulty could be made explicit with the use of such techniques as repertory grids and rating sheets. In fact, the methodology of this study could be turned into diagnostic and/or therapeutic tools to be used within the system.

The main point to emerge from the interviews, with regard to supervision, was that the length of time that it took for postgraduates to become autonomous was a function of their relationship with their supervisors. This was observable over the three years of the research. The more direction (as opposed to guidance) that the postgraduates received from their supervisors, the longer they remained dependent upon them.

How students planned their work and the degree of accuracy they achieved in meeting these plans was another facet of the postgraduates' experience that was investigated. The observed discrepancies between what students expected to achieve and what they actually did achieve were used as the basis for describing a hypothetical mechanism by which plans are revised as goals and time limits are adjusted. The hypothesis here was that plans for work are modified as the results of action on parts of the plan are interpreted by the individual.

Throughout this thesis, the students' changing perceptions of the Ph.D. have been presented as vital to completion of the higher degree course. The hypothesis concerning how the postgraduates perceive their work is that the more the Ph.D. is felt to be special, the higher is the probability that the postgraduate will not complete the thesis.

Answers to the questions concerning supervision, planning and writing

have been considered with regard to the question of how perception of the
Ph.D. changes as time progresses. All these points, taken together, were
presented as important parts of learning to do research. They are sug-
gested to be significant aspects of the Ph.D. as a learning process.

The research has shown that there is a need to incorporate some
feedback, or knowledge of results, into the postgraduates' programme.
Some intermediate, or short term goals, would facilitate progress and
some written work should be mandatory at the end of each academic year.

The approach taken throughout this thesis has been one based on cogni-
tive social psychology. It has investigated learning as a process by con-
sidering the changes which influence the development of the learner, rather
than concentrating specifically on the product, in this case the Ph.D.
thesis, as the evidence that learning has occurred.

Cognitive social psychology gives an optimistic view of the gradual
acquisition of fluency and flexibility in thought processes as a function
of a particularly beneficial social situation. This is very different
from a purely cognitive approach which allows little room for manoeuvre
in the development of specific mental characteristics after the age of
adolescence. The context in which the postgraduates are operating needs
to be taken into account. By manipulating the social aspect of the situ-
ation, it may be possible to affect the cognitive responses of the indi-
viduals within it. If this should happen then doing research for a Ph.D.
may eventually become an enjoyable, rather than a painful experience.

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APPENDICES

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UNIVERSITY COLLEGE LONDON
Department of Phonetics and Linguistics, Annexe
Wolfson House, 4 Stephenson Way, London NW1 2HE

Psycholinguistics
Research Unit

tel. 387 7050 (office ext. 735)

Dear

I am a postgraduate student working under the direction of
Dr. Peter Wason. My research is concerned with practical
problem solving in the academic setting.

As I am particularly interested in the way postgraduate
students perceive the problem on which they are working, I
would be most grateful to have your co-operation.

Could you please let me have the names of students who have
registered for M.Phil/Ph.D. degrees for the first time in
October 1976, as I would like to discuss with them the way
in which they formulate the research problem for their
doctoral thesis.

Yours sincerely,

Estelle Reback.

.

UNIVERSITY COLLEGE LONDON
Department of Phonetics and Linguistics, Annexe
Wolfson House, 4 Stephenson Way, London NW1 2HE

Psycholinguistics
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As I am particularly interested in the way postgraduate students perceive the problem on which they are working, I would be most grateful to have your co-operation.

I understand that you registered for an M. Phil/Ph.D. degree for the first time in October, 1976. I would very much like to discuss your research with you and would be glad to hear from you in order to arrange a mutually convenient time for us to meet.

Would you please write to me via the internal mail - Room G.23, Wolfson House - suggesting some possible dates and times that would be convenient for you to make an appointment. Alternatively, I may be contacted by telephone - internal extension 04.216 or 04.283 - most Tuesdays, Wednesdays, and Thursdays after 11.00 a.m. I look forward to meeting you.

Yours sincerely,

Estelle Reback.

UNIVERSITY COLLEGE LONDON
Department of Phonetics and Linguistics, Annexe
Wolfson House, 4 Stephenson Way, London NW1 2HE

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time in October, 1976. I would very much like to discuss your research
with you and would be glad to hear from you in order to arrange a mutually
convenient time for us to meet.

Would you please reply to me via the internal mail, Brunel Psychology Dept.,
with some suggested dates and times for a meeting. I may also be reached
on Brunel internal phone No. 531 on Mondays between 12 noon and 3.0.p.m.

I look forward to meeting you.

Yours sincerely,

Estelle Reback.

I think I am making   progress

1. Excellent   2. Good   3. Reasonable   4. Poor   5. No.

I think my supervisor considers I am making   progress

1. Excellent   2. Good   3. Reasonable   4. Poor   5. No.

I consider my research problem to be   defined.

1. Totally   2. Fairly well   3. Vaguely   4. Beginning to be   5. Not yet
                                                        started being

Rate your work according to your feeling of satisfaction with the following aspects:

	1	2	3	4
	Very Satisfied	Satisfied	Neutral	Dissatisfied

1. Amount of interest

2. Degree of independence to
   plan and carry out work

3. Interaction with peers

4. Supervision

5. Opportunity to gain experience
   and develop ability

6. Any other aspects you consider important
   Please specify and rate similarly

I think   is making   progress.

1. Excellent   2. Good   3. Reasonable   4. Poor   5. No.

I consider   's research problem to be   defined

1. Totally   2. Fairly well   3. Vaguely   4. Beginning to be   5. Not yet
                                                                       started being

Rate the student according to your feeling of satisfaction with the following

aspects of his/her work:

	1	2	3	4
	Very satisfied	Satisfied	Neutral	Dissatisfied

1. Amount of interest

2. Degree of independence to plan
   and carry out work

3. Interaction with peers

4. Attitudes to supervision

5. Use of opportunity to gain
   experience and develop ability

6. Any other aspects you consider important
   Please specify and rate similarly

1 Excellent, 2 Good, 3 Reasonable, 4 Poor, 5 No progress

		Progress				
Adam		2	2	Prof Andrews	1	
		1	2		1	
		4	3		1	
	M=	2.3	2.3		1	✔
Bradley		3	2	Mrs Briggs	1	
		2	2		1.5	
		3	2		1	
	M=	2.6	2		1.2	✔
Charles		3	3	Dr Chadwick	3	
		4	4		4	
	M=	3.5	3.5		3.5	≂
Diana		3	3	Prof Dymond	–	
		3	3		–	
		3	3		2	
	M=	3	3		2	✔
Ewan		3	3	Dr Eustace	2.5	
		3	2		2	
		2	3		2.5	
	M=	2.6	2.6		2.3	✔
Freddy		3	3	Prof Forsdike	3	
		2	3		1	
		3	3		1	
	M=	2.6	3		1.6	✔
Greg		3	3	Dr Green	3	
		3	3		2	
		3	3		3	
	M=	3	3		2.6	✔

N = 20 N = 18

Supervisor thinks

6 - better

1 - equal

Definition of Research Problem

1 Totally, 2 Fairly well, 3 Vaguely, 4 Beginning to be, 5 Not yet started
                                                                    being

Adam	2	Prof Andrews	2		
	2		1		
	1		1		
M =	1.6		1.3	✔	
Bradley	2	Mrs Briggs	2.5		
	2		2		
	1		2		
M =	1.6		2.2	✘	
Charles	2	Dr Chadwick	2		
	2		2		
M =	2		2	≈	
Diana	5	Prof Dymond	–		
	3		–		
	3		2		
M =	3.6		2	✔	
Ewan	2	Dr Eustace	1		
	1		2		
	1		1		
M =	1.3		1.3	≈	
Freddy	2	Prof Forsdike	2		
	2		2		
	2		1		
M =	2		1.6	✔	
Greg	2	Dr Green	4		
	2		2		
	2		2		
M =	2		2.6	✘	

Supervisor thinks

3 better

2 =

2 worse

Interest

1 Very Satisfied, 2 Satisfied, 3 Neutral, 4 Dissatisfied

Student			Supervisor		
Adam	1		Prof Andrews	1	
	1			1	
	1	same		1	same
	M = 1			1	
Bradley	2		Mrs Briggs	1	
	1			1	
	2	worse		1	same
	M = 1.6			1	
Charles	2		Dr Chadwick	2	
	2	same		3	worse
	M = 2			2.5	
Diana	2		Prof Dymond	–	
	2	better		–	
	1			1	
	M = 1.6			1	
Ewan	2		Dr Eustace	2	
	2	same		2	same
	2			2	
	M = 2			2	
Freddy	2		Prof Forsdike	1	
	2	same		1	worse
	2			2	
	M = 2			1.3	
Greg	2		Dr Green	2	
	1	worse		2	worse
	2			3	
	M = 1.6			2.3	

$\leq$ 13.4 $\leq$ 11.1

Independence

1 Very satisfied, 2 Satisfied, 3 Neutral, 4 Dissatisfied

	Student		Supervisor		
Adam	1		Prof Andrews	1	
	1	same		1	same
	1			1	
	M = 1			1	
Bradley	2		Mrs Briggs	1	
	1	better		1	same
	1			1	
	M = 1.3			1	
Charles	1		Dr Chadwick	3	
	2	worse		4	worse
	M = 1.5			3.5	
Diana	2		Prof Dymond	-	
	2	better		-	
	1			1	
	M = 1.6				
Ewan	2		Dr Eustace	3	
	1	worse		2	worse
	2			3	
	M - 1.6			2.6	
Freddy	3		Prof Forsdike	1	
	2	worse		2	better
	3			1	
	M = 2.6			1.3	
Greg	1		Dr Green	2	
	1	same		1	worse
	1			2	
	M = 1			1.6	

$\leqq$ 10.6 $\qquad$ $\leqq$ 12

Peers

1 Very satisfied, 2 Satisfied, 3 Neutral, 4 Dissatisfied

Adam	4		Prof Andrews	2		
	4	better		2	better	
	2			1		
	M = 3.3			1.6		
Bradley	3		Mrs Briggs	2		
	3	same		3	better	
	3			2		
	M = 3			2.3		
Charles	1		Dr Chadwick	2		
	2	worse		3	worse	
	M = 1.5			2.5		
Diana	3		Prof Dymond	–		
	3	better		–		
	1			2		
	M = 2.3					
Ewan	3		Dr Eustace	1		
	1	worse		1	worse	
	3			2		
	M = 2.3			1.3		
Freddy	1		Prof Forsdike	2		
	2	worse		2	same	
	2			2		
	M = 1.6			2		
Greg	2		Dr Green	2		
	2	same		3	worse	
	2			4		
	M = 2			3		

$\leq$ 16 $\leq$ 14.7

Supervisors

Sciences N = 4 M = 2   M = 2

Arts   N = 3 M = 3   M = 2.3

Students' satisfaction with supervision

1 Very Satisfied, 2 Satisfied. 3 Neutral, 4 Dissatisfied

Adam	1	3		
	2	2		
	3	3	worsened	2.7
Bradley	1	2		
	2	2	same	2
	3	2		
Charles	1	4		
	2	4	same	4
	3	4		
Diana	1	2		
	2	3	improved	2.3
	3	2		
Ewan	1	3		
	2	2	improved	2.3
	3	2		
Freddy	1	1		
	2	2	worsened	2
	3	2		
Greg	1	2		
	2	2	worsened	2.3
	3	3		

18.2

$$\sigma_{\leq 1} = 2.4$$

$$\sigma_{\leq 2} = 2.3$$

$$\sigma_{\leq 3} = 2.6$$

N = 7

better	2
same	2
worse	3

N.B. Charles who was dissatisfied, dropped out.

