FACULTY OF EDUCATIONAL STUDIES

DEPARTMENT OF EDUCATION

THE PERCEPTION AND IMPLEMENTATION OF EXAMINATION SYLLABUS OBJECTIVES

- With Specific Reference to the Southern Regional Examinations Board Certificate of Secondary Education Mode 1 Biology Syllabus

By

Anne Jones

University of Southampton, 1984

ACKNOWLEDGEMENTS

I should like to thank all those who have made it possible to undertake this research thesis.

In particular I am grateful to Dr. R. J. L. Murphy for his continued support and constructive advice; to members of the staff of the Southern Regional Examinations Board and to the teachers I interviewed for their co-operation; and to Annette for her skillful typing and good humour.

I would also like to acknowledge the encouragement and patience which my husband, David, has extended to me over the years that this research has been in progress.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

UNIVERSITY OF SOUTHAMPTON

ABSTRACT

FACULTY OF EDUCATIONAL STUDIES

EDUCATION

Master of Philosophy

THE PERCEPTION AND IMPLEMENTATION OF EXAMINATION SYLLABUS OBJECTIVES

- With Specific Reference to the Southern Regional Examinations Board Certificate of Secondary Education Mode 1 Biology Syllabus

by Anne Jones

This study was designed to examine the way in which educational objectives are used and perceived in the teaching and assessment of an examination course. It investigated the relationship between the function of objectives, as perceived by teachers and examiners, and their practical use in the classroom and in assessment. A theoretical model of the roles which objectives might be perceived to play in the teaching and examining of a CSE Mode 1 Biology syllabus was constructed. This model was then tested against descriptions of the way in which syllabus objectives were used by individuals involved in the teaching and examining process. The research highlighted situations where there appeared to be differences between the theoretical function of objectives as described in the model and their actual use as described by teachers, subject panel members and examiners. The role of examination syllabus objectives appeared to be further confused by the fairly imprecise relationship between the objectives and the questions set in the examination paper.

Pupil achievement in the same 1981 CSE Biology examination was analysed to identify the objectives which were mastered by individual groups of pupils. Some of the difficulties associated with determining the objectives assessed by individual questions were discussed and these issues were further considered in relation to the development of grade related criteria. Finally the introduction of syllabus objectives into examination syllabuses was considered as an example of an educational innovation. The difficulties associated with understanding the influence of this innovation on the practice of teaching and examining were explored.

CHAPTER ONE

INTRODUCTION

EDUCATIONAL OBJECTIVES IN TEACHING AND EXAMINING

Introduction

Educational objectives help to define the purpose of teaching courses. In the specific context of the teaching and examining of a Mode 1 CSE syllabus they function in a number of roles aimed at clarifying the purpose of the syllabus to teachers and ensuring that the assessment strategies employed test skills which match these purposes. These roles are considered in relation to the wider use of objectives in curriculum development in the first section of this chapter. The second section outlines the rationale for the research undertaken. The third reviews previous research relevant to this project and the fourth introduces a theoretical model describing the teaching and assessment of an examination course. This theoretical model is then used in subsequent chapters as a framework within which to examine the actual practice identified by the research.

Curriculum Development and Educational Objectives

In recent years there has been a rapid expansion of interest in the field of curriculum development. This has in turn led to research studies which point to the complexity of the process of teaching and assessing courses. Furthermore it has become evident that it is no simple task to translate such research findings, no matter how well grounded in relevant experience, into effective classroom practice on a wide scale. Evidence for this can be found in the work of Becher (1981a and b), Walton and Welton (1976) and Macdonald and Ruddock (1981).

The problems of 'translating' the lessons of research findings into the reality of the classroom have been addressed by several educationalists. (Kelly, 1975; SAFARI Project, 1974; CERI, 1973; Goodlad and Klein, 1970) Their work has identified a range of factors which are likely to influence curriculum development and innovation. These factors include philosophy, politics and other social values as well as factors such as teacher and pupil motivation, financial, administrative and technical provision. Although there is considerable evidence for the variety of factors which are likely to influence the way in which a teacher operates in the classroom, few studies have been carried out to establish the way these factors interact with and affect specific examples of curriculum development.

This project set out to investigate the way in which one influence, that of examination syllabus objectives, has been utilised in the curriculum development process and the factors which have contributed to its use and impact in the classroom.

The research is divided into two main lines of inquiry. The first is directed at the historical introduction of objectives as a curriculum development tool, this aspect of the work forms the basis of Chapter Two. The second focuses on the way in which objectives have been perceived and used in examination syllabuses, from both a theoretical and practical standpoint, and this forms the basis of chapters Four, Five and Six.

The Choice of Examination Syllabus Objectives as a Focus for the Study

At this point it is important to identify the reasons behind the selection of examination syllabus objectives as the focus for this research. Objectives have formed an integral part of many curriculum development programmes. These include both those which have a national development approach, such as the Nuffield science

programmes and those which have developed on a smaller scale such as regional examination courses. The inclusion of objectives as part of new course proposals has been promoted over the years and continues to be seen by many as an important step in any development. For example the new 16+ national criteria all contain statements of objectives which are seen as central to both teaching and assessment. This continued use of objectives in the development of examination syllabuses makes the investigation of their perceived and actual use of particular relevance to current developments. Objectives, then, are well recognised tools for curriculum development. In this study it is the role which they play in examination syllabuses which is of particular relevance.