Supervisors' satisfaction with attitude to supervision

1 Very Satisfied, 2 Satisfied, 3 Neutral, 4 Dissatisfied

Prof Andrews	1	1		
	2	1	same	1
	3	1		
Mrs Briggs	1	1		
	2	1	worse	1.3
	3	2		
Dr Chadwick	1	3		
	2	2	better	2.5
	3	-		
Prof Dymond	1	-		
	2	2		
	3	-		
Dr Eustace	1	1		
	2	1	same	1
	3	1		
Prof Forsdike	1	1		
	2	1	worse	1.3
	3	2		
Dr Green	1	1		
	2	1	worse	1.6
	3	3		

10.7

$$\sigma_{\leq 1} = 1.5$$

$$\sigma_{\leq 2} = 1.25$$

$$\sigma_{\geq 3} = 1.6$$

N = 6

better   1

same   2

worse   3

Development

1 Very Satisfied, 2 Satisfied, 3 Neutral, 4 Dissatisfied

Adam	1		Prof Andrews	1	
	1	same		1	same
	1			1	
M =	1			1	

Bradley	4		Mrs Briggs	2	
	2	better		2	better
	1			1	
M =	2.3			1.6	

Charles	2		Dr Chadwick	1	
	3	worse		4	worse
M =	2.5			2.5	

Diana	3		Prof Dymond	-	
	2	better		-	
	1			2	
M =	3				

Ewan	2		Dr Eustace	2	
	2	same		2	same
	2			2	
M =	2			2	

Freddy	2		Prof Forsdike	2	
	2	same		1	better
	2			1	
M =	2			1.3	

Greg	1		Dr Green	3	
	2	worse		2	better
	2			2	
M =	1.6			2.3	

Σ 14.4 Σ 12.7

Analysis of Grids

Introduction

Both principal components analysis and cluster analysis yield two

matrices giving similarity measures. One is an element matrix which

matches, or correlates, every element with every other element; and

the other a construct matrix, which gives the matching score, or

correlation, between every construct and every other construct. These

are not independent. Slater (1964) has shown that there is a close

structural relationship between the two matrices. Both elements and

constructs can be plotted in the same set of axes.

Constructs	1	2	3	4
1	x	80	10	15
2	80	x	20	08
3	10	20	x	75
4	15	08	75	x

Figure 3

In the above matrix (Fig.3) the matching scores between constructs 3

and 4 are high (75%) as are those between constructs 1 and 2 (80%).

But the relationship of construct 2 with 3 and 4 is very low, as it is

for construct 1. This suggests that these constructs form two pairs

which have very little relationship with one another.

Principal Components Analysis

Principal components analysis extracts the major dimensions, or components, of the matrix of the relationships between the elements and the constructs. This analysis also provides the contribution which each of the components makes to the description of each of the elements or constructs. These contributions are frequently referred to as loadings or weightings.

This method uses a well established mathematical treatment. It is both powerful and economical in the sense that the components are independent of each other (uncorrelated) and hence they comprise the minimum set necessary to locate any individual element or construct.

However, the drawback to the component analytic method is that the data are transformed. It becomes difficult to explain to a non-mathematical person how their entries in a grid table have become points in N-dimensional space. Indeed, the concept of N-dimensional space is itself fraught with difficulty for the mathematically naive.

Cluster Analysis

Cluster analytic techniques make no such demand on the participants. The data displayed comprise the actual digits which they themselves selected for the original grid, totally untouched by algebraic sleight of hand.

This method extracts groups, or clusters, of similar items instead of major components. It is based on multi-dimensional scaling and the patterning of the original data can be shown to the participants. This form of analysis provides information concerning the relationship between items without the detailed measurements. What is being described is that

A and B are more closely related than C and D without measuring exactly how close A and B are. This analysis orders the distance between items, without making assumptions about the size of the intervals.

Thus, the main difference between principal components and clustering as methods of analyses is that the former searches out the hierarchy of independent dimensions of maximum variation and treats these in a manner analogous to the dimensions of latitude and longitude. A town (or an element or construct) may be identified with reference to its co-ordinates. The latter relies on building up a series of hierarchical groups created so as to minimize the distance between group members and to maximize the distance between groups.

Hierarchical cluster analysis gives the relationships but does not describe the links between those relationships. So that although we may know that A and B comprise one cluster (AB) and C and D comprise another cluster (CD) we know nothing about the relationship between (AB) and (CD) unless they should happen to comprise the higher level structure (ABCD). In addition McQuitty's (1960) method gives information concerning con-structs which are similar to each other, but does not clarify which ends of the construct poles go together.

Focus

A modification of McQuitty's program was used to analyse the postgraduates' grids. Focus is a computer program devised by Shaw and Thomas (1978) which goes some way towards providing links between relations.

The Focus program re-orders the elements to highlight similarities in the way in which they are construed and also re-orders the constructs,

using matching scores in both cases. Unlike the correlations used in
the earlier programs described above, these matching scores are derived
from counting the sum of the differences between pairs of columns
(Elements) or rows (Constructs). As correlations usually assume a
normal distribution of scores, it is statistically safer to use this
matching method which refrains from making such assumptions. These
matching scores form the basis for the hierarchical linkage analysis
used in the program. An example of the matrices developed in this
way is given below using the technique described by Shaw and McKnight
(1981).

Raw Grid						
Elements	1	2	3	4	5	
C 1	5	5	4	4	3	
o						
n 2	2	1	3	1	3	
s						
t 3	4	5	2	4	3	
r						
u 4	1	1	2	1	3	
c						
t 5	3	1	3	1	3	
s						

Elements Matching Scores Matrix				
	2	3	4	5
1	4	5	4	6
2	–	9	2	10
3		–	7	3
4			–	8
5				–

Figure 4

Figure 5

Construct Matching Scores Matrix

Constructs	2	3	4	5
1	10	3	13	10
2	-	10	2	1
3		-	10	9
4			-	3

Figure 6

Focus Matrix

Elements

Constructs	5	3	1	2	4
3	3	2	4	5	4
1	3	4	5	5	4
4	3	2	1	1	1
2	3	3	2	1	1
5	3	3	3	1	1

Figure 7

The element matching scores matrix (Fig.5) shows at a glance how close the various elements are to each other. The smaller the difference the greater the match. This is because zero means that the elements are rated identically on all constructs. The largest possible difference is 20 when there are 5 elements rated on a 5-point scale. 2 means there is almost total similarity and 10 means very little similarity. This matrix shows where constructs agree. When constructs C_1, C_2 agree, it means that whenever the individual experiences A as C_1, she also experiences A as C_2. This means that those constructs C_1 and C_2 are being used in a similar way by the individual.

The construct matching scores matrix (Fig.6) shows how close the constructs are to each other. It shows where elements agree. When elements E_1 and E_2 agree it means that whenever the individual experiences E_1 as something 'C' she also experiences E_2 as something, construct 'C'. This means that those elements E_1 and E_2 are very like each other.

Elements in one cluster tend to have high ratings on one set of constructs and another cluster of elements have low ratings on the same set of constructs. Alternatively, one set of elements has high ratings on one cluster of constructs and low or intermediate rating on another cluster of constructs.

An important difference for the construct matching score matrix is that, as constructs are bi-polar, a large difference score would be as significant as a small one if the poles were reversed. In this case a difference of zero would mean the same as a difference of 20; a difference of one the same as a difference of 19 and so on.

Core

Figures 8 and 9 represent a grid with five elements and four constructs on two occasions. By comparing the two grids, it can be seen that element 5 ratings have changed very little compared with the change on element 1 ratings. From this a matching score matrix for elements can be obtained which highlights the different matching scores for each element with itself.

		Grid at time 1						Grid at time 2 (6 months later)				
Elements		1	2	3	4	5		1	2	3	4	5
C												
o	1	3	4	1	5	4		5	2	3	5	4
n												
s	2	2	3	4	3	5		4	2	4	3	5
t												
r	3	4	5	2	5	3		2	2	3	4	3
u												
c	4	3	3	4	3	3		4	3	4	1	5
t												
s												

Figure 8	Figure 9

The same can be done for constructs by holding the elements constant
and entering two sets of ratings along each construct (one set being the
ratings on one occasion and the second the ratings obtained on a subse-
quent occasion) in the same raw grid.

THE GRIDS

The raw grid is at the top right hand corner of the Focused grid on each of the pages that follow.

The differentiation scores are shown at the lower right of the page.
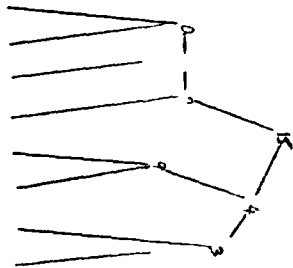
Help me to understand others/myself
Analytical activities/Creative leap
Interdependent with others Relying on myself
Passive intellectually Intellectually active
Easy / Difficult
Most like to do /Least like to do
High fulfillment/ Low fulfillment
Grow and develop through immediate feedback/
Long term result

	1	2	3	4	5	6	7	8
1	3	2	4	1	5	4	4	
2	4	3	4	2	3	4	4	
3	1	3	1	4	2	2	1	
4	3	2	2	3	4	4	2	
5	3	1	2	4	4	2	1	
6	5	1	4	4	1	2	3	
7	3	5	1	4	6	4	3	
8	4	2	1	2	3	2	2	5

Synthesize theories
Deal with student s
Meeting with supervisor
Reading
Thinking
Making conjectures
Writing
Devise tests

	2	5	4	6	7	3	8	1
1	2	2	2	3	4	5	4	3
2	1	4	3	2	4	5	4	3
3	1	3	3	2	2	4	4	4
4	2	4	2	2	2	4	4	4
5	1	4	2	3	2	1	2	3
6	1	4	2	2	4	4	4	3
7	1	2	2	2	2	1	3	5

1X1-1/84 - 0.02

Easy /Difficult
Immediate Feedback/Long term result
Most like/least like
High degree of fulfillment/low fulfillment
Active/Passive
Self reliant/interdependent
Creative/Analytic
Helps me to understand myself/to understand others
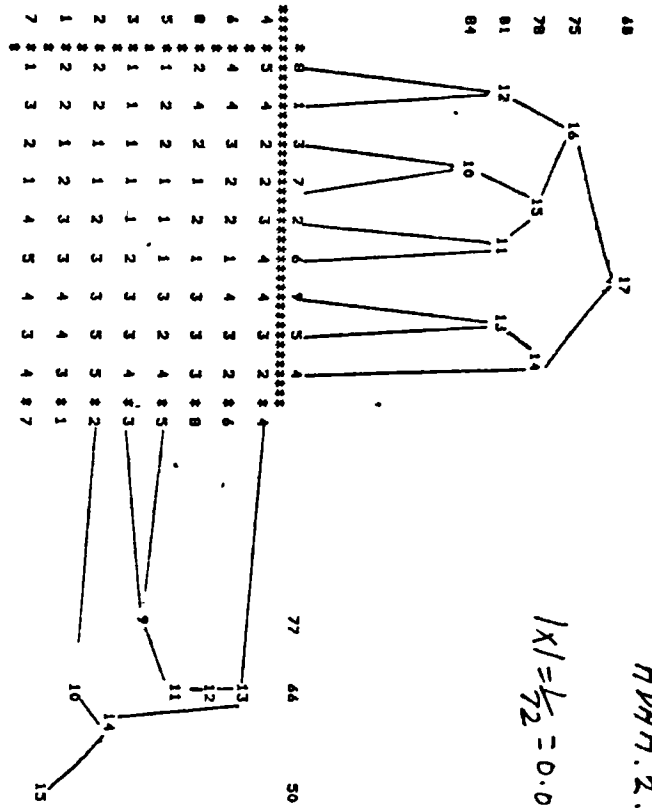
Writing
Devise tests
Making conjectures
Thinking
Synthesize theories
Reading
Observe
Deal with students
Meeting with supervisor

ADAM.2.

$|X| = \frac{1}{72} = 0.01$

17

ADAM 3.

$$|x| = \frac{1}{72} = 0.01$$

Helps me to understand myself/to understand others

Most like to do/Least like to do

High degree of fulfillment/Low degree of fulfillment

Active intellectually/Passive intellectually

Relying on myself/Interdependant with others

Creative leap/a alytical activities

Difficult/Easy

Long term result/Grow and develop through immediate feedback

Reading

Think ng

Makin Conjectures

Writing

rganize sequen e of ideas

S thesize the ries

se t sts

pd e

Meeti g w   erv s r

APPM.4.

$$|x| = \frac{1}{56} = 0.02$$

Active/Passive
Hi Fulfil/Lo Fulfil
Most Like/Least Like
Easy/Difficult
Imm. Feedback/Long Term Result
Understand Others/Understand Myself
Inter-Depen./Self-Reliance
Analytic/Creative
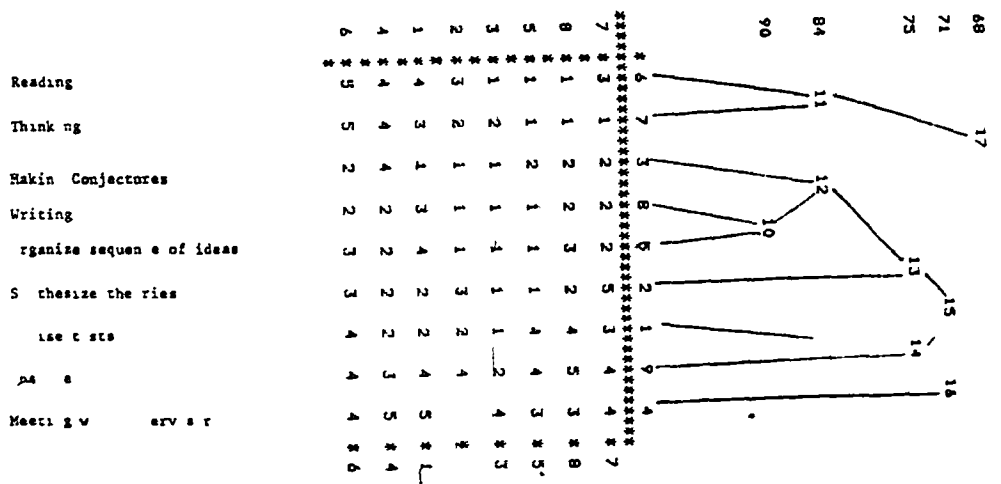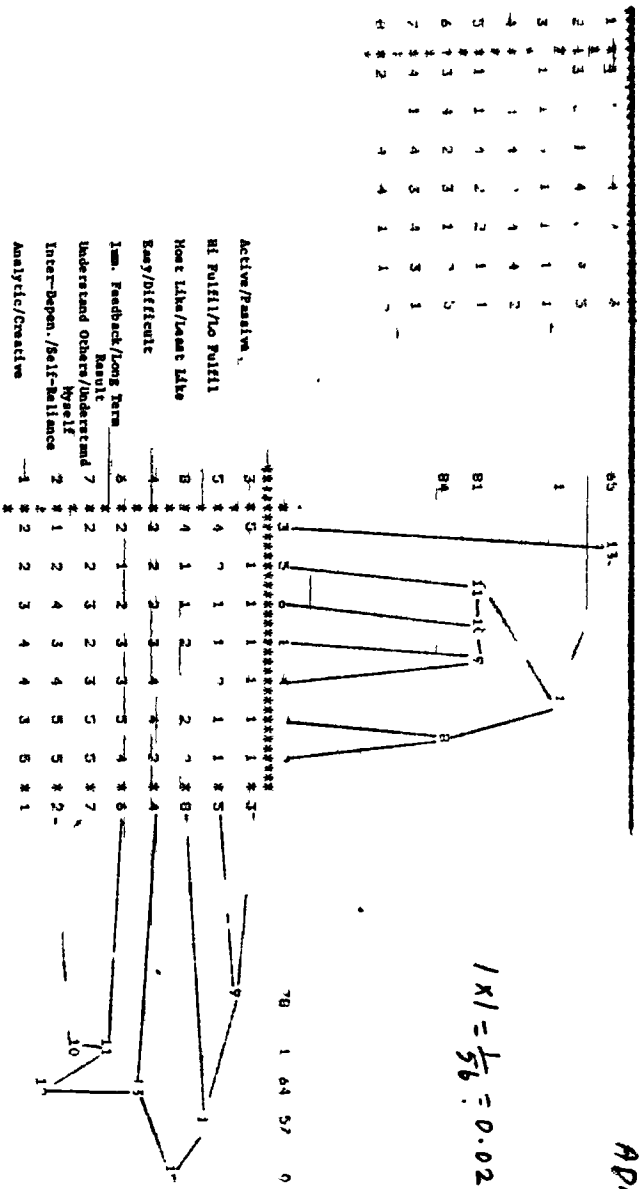
Meeting with Supervisor
Reading
Thinking
Synthesize Theories
Organize sequence of ideas
Writing
Making Conjectures
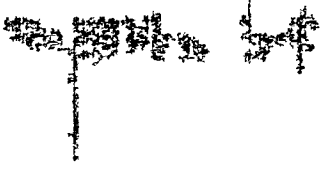
Internal expectation/Necessary for career

Understand others/Understand myself

Analytic/Creative

Immediate feedback/Long term result

Most like/Least like

High degree of fulfilment/Low degree of fulfilment

Active intellectually/Passive

Self reliant Interdependant with others

Difficulty/Easy

Meeting with supervisor

Reading

Synthesize theories

Think ng

Making conjectures

Writing

Pat e e and perseverance

Organize sequence of ideas

Helps me to understand myself/Helps me to understand others

Difficult/Easy

Relying on myself/Interdependant with others

High degree of fulfilment/Low degree of fulfilment

Active intellectually/Passive intellectually

Grow and develop through immediate feedback / Long term result

Most like to do/Least like to do

Internal expectation/Necessary for career

Creative loop Analytic activities
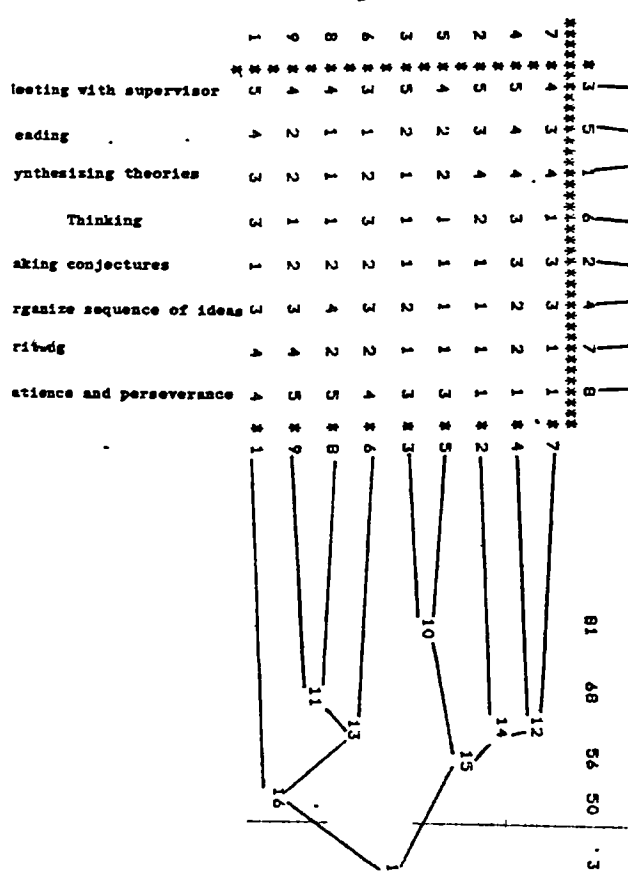
	Meeting with supervisor	Reading	Synthesizing theories	Thinking	Making conjectures	Organize sequence of ideas	Writing	Patience and perseverance

81   68   56   50   .3

Possibility of terminating/
Acceptance of research

Non-professional life/Professional activity

Home/College

Important for me only/Concerns discussions with
others

Private activities/External discipline

Natural inclinations/Self-discipline

Fulfilling/Frustrating

In London/Anywhere

Intervention of
unprecendented event

Thinking

Avoidance of overwork

Reading

Writing

Setting and meeting
targets

Contacting others in the
field
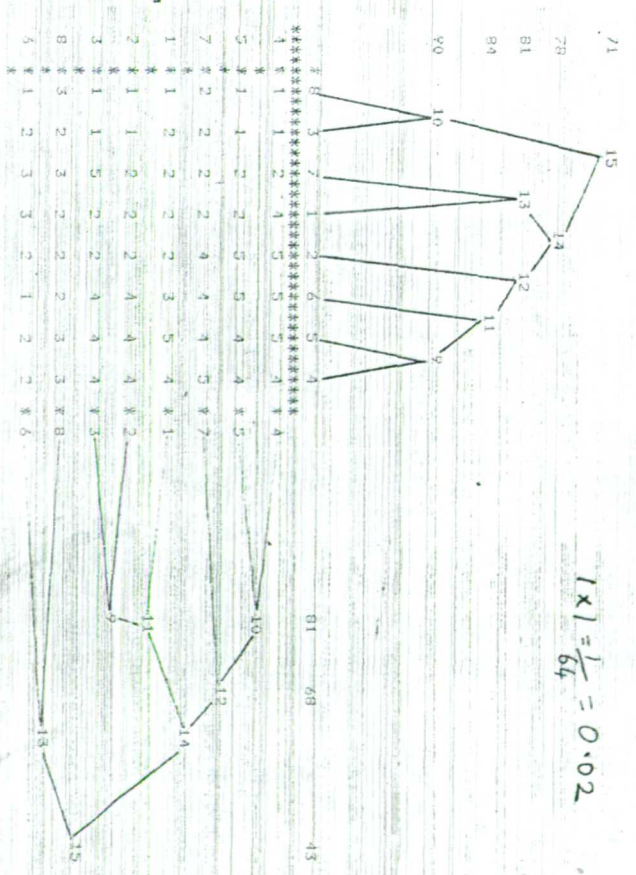
Seeing supervisor

$$|x| = \frac{1}{64} = 0.02$$

Important for me only/Concerns discussion with others

Home/College

Private activities/External discipline (heavy overlap)

Natural inclinations/Self-discipline

Non-professional life/Professional activity

Anywhere/In London

Fulfilling/Frustrating

Acceptance of research/Possibility of terminating

Speed/Retardation

Intervention of unprecedented event

Reading

Avoidance of overwork

Setting and meeting targets

Writing

Thinking

Contacting others in the field

Seeing supervisor

$1 \times 1 = \frac{1}{72} = 0.01$

Looking for n/l old back

Fulfill g/ ... ating

I pr ent f m o / n ms
di uss n others

Na ural in ..a ion /S if iso—

P ib l t f m a l y
A co e of ro o rch
vat act vit Ext rnal
discipline

l. / llega

Anyw ere/i l don

of per anent la o nco/Ot
te ora y porta ce

lon pr s a l a ' f as
- l act vity

In.er enti n of
unp recedented ovent

inking

R a n

I n l t oan
wor and n n—iork

ri ng

S tt & m ting
tar

K n u h
lat s ro rcn

Con ting t ers in
el

So g perv s r

83

$$|x| - \frac{1}{99} = 0.01$$

Looking forward/Looking back
Important for me only/Concern discussion with others
Private activities/External discipline
(Heavy overlap)
Fulfilling/Frustrating
Natural inclinations/Self discipline
Of permanent importance/Of temporary importance
Home College
Non professional life/Professional activity
Anywhere/In London
Irrelevant to academic career important for academic career
Possibility of termination/Acceptance of research