In the British secondary education system curriculum development takes place within a process of certification which has great status both in schools and in society at large. Any course which is developed or studied in schools gains credibility within the whole curriculum structure if it results in a certificate of achievement. At the present time, the two main currencies of achievement for the 16 year old school leaver in this country are Certificates of Secondary Education (CSEs) and General Certificates of Education (GCEs). Together they comprise the major part of the public examination system.

It is clear that all curriculum developments in secondary schools should be considered with regard to their relationship to these dominant systems of certification. It is also evident that the functional operation of these two examination systems has a significant influence on the kinds of curriculum development which take place. In other words examination syllabuses can be considered to be a major factor in influencing teaching practice in the classroom. The nature of this influence has been the subject of a number of previous research studies (e.g. Lewin, 1980 and Lawton et al, 1978). It can be argued that the examination should be derived from and reflect the purpose of the programme which pupils undertake. However there is

considerable evidence that in practice it is the examinations themselves which have a major influence on teaching and hence the curriculum. References to this phenomenon are easy to find. Cited below are a few examples:

> It has long been held that examinations distort the school curriculum. Development is stunted as teaching to external syllabuses hampers more adventurous approaches.
> (Gordon in Elliott (1981) page 13)

> '..... in secondary schools where the curriculum is dominated by the external examination system .....
> (Black and Broadfoot, 1982, page 3)

> The dominating and deleterious effect of examinations on teaching and learning has been comprehensively documented by HMI.
> (Nuttall, 1982, page 60)

> Secondary school teachers also recognise examinations as the most powerful constraint on their practice.
> (Broadfoot, 1982, page 67)

Not only do examinations seem to be highly influential, controlling practice, but their influence is often discussed in terms of its undesirable consequences. Descriptions of their influence including words such as "deleterious", "a constraint", "dominating" etc are far from uncommon. This is a point which many other sources (Nuttall and Willmott, 1972; Lawton, 1973; HMI, 1977; HMI, 1979; Waring, 1979; Tattersall, 1982) also expound. This particular point of view is often summed up in the well known analogy of the examination tail wagging the curriculum dog.

By focussing on the role of objectives in an examination syllabus this project was designed to examine the theoretical and practical functions of a recognised and commonly used curriculum development tool in an important and influential educational context. If the processes and influences which determine the perceived and actual role played by objectives can be illuminated then they may facilitate a better understanding of the requirements for translating curriculum theory into effective classroom practice.

The following section indicates relevant areas of research which have examined the functioning of the examination system. The research documented here and in the following two chapters serves to fill in some of the background to the work presented in this thesis.

Research into the Operation and Control of the Public Examination System in Britain

The functioning and influence of the examination system is of considerable interest on two main counts. Firstly it is seen as an important element of secondary school education where it has high status. The fairness and standards embodied in the examination system are therefore of interest to teachers, pupils, parents, employers and establishments of further education. Secondly the influence which examinations exert on the school curriculum in terms of subjects studied, teaching methods etc is also of interest to those concerned with curriculum development. These would include HMI and the various national curriculum development bodies such as the Nuffield Foundation and the Schools Council.

A good deal of research has been carried out with respect to these areas of interest. The reliability, comparability and validity of examinations have been major areas for study. Reliability studies attempting to indicate the way in which the grade a candidate is awarded can be subject to chance variation have been carried out by Murphy (1978) and Willmott and Nuttall (1978). Such studies point to the limitations of the grading systems and serve to increase awareness of the way in which grade awards should be interpreted by users. There are two major areas of comparability study. There are those which examine how comparable grading standards are between subjects such as those carried out by Forrest (1971); Forrest and Smith (1972); Nuttall, Backhouse and Willmott (1974); Bardell, Forrest, Shoesmith (1978) and Orr and Nuttall (1983). The other area of study compares grading standards between boards. Examples of this include Skurnick and Hall (1969); Skurnick and Connaughton (1970); Nuttall (1971); Bardell, Forrest, Shoesmith (1978) and Orr and Nuttall (1983). These studies compare performances in order to establish relative standards of achievement. However methodologically such studies have proved difficult to design as suggested in the Schools Council Forum on Comparability (1979) and Goldstein (1982). Furthermore the results also pose problems of interpretation. Nevertheless they do serve to indicate the complex nature of the present examination system in terms of the validity of the grades candidates are awarded. Other aspects of validity [1] have also been considered by Connaughton (1969); Hoste (1980) and (1981) and Willmott and Nuttall (1972). Such studies have typically examined the way in which the syllabus objectives are reflected by the examination paper in quantitative terms. They have also been subject to problems of methodology related to classification of question items. This point is considered in more detail in Chapter Six.

---

(1) There are many forms of validity (Jupp and Miller (1980)) identify 12.

Any study of examination comparability or validity must take into account the purpose of the examination. In other words the educational objectives which are established for the course or curriculum are central to any comparison or evaluation study. In many cases, previous investigations in this field have taken syllabus objectives as read. Little attempt has been made to either investigate how the objectives for a course or curriculum are derived, or examine their effect on teaching.

This project attempted to establish both a quantitative and qualitative investigation of the teaching and assessment of an examination syllabus. In so doing it addresses such questions as: 'Who controls the syllabus and hence the curriculum in schools?' 'How valid is the examination in terms of the syllabus and teachers perceptions of the ideal