Avoidance of overwork

Intervention f unpre
   cedented event

Thinking

Reading

Writing

Setting and meeting
    targets

Keeping up with t
  lat st research in
  the field

Seeing upervisor

Contac ng thers a
    the f e

$$|x| = \frac{1}{110} = 0.01$$

Irrelevant to academic career/Important for academic career

Of permanent importance/of temporary importance

Private activities/External discipline

Important for me only/Concerns discussion with others

Home/College

Possibility of terminating/Acceptance of research

Non-professional life/Professional activity

Anywhere/In London

Natural inclinations/Self discipline

Frustrating/fulfilling

Looking back/Looking forward

Intervention of unprecedented event

Reading

Thinking

Balance of work and non-work

Writing

Seeing & meeting targets

Keeping up with latest research

...ating the s in the field

...ing supervisor

Concerted work the is

90   80   70

TREE FOR CONSTRUCTS
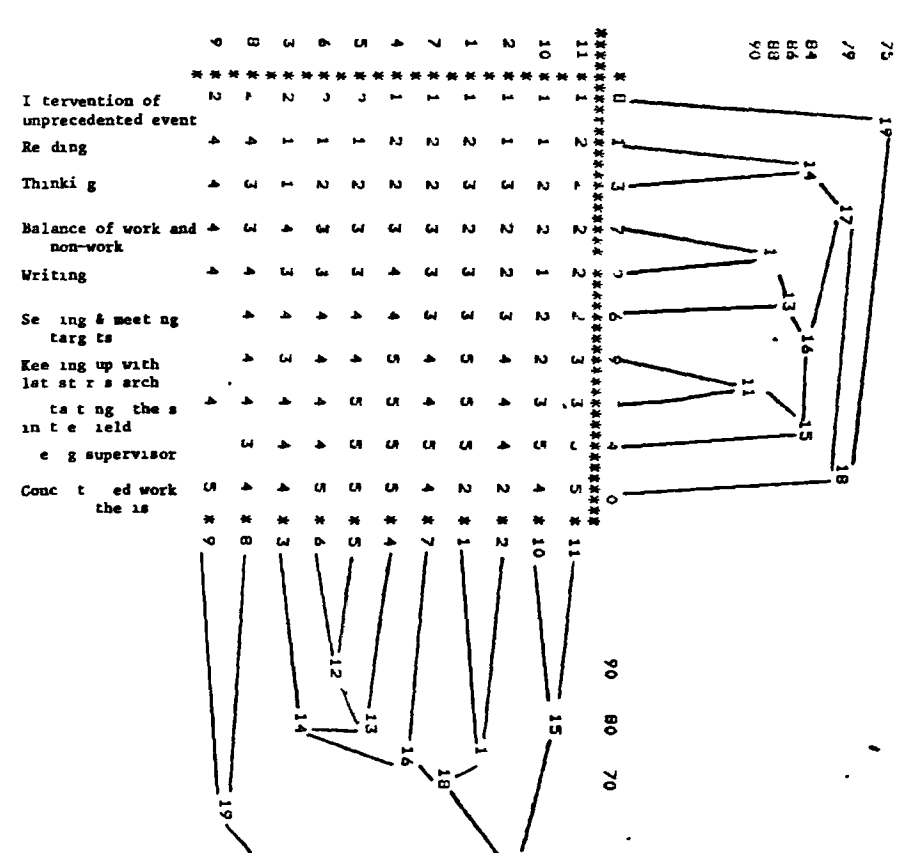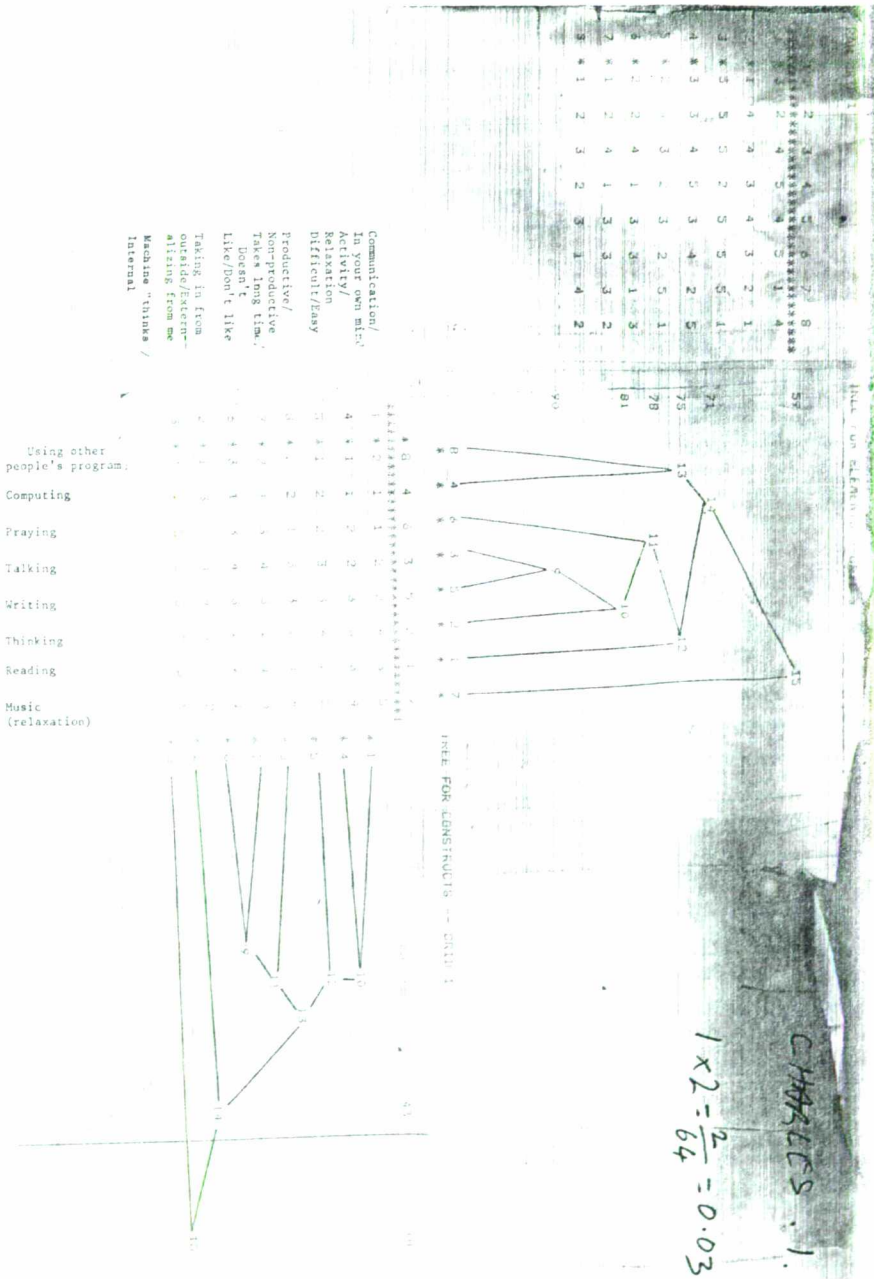
Communication/
In your own mind
Activity/
Relaxation
Difficult/Easy
Productive/
Non-productive
Takes long time/
Doesn't
Like/Don't like
Taking in from
outside/Extern-
alizing from me
Machine "thinks"/
Internal
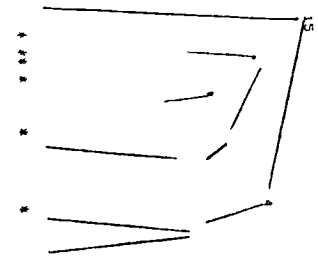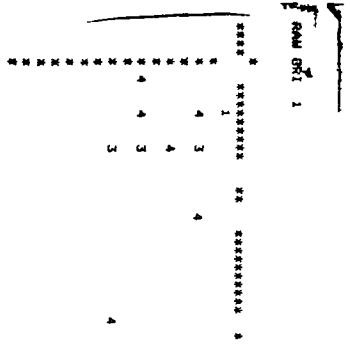
Using other
people's program

Computing

Praying

Talking

Writing

Thinking

Reading

Music
(relaxation)

RAW DATA 1

Pro ct ve/N n produ tive
Diffi ult ea
A t ty Re xx i n
Ta a lo g ti /D es t take long
Taki g l r tei e t a l
iro my f
Me ne ka int rnal
u t l like
l) ao nd

Comp ting

Rea ing

Th k ng

Pr ing

Tal ng

W ing

Mus c a

CHARLES . 2.

$1 \times 2 = \frac{2}{64} = 0.03$

CHARLES.3

$|X| = \frac{6}{64} = 0.02$

Doesn't take a long time Takes a long time

Easy/Difficult

Not productive/Productive

Relaxation/Activity

I your o mind communication

Like it/like

Inter V/ Male 'thinks'

Thinking from outside Externalizing from m if
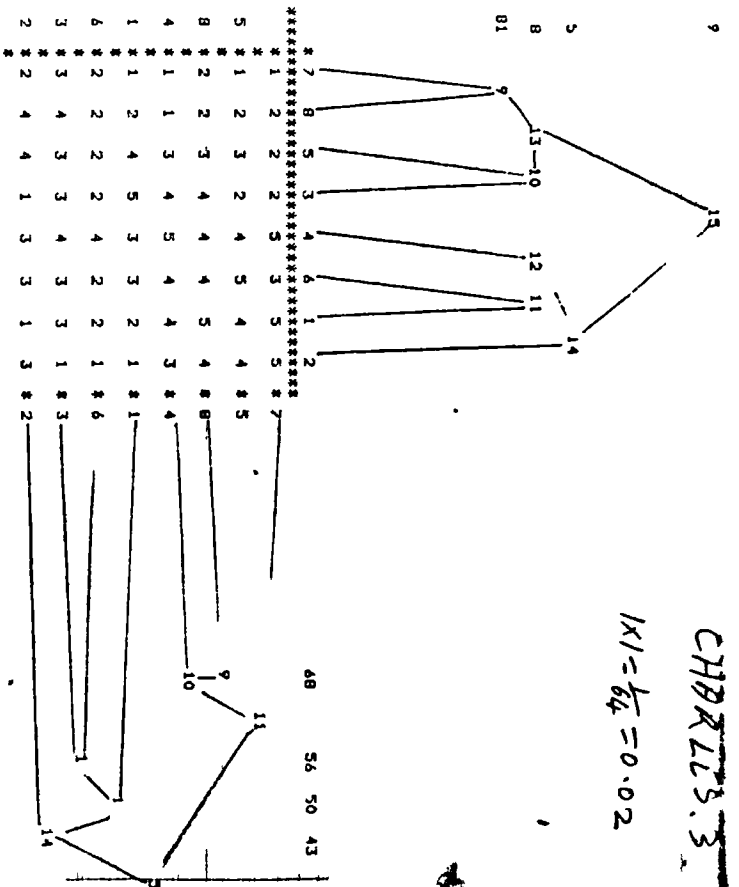
Music relaxation

Music playing

Writing

Talking
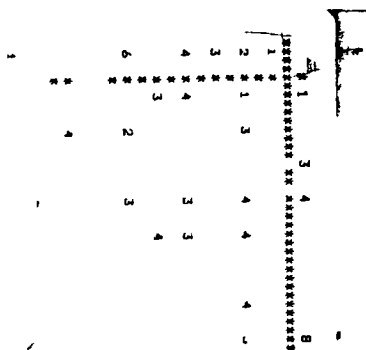
...ting

P

R a   g

Thinking

48   56   50   43

CHARLES. 4.

$|X_2 = \frac{?}{8?} - 0.03,$
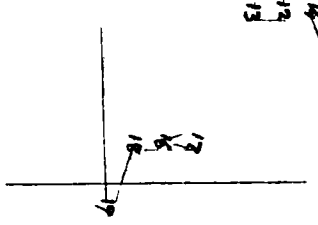
Before experiment/After experiment

Validity of expt. assumed/Validity of expt. assured

Formulating hypotheses/Making conclusions

Almost same thought process mechanical rather than thought conclusions

Reference to literature/None

Involves reading/Involves writing

Difficult/Easy

Time consuming/Quick

Present written conclusions
Present conclusions verbally
Check experiments
Be able to interpret results of experiment
Think of relevant expts t test hypothesis
Pick out item from literature that needs investigating
Survey literature and keep up to date
Carry out experiment

$1 \times 2 - \frac{2}{64}$ 0.03

Reference to literature/None

Time consuming/Quick

Difficult/Easy

(Thought) Almost same process/Mechanical rather than thought

Making conclusions/Formulating hypotheses

Involves reading/Involves writing

Before experiment/After experiment

Validity of expt. assured/assumed

Carry out experiments

Learn new techniques

Check out item from literature that needs ... gation

Think of relevant expts to test hypotheses

Survey literature and ...

Ability to interpret results ...

the experiments

Present conclusions verbally

... written ...

$|X| = \frac{1}{72} = 0.01$
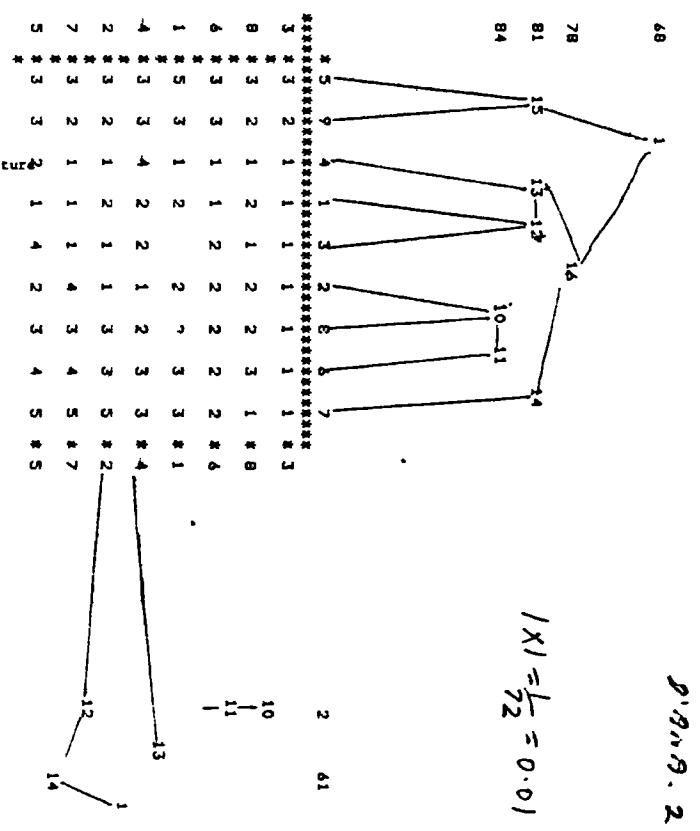
$$|X| = \frac{1}{90} = 0.01$$
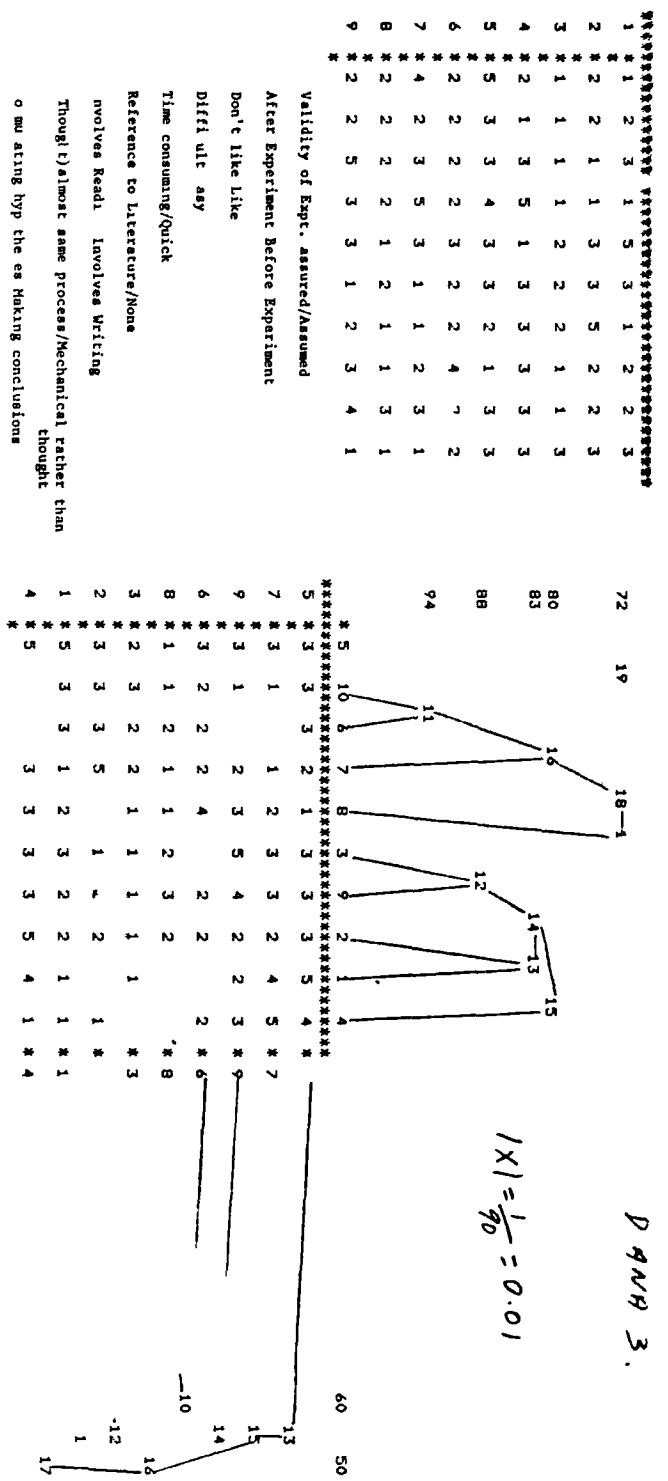
Validity of Expt. Assured/Assumed
After Experiment Before Experiment
Don't like Like
Difficult Easy
Time consuming/Quick
Reference to Literature/None
Involves Reading Involves Writing
Thought almost same process/Mechanical rather than thought
o mu ating hyp the es Making conclusions

arry ut experiments

Present papers at scientific me ti gs

Pres t u i ns
rba

res n wri n
lusi ns

e xperiment

u lit r t and
ke up t d te

rn new te i ues

e a t terpret
s f xper ment

t xpt
t t t h s
ck l em f om t at
t t
ng

Quick/time consuming

Before experiment/after experiment

In olves reading/involves writing

Reference to literature none

(Thought) almost same process/mechanical
rather than thought

Difficult/easy

Validity of experiment assured/vali ty of
e p r me t ssume

Making conclusi n f rmulating h pothe es

Like/don't like

Carry out experiments

Self confiden

Be able t   rp e
res ts f experiment

Ch ck xperiments

Pre ent writ   cl ons

Pre n pap r at scient fi
meet gs

Pre ent on us
ver lly

Lea new t   s

Survey l ra ure   d k
up t ate

P ck l m f   l r t
tha ne   gation

 ink f r evant xperim
ents t te t   s

$1 \times 3 = \dfrac{3}{99} = 0.03$

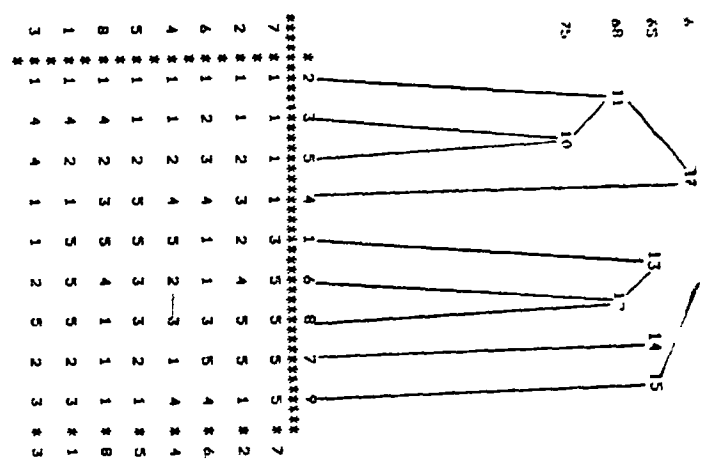$1 \times 3 = \frac{-3}{108} = -0.03$

Need thought/tells if on right path.

Gather information/giving out information.

To do with understanding/ability to use what is understood.

Ability to notice mistakes important/reproduce ability

Te hnique imp ant mere recording.

Ta e a long time/quick.

La orious/e oy
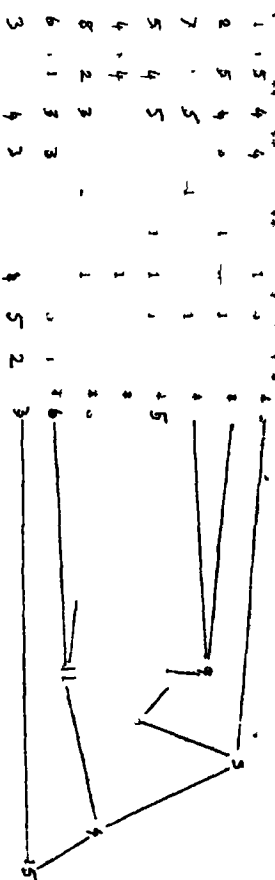
P itive feed a k own initiative.

Complete write up.

Linking literature and
        measurements.

Good rela ons ip w h
        supe s

Interpret results.

Thinking abo t what you ve
                read.

Carry out measurements.

Reading.

Obtain results.
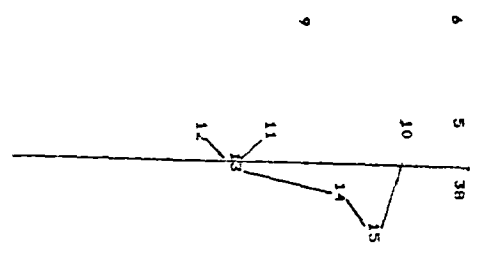
EWAN

$|X| \cdot \frac{1}{64} = 0.02$

To do with understanding/Ability to use what is understood

Gather Information Giving out information

Enjoy/Laborious

Technique important/Mere recording

Ability to notice mistakes important/Reprod c ability

Quick/Takes long time

Needs thought/Tells if on right path

Own initiative o itive feedback

Carry out measurements

Reading

Interpret Results

Think about what you've read

Obtain results

Linking literature and measurements

Good relationship with supervisor

Complete write-up

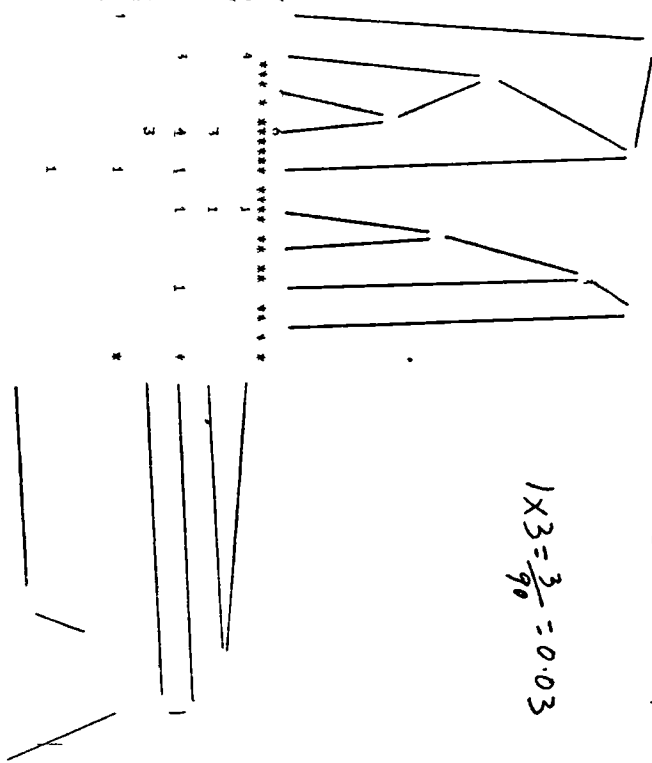Knowledge of an ther language

$$1 \times 3 = \frac{2}{72} = 0.04$$

Gather information/Give out information

Quick Takes a long time

Enjoy Lab rious

To do with understanding/Ability to
use what is understood

Ability to notice mistakes important/
Reproducibility

Technique important/Here recording

Needs th ught/Tells if on right p th

Own init ative/Positive feedback

Room for manoe vre/important

Interpret results

Obtain results

Carry out measurements

Thinking about what
y 've read

Reading

Good worki g relation-
s   wit sup.

Link ng literature and
me   ureme ts

Comp e e write-up

$|X| = \dfrac{1}{72} = 0.01$

EWAN. 4.

$1 \times 3 = \frac{3}{90} = 0.03$

Tells if on right path Needs thought
Positive feedback Own initiative
Here recording Technique Important
Enjoy Lab rious
Important Room for manoeuvre

To o with understanding Ability
  t use what is understood
Gat er inf rm tion Give o t
  informati n
1 k Ta es l g time
Reprodu ibility Ability to
  notice mistakes imp rta t
Tr ning suffi ient Need f r
  experience

arry   ut
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Thi ng   w
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Comp te wr -up

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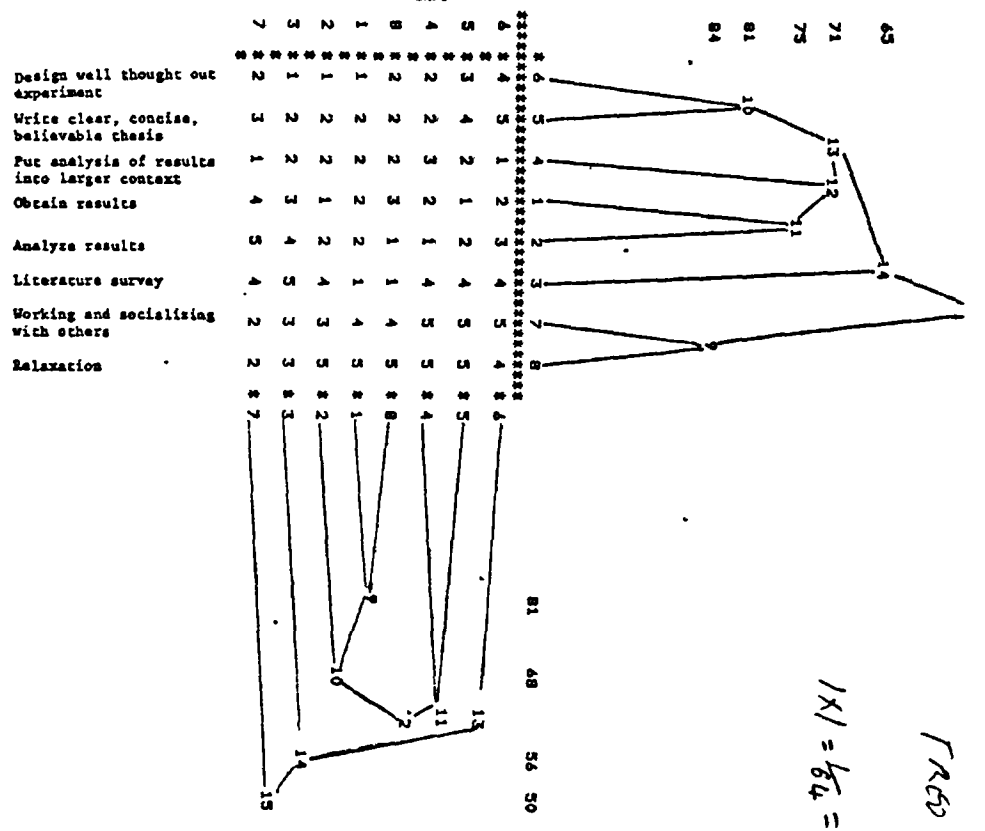
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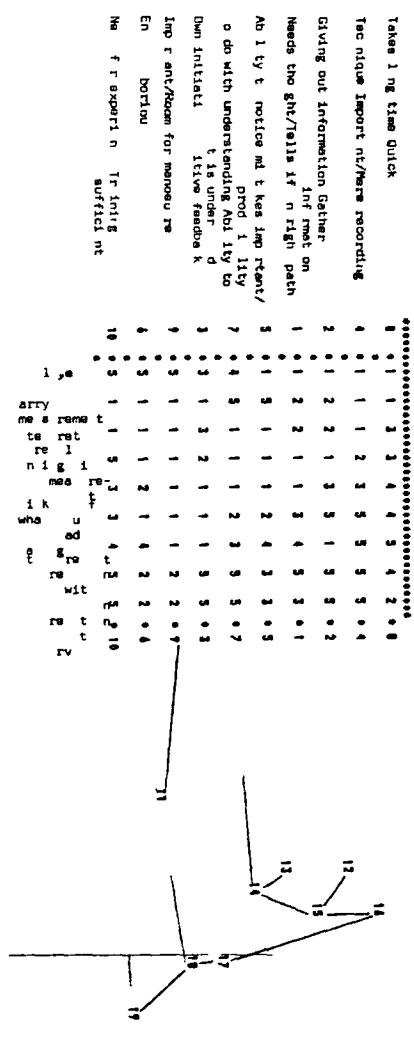
Scope for original thought/following other people's ideas.

Beneficial for career/unnecessary for career.

Linked to each other/not involved with work.

Has to be done/escape.

Boring/interesting.

Bulk of thesis/important but small in space occupied in thesis.

Numerate/no mathematical ability.

Knowledge of prior art/don't need knowledge of prior art.
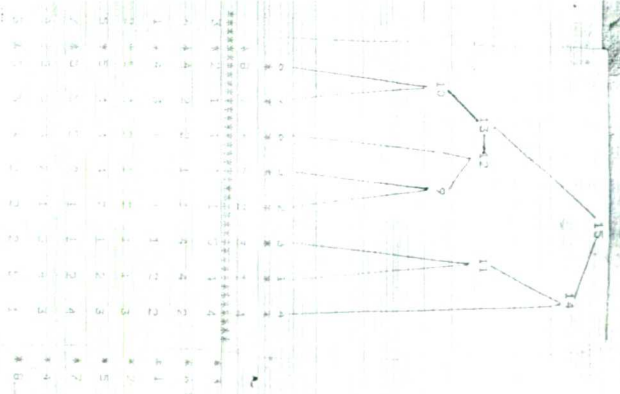
Relaxation.

Working and socialising with others.

Design well thought out experiment.

Writing clear, concise believable thesis.

Analyse results.

Literature survey.

Obtain results.

Put analysis of results into larger context.

$1 \times 1 = \frac{1}{64} = 0.02$

Unnecessary for career/beneficial to future career

Boring/interesting for me

Numerate/No need for mathematical ability

Knowledge of prior art/No need for prior knowledge

Linked to each other/Not involved with work

Has to be done/Escape

Scope for original thought/Following other people's ideas

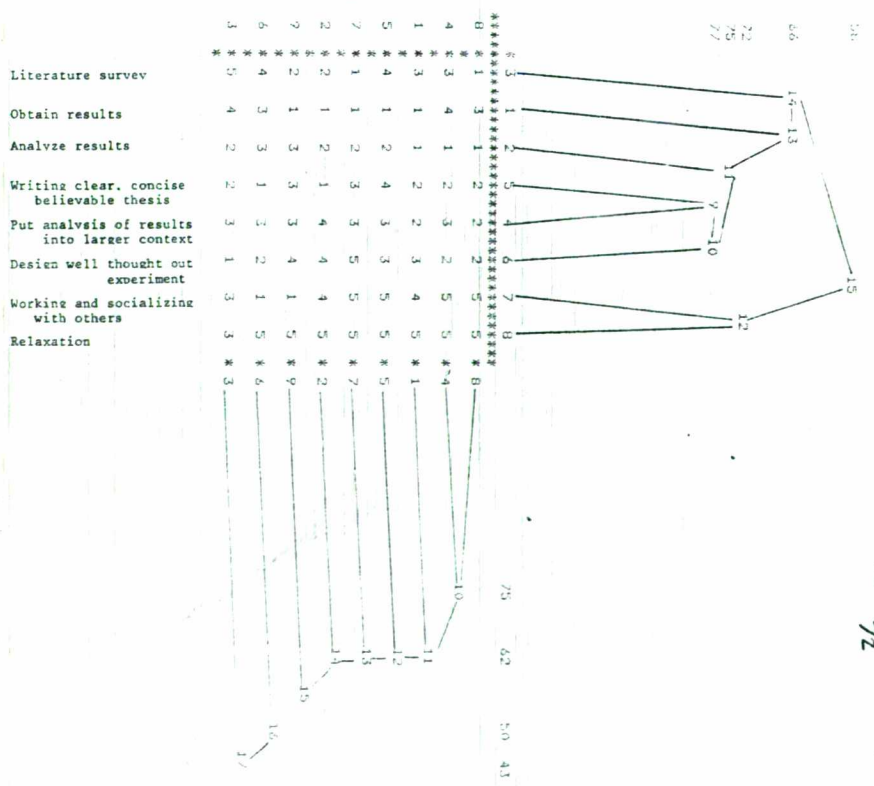Important but small in space occupied in thesis/bulk of thesis

Design well thought out experiment

Write clear, concise, believable thesis

Put analysis of results into larger context

Obtain results

Analyze results

Literature survey

Working and socializing with others

Relaxation

$|x| = \frac{64}{84} = 0.02$

$1/X) = \frac{1}{72} = 0.01$

Knowledge of prior art/Don't need prior knowledge
Numerate/no need for mathematical ability
Linked to each other/not involved with work
Boring/Interesting for me
Bulk of thesis/Important but small in space occupied in thesis
Has to be done/Escape
Laboratory time/My own time
Beneficial to future career/Unnecessary for career
Scope for original thought/Following other people's ideas
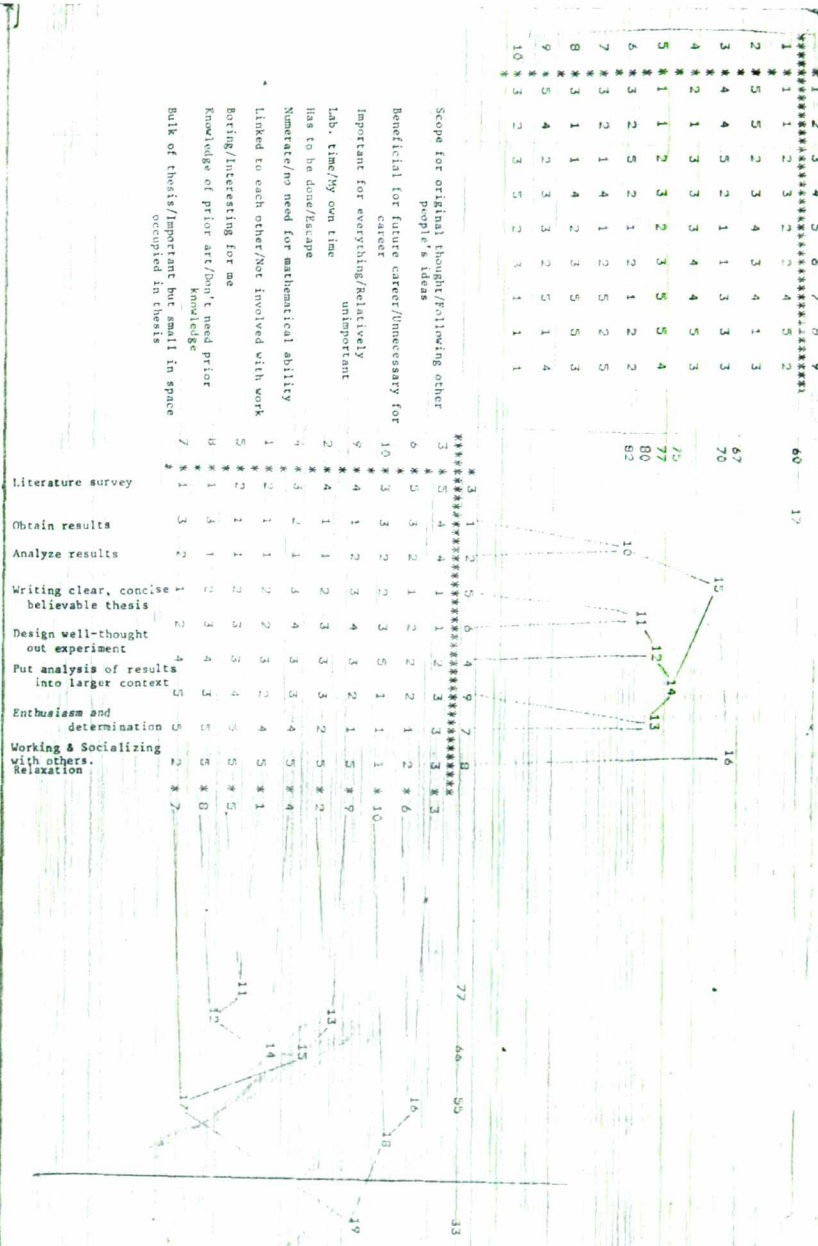
Literature survey

Obtain results

Analyze results

Writing clear, concise believable thesis

Put analysis of results into larger context

Design well thought out experiment

Working and socializing with others

Relaxation

Scope for original thought/Following other
    people's ideas

Beneficial for future career/Unnecessary for
    career

Important for everything/Relatively
    unimportant

Lab. time/My own time

Has to be done/Escape

Numerate/no need for mathematical ability

Linked to each other/Not involved with work

Boring/Interesting for me

Knowledge of prior art/Don't need prior
    knowledge

Bulk of thesis/Important but small in space
    occupied in thesis

Literature survey

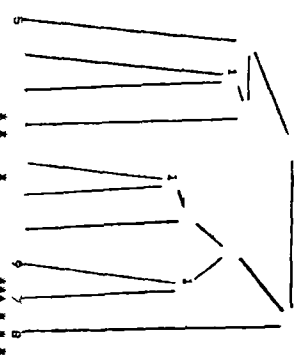Obtain results

Analyze results

Writing clear, concise
    believable thesis

Design well-thought
    out experiment

Put analysis of results
    into larger context

*Enthusiasm and
    determination*

Working & Socializing
with others.
Relaxation

/X/ 100-0.01

Knowledge of prior art/Don't need prior knowledge
Numerate/No need for mathematical ability
Beneficial to future career/Unnecessary for career
Linked to each other/Not involved with
b t: My own ti e work
Has to be done/Escape
of t e s Importa , but s all in
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Relatively unimportant/important for
e e thing
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Obtain results

Analyse results

Literature survey

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    int a ger c iex

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    exp rime t

a t iase & de rmi   on

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z axation

GREG. 1.

$1 \times 3 = \frac{3}{64} = 0.05$

All to do with people: Directly Ph.D./more indirect

Almost mechani al process not automatic

Self as essent   Good at not good at

Like don't like

Can do anytime/To do with time

Creative/Not creative

End   Means

Not to do with people/To do with people

Th nking it out

Writing

Tak ng Notes

Reading

Attending classes

Getting on with tut rs

Kee ing th   work in
                    bounds

Organizing ime

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5 68   56   50   3   18
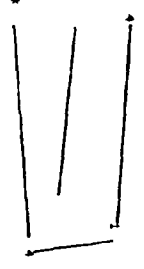
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                          2  3        4  5     6              8
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        *  3  2  1  2  +     3     3  1
  2  *  2  1  1  4  3  5  5  2
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  4  *  1  2  5  3  4  4  5
  5  *  1  1  5  2  2  4  5  3
  6  *  1  2  5  3  3  2  2  1
  7  *  1  1  4  3  3  4  1
  8  *  4  3  2  5  5  5  5  2
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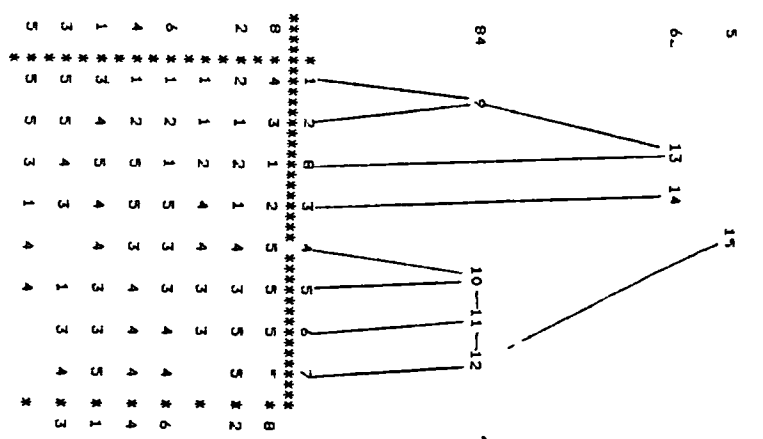
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(Self assessment)G od a Not

Like don't

Almost mechanical process/not automatic

C n do anytime/To do with time
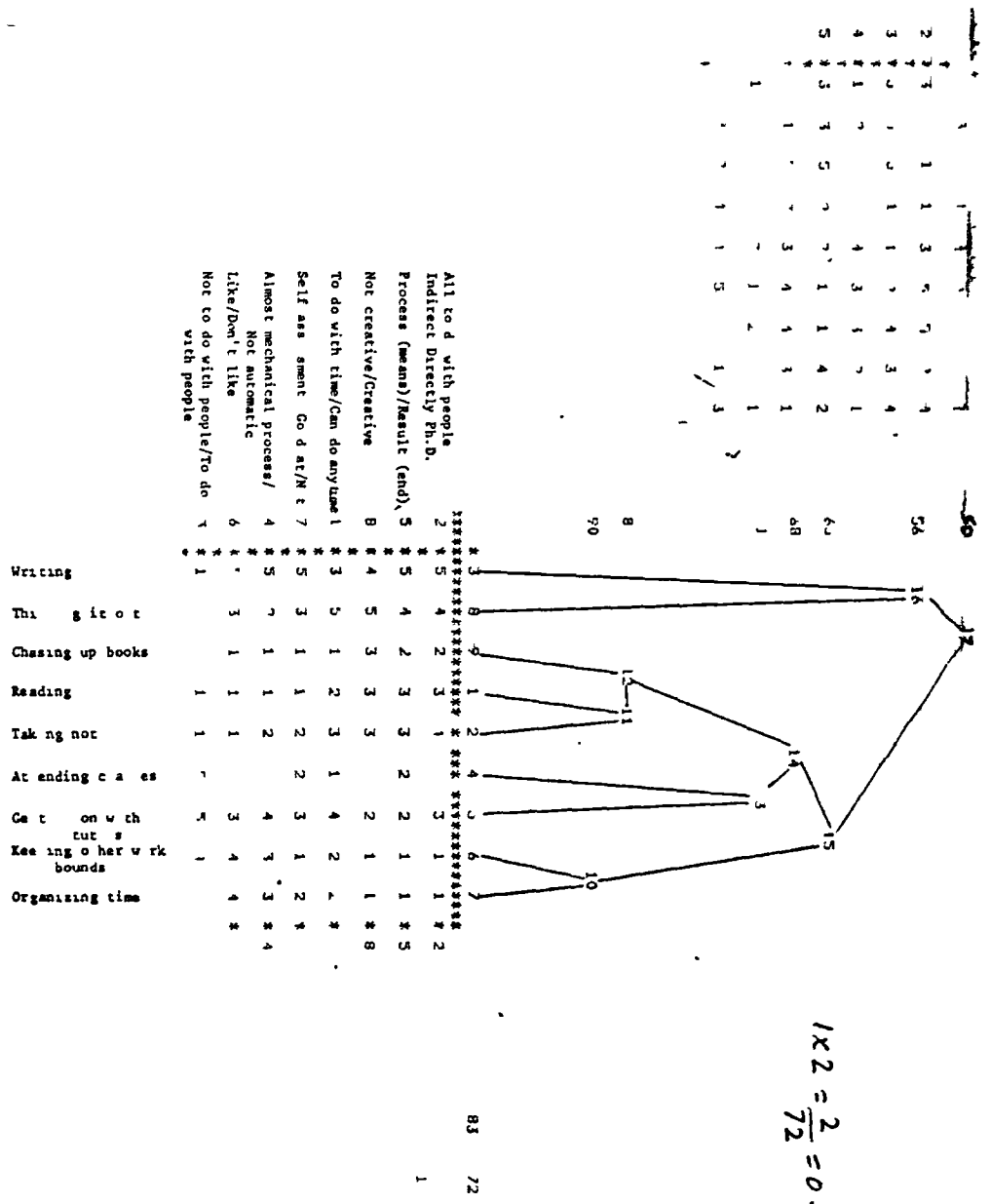
T do with people Not

End Means

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  4  *  4      4  3  3  4  5
  6  *  4  1  3  4  3  3  5  5
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  84 *      4  5  4  4  5  1
        *  3  1  4  4  6  2
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Reading

a   g Not s

Thinking it out

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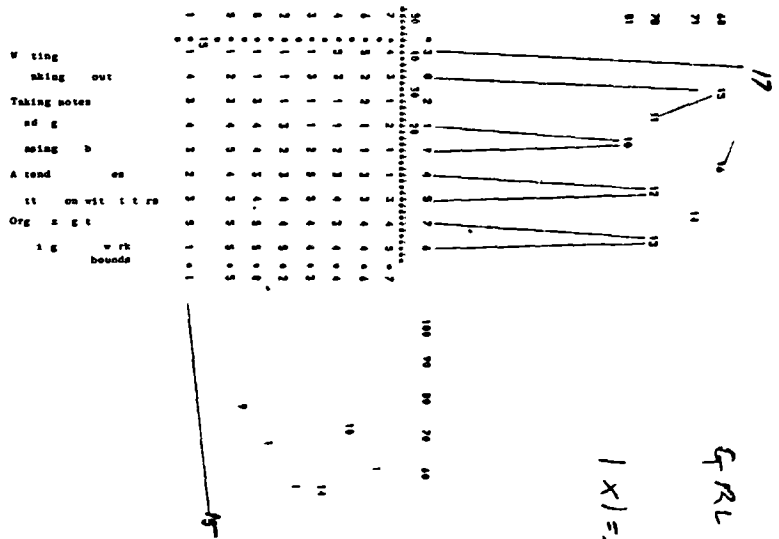
GR 6. 2.
1x1 4/64 - 0.02

All to do with people
Indirect Directly Ph.D.
Process (mean)/Result (end),
Not creative/Creative
To do with time/Can do anytime
Self assessment Good at/Not good at?
Almost mechanical process/Not automatic
Like/Don't like
Not to do with people/To do with people

Writing
Thinking of it
Chasing up books
Reading
Taking notes
Attending classes
Getting on with tutors
Keeping other work bounds
Organising time

$$1 \times 2 = \frac{2}{72} = 0.03$$

GREG. 4.

1X3 − 3/72 − 0.04

To do with time/Can do anytime

Not creative/Creative

Process (Means)/Result (End)

Like Don't like

Almost mechanical process/Not automatic

(Self Assessment) Good at/Not good at

(All to do with people) Directly Indirectly
for Ph.D

To do with people Not to do with pe ple

Keeping other work in
bounds

Organising time

Gett ng on with tutors

at ending class

Chasing p ks

Taki g notes

each t

Thi king it out

Writing

GRL Gr. 5.

$|x| = \frac{1}{72} = 0.01$

Education for research: the changing constructs of the postgraduate

ESTELLE M. PHILLIPS

The Open University, Design Discipline, Faculty of Technology, Milton Keynes, U.K.

The development of research skills was investigated in case studies of seven Ph.D. students and their supervisors. A combination of repertory grids and interviews was used to monitor changes over time. Focus and Core analyses, together with feedback sessions, helped to isolate specific areas of importance to the postgraduates.

Results indicated that (a) it was necessary for the students to develop an ability to evaluate their own work; (b) the pace of this development appeared to be related to the degree to which the students were allowed to remain dependent on their supervisors; (c) their enthusiasm for their Ph.D. diminished due to the length of time they had to spend working on a single problem.

In addition, it appeared that providing information from the repertory grid to the students helped them to learn from their experiences of the research training process.

Introduction

Very little is known about research at the postgraduate level or what it is that is being assessed when candidates are examined for the Ph.D. degree. The degree is conferred for work judged to make an "original contribution to knowledge" in the students' discipline but it is not clear what this requirement means in practice (Francis, 1976). There are no guidelines for students regarding how it is to be achieved, in fact what is involved in order for a student to produce the completed article is relatively unknown.

Students may eventually discover, at the time of their oral examination, what they have learned during the preceding years in terms of what it is that is needed to bring a research project to a successful conclusion. However, it is the end product which is being judged and upon which the decision concerning success or failure is taken.

Some concern has been voiced by supervisors of research students regarding current training for the Ph.D. degree (Wason, 1974; Baddeley, 1979). These comments, while valuable from the point of view of people who have themselves been involved in the process from both sides, are made without any systematic knowledge of the way in which students experience the training.

In order to acquire some information from the viewpoint of the students, rather than compare differences between successful and unsuccessful candidates, it was decided to pay attention to the process of research rather than to the final product. This is potentially a more illuminating approach, as it leads to an understanding of the requirements for completion of the research degree rather than merely revealing aspects of evaluation of the training based on eventual performance.

39

constructs. Table 1 lists the original eight elements and constructs† of those post-graduates discussed in this paper.

The grids were then analysed using the FOCUS program (Shaw & Thomas, 1978) and CORE program (Shaw, 1979). The FOCUS program prints out individual grids, re-ordered in such a way that relationships between elements and constructs are visible. The core program analyses two grids, comparing each element and each construct with itself and printing out those constructs and elements that have changed the most in the way the postgraduate is using them. These grid analyses were used to form the basis of a feedback session during which the postgraduates could comment on the information presented to them by the researcher.

Depending on which two grids were being discussed, it was possible to give the postgraduates information concerning changes in the way they thought about certain aspects of their work. The feedback session was the forum for discussing possible causes of changes in thinking about their work since they last completed a grid, or since they started the Ph.D., or since the same time a year earlier. In this way the postgraduates were helped to articulate, in some detail, aspects of their thinking about their work that had not previously been clearly defined.

Much of the data on which this paper is based results from postgraduates responses to the question "The way you think about . . . has changed in the last six months, (or since you started your Ph.D., etc.). Can you account for it?" from the researcher. By this means the changes in the students' views of their work, as they occurred during the three years, was monitored while the students explored issues of importance to them. The use of this grid-plus-feedback technique also helped the postgraduates to define their roles as research students.

This type of learning is rare during research degree training and it is clear that the two results of the feedback sessions must interact. Therefore, part of what is being produced in the research results is a direct effect of the methodology used. It is suggested, however, that the information acquired through these means is no less valuable for being the outcome of action research of a novel kind.

The first FOCUSed grid of one of the postgraduates, revealed that his elements "Synthesize theories", "Deal with student", "Meet with supervisor" and "Reading" were all seen in terms of being passive analytical activities which were interdependent with others and helped him to understand others. Similarly, his elements "Thinking", "Making conjectures", "Writing" and "Devising tests" were seen as intellectually active and creative, requiring him to rely on himself and helping him to understand himself.

When these links between elements and construct clusters were made explicit his reaction was one of extreme disappointment. Postgraduate 1 said that he completely recognized himself from the analysis and, therefore, had not learned anything as everything that had been said he had taken for granted for years. Once it was suggested to him that, on the strength of only one meeting, he had been presented with a picture of himself that he knew perfectly well but that the researcher had not known at all before then, he said that he found that "very impressive indeed". On this kind of testimony,

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† No grids are reproduced as the comments are derived from the Core analysis which compares pairs of grids, so that for each example of a single changed construct from only one postgraduate, two full FOCUSed grids would need to be given in illustration.

TABLE 1 (cont.)

	Elements	Constructs
Postgraduate 5	Reading	Concerns discussion with others/Important for me only
	Writing	Private activities/External discipline
	Thinking	Natural inclinations/Self discipline
	Seeing supervisor	Possibility of terminating/Acceptance of research
	Contacting others in the field	Non-professional life/Professional activity
	Setting and meeting targets	In London/Anywhere
	Avoidance of overwork	Home/College
	Intervention of unprecedented event	Fulfilling/Frustrating

which is not atypical, the analyses plus feedback sessions were taken to give an accurate picture of the way in which postgraduates perceived their situation.

The open ended interviews had already shown that the students' attitudes toward the Ph.D. changed as they came closer to the time for completion (Phillips, 1979) but the grid analyses and feedback sessions gave more detailed information. This was concerned with various aspects of their work, two of the main items being those to do with supervision and the students' relations with their Ph.D. project itself.

The student and supervisor relationship

The regular interviews had shown that the length of time it took for research students to become autonomous research workers was dependent upon the kind of supervision they received, but the grids made it possible to bring out the topic for further discussion with the postgraduate sample. The combination of the analyses of the grids and the feedback sessions revealed an inverse relationship between dependence on the supervisor and involvement with the work for its own sake.

The CORE analysis of his first two grids showed the most changed construct of postgraduate 1 to be Easy/Difficult (44°o match). Inspection of the two FOCUSed grids showed the way in which it had changed. In the first grid this construct had been quite separate from the others. In the second grid it had been linked to the constructs Most like to do/Least like to do and Immediate feedback/Long term results. When postgraduate 1 was asked about his reaction to the cluster Easy, Most like, Immediate feedback, he said "The obvious thing is the uncertainty and conviction of failure. I worry about doing the right thing and what others think."

Another cluster revealed by the FOCUS analysis of his second grid was the link at 84% of the elements Thinking and Making conjectures which were seen in terms of the constructs Intellectually active and giving a high degree of fulfillment. Postgraduate 1 responded to this information: "I get fulfillment from the intrinsic nature of the work". Here, after only one year, it was already becoming apparent that satisfaction from the work itself was balanced against the need for explicit information and approval from external sources

study for a research degree. At that time they had said either that it would allow them to make a personal contribution to their field or that it would enhance the choices open to them for their future career, or both. By the time they had reached their final year, the grids showed that the way in which the postgraduate sample thought about their Ph.D. had changed considerably.

The postgraduates had commenced their 3-year course full of enthusiasm, but once the research had been completed and they had only to write the thesis in order to complete the Ph.D. they spoke of wanting "to get it and forget it". What the grids typically reveal is illustrated in the following example taken from the end of the second year of one of the students.

Discussion of the several constructs that had changed since she had completed her first grid led her to comment "it's a totally different way of thinking because I'm aware that I've got only a year left and two years have already gone. Three years doesn't seem half long enough; it seemed a long time in the beginning." When she was shown that the element "Be able to interpret results of experiments" was grouped quite differently in her latest grid compared with all the preceding ones (FOCUS analysis) postgraduate 3 said "That is because I'm trying to finish off groups of experiments and say 'that's the answer' rather than exploring it more fully, which is what I used to do. Before I was aiming for 'the truth' now I'm aiming for results. I'm looking forward to finishing rather than doing the work for its own interest."

Unfortunately, this disillusionment was the rule rather than the exception with the postgraduates in the sample. Another student had originally seen his work resulting in a creative end product which would emerge out of the mechanical process of collating manuscripts. He was shown that the CORE analysis of his first grid and the one he completed $2\frac{1}{2}$ years later gave only a 56% match on the construct "Almost mechanical process/Not automatic". His response to this was "I'm really fed up with it right now, doing the mechanical things just goes on".

This was from an arts student but another science student, at the same stage in his degree course, reported during the grid feedback session that he had become more remote and detached. He said "in the beginning I had to concentrate hard on what I was doing, it completely occupied my mind. In some ways I've got less enthusiastic, all I want to do is finish and get out." Everything in the comparison of his first and latest grids pointed to the differences in his early and more recent perceptions of doing the Ph.D. He said "at first I was full of enthusiasm for work and work was going to be very important, but at the end other things gave me much more satisfaction. The work was boring and monotonous and I was waiting for it to be over and done."

These remarks from both science and arts postgraduates are similar in their reference to the repetitive nature of the work. The regular interviews had established that there was a growing disillusionment with and disinterest in the programme on which they had embarked so enthusiastically. The reason for this disillusionment and unrest only became clear when the discussion was based on the particular constructs that had changed within a certain period.

One postgraduate who changed to a more positive perception of his Ph.D. over the same period commented when asked about his reaction to the grid feedback sessions, "I might have formulated it differently, but I'm not surprised. It's a useful breakdown of the conceptualization of my gradual acquiescence." Evidence of this gradual acquiescence to complete the research and write the thesis comes from the CORE analysis of the two grids elicited during the first half of his final year. This postgraduate's construct

them. Although these issues had been partially explored in the regular interviews, it was only in the feedback sessions that the more subtle details were uncovered as a result of discussion regarding which elements and constructs had changed in a given period.

The interview data had already revealed that supervisory style directly affected the way in which the postgraduates approached their work (Phillips, 1979). The important additional information revealed by the grids was the connection between this and the postgraduates' appreciation that their own actions could be used to monitor their performance. Once they were able to make use of the informaton concerning their progress that was contained within their own work, they began to reflect on their own performance and evaluate it.

It is at this point that the students' perception of the supervisors' role changes. Instead of seeing it as one of primarily generating external approval and information, the supervisor becomes somebody with whom they can discuss new ideas and develop earlier thinking. The supervisor is used as a sounding board, as an expert with the ability to proffer the reverse arguments to be countered. The supervisory role is changed from one of tutor to that of colleague through the developing autonomy of the postgraduate.

This comes about as a result of the students' increased ability to evaluate their own work. The teaching of this skill, together with those needed to impose structure on the planning of projects, was what the postgraduates in the sample most needed at the start of their 3-year training in research. The changing constructs of the postgraduate involve an expectation of less direction from their supervisors and more guidance through the negotiation of suggestions originating from either the student or the supervisor.

The postgraduates' changed perception of the Ph.D. degree was also apparent from the interviews but it was only the grid analyses which resulted in the knowledge that it was mainly due to repetitive work and the monotony of concentrating on the same thing for an extended period of time. Also, the possibility of a link between supervisory style, developing involvement with work and increasing enjoyment of research is indicated by the equally definite, but encouragingly different, change in perception of the Ph.D. of one member of the sample.

There are indications from the comments of the students that the continuing use of the grid throughout their period of research helped them to isolate precise problem areas. This knowledge was often used by them either to decide upon a course of action or to define and understand the source of irritants which they had previously been unable to locate.

It is clear from these results that valuable insights can be acquired by both parties when series of grids are used as a tool to help understand changing attitudes and ideas from the point of view of the participants. This use of the grid technique permits straightforward negotiation of constructs that change over time between those being researched and the researcher. It may well be that it could be incorporated into the postgraduate educational plan as an instrument to help students and supervisors identify problems and develop strategies for a more humane training in the skills needed for successful research workers.

The PhD: Learning to do research

Estelle M. Phillips

I have been interviewing a small sample of post-graduate students and their supervisors, from a variety of disciplines and from two different universities, for a period of 2½ years. This investigation is concerned with what actually happens during the PhD research programme. Therefore, the open letter by Alan Baddeley (April, *Bulletin*) was of direct relevance to my work and my own experience of the British PhD system.

Baddeley discusses the system from within psychology and it is from within psychology that my interest in this area of higher education began, after reading an article on this very topic 5 years ago (Wason, 1974). However, I feel that if psychologists are to discuss the British PhD system as a whole rather than merely the system of obtaining the PhD in psychology, we need to have detailed information on the PhD system as it operates in other disciplines. Only then will we be in a position to compare our observations and experiences and make recommendations for improving the system at a general level.

My research sample includes students of nuclear physics, biochemistry, astronomy, architecture, English literature, industrial chemistry and mediaeval history. Of course, there are many differences which can be ascribed to traditional approaches to the arts or sciences, but there are also some general observations which may be made. It is here that the overlap with psychology occurs as documented by Baddeley (1979) and Wason (1974). In addition, 3 years ago a two-part article on the PhD was written by a professor of hydraulics after having been involved with the award of the degree in the area of civil and mechanical engineering (Francis, 1976a). The description he gave and the views he expressed are equally relevant to psychology and to my own findings from other disciplines. It is on these data that the following observations are based.

(1) The new postgraduate has to identify and formulate a research problem. In the sciences the project is usually presented as part of an ongoing programme of research, in the arts it is often the result of trial and error. A typical comment from a postgraduate at this stage is 'one is not very sure what one is supposed to be doing'.

(2) It is essential that a student establishes a working relationship with his supervisor very early on. The new postgraduate has been placed by the university department according to his research interest and

neither he nor his supervisor has any information about the other's customary way of working. The supervisor may leave the student alone to get on with his work or else he may be constantly around and keeping himself informed of the day-to-day (or week by week) progress of the postgraduate.

(3) My research shows that supervisory style, accidental and unplanned as it often is, directly affects the way in which the research is approached. The result is often frustration and doubt on the part of both student and supervisor. When a student who needs time to plan his work and continue unhurriedly until he is satisfied he has something interesting to contribute, is paired with a supervisor who constantly asks if he has got any worth-while results, the student becomes irritated and feels he is not working to adequate standards. The supervisor feels that the postgraduate is too cautious and unable to work alone. When a student who needs constant feedback and encouragement is paired with a supervisor who wants to be kept informed of progress and ideas at intervals that allow for some development to have occurred, the student feels neglected and the supervisor resents the demands being made on him (if the student is able to ask for more of his time). A typical example of a supervisor in this position is given in this quotation from one of my interviews: 'On his own he'd be a complete flop but with guidance and pushing he'll be OK. He'll probably do a good PhD if my colleague and I put enough effort into it.' More usually, the supervisor continues in his accustomed manner regardless of individual differences between his students

(4) The student must learn either to conform to the supervisor's expectation of how he will conduct his work and thus raise the probability of attaining the PhD degree or if he cannot conform to the supervisor's expectation, he may drop out. One of the supervisors in my sample said that an essential ingredient for a PhD student was a degree of conformity. 'Despite the value placed on originality you must give the examiners what is expected and what they will like otherwise you risk not getting the doctorate.'

(5) The Student's perception of actually doing the PhD changes as time progresses. Early interest in and excitement about the work becomes boredom and frustration which in turn leads to a desire to 'get it

over and done with' because of the time and effort invested in it. Students from different disciplines make similar comments during the final year — 'My attitude to the thesis now is very much a job of work that has to be finished. It's very much a practical task.'

(6) Even given these sentiments postgraduates have considerable difficulty in writing the thesis. Baddeley speaks of problems of adequate supervision in writing and training of writing skills. Wason describes procrastination and incoherence in presenting results in written form. My research sample are consistent in their inability to meet writing deadlines. This is true of periodic efforts throughout the 3 year programme and also at thesis writing time. Many intended projects are never completed, some are never started. Here there is real cause for concern; especially as it is currently possible to avoid presenting any written work at all from registration for a research degree until completion of the practical work.

Baddeley suggests the possibility of early publication being used as a measure of ability. This is potentially a solution, but a solution which raises its own problems. If publication becomes a necessary prerequisite for award of the PhD there is a risk that research in all disciplines will follow even more conventional and professionally respectable (as opposed to creative and professionally challenging) lines than it does at present. This would come about as a result of editorial decisions concerning suitable topics for publication. Students would need to conform to existing areas and methodologies in order to raise the probability of acceptance of an article by an unknown writer; just as they need to follow certain trends in order to raise the probability of receiving a grant from one of the research councils to fund their PhD research.

Conflict is inherent in the idea of the PhD as an 'original contribution to knowledge'. Francis (1976b) makes the point that originality in this context has never been defined and lists several ways in which the work may be regarded as original. Given the ambiguity of the concept of originality and the traditional approach of scientists working within an established paradigm (Kuhn, 1962) it may be almost impossible for the majority of postgraduates, half way through their course, to have their work accepted for publication.

Baddeley raises the question of whether or not the PhD gives a good training. He answers that it does not. Similarly, experienced supervisors in my sample, from both the arts and sciences, have expressed negative views of the PhD as a training either to do original research or to become a skilled writer. One way of considering the problem is to ask to what extent is the beginning postgraduate an autonomous research worker and to what extent a research assistant, and when does this change? What are the goals of the training?

If the goals of training are meant to be the development of an autonomous individual with an ability to tolerate uncertainty over time, which could be what an academic career in research is really about, then the PhD training is successful for those who complete it. Nevertheless, the feelings of isolation experienced by the students, even when working in busy laboratories, are both painful and depressing. They need not be an essential ingredient of the training and I agree with Baddeley that something should be done to make the system more humane. Just as important is the need to define the goals of training and to rethink the haphazard way in which students and supervisors are paired for what is a relatively long period of time in the careers of both of them.

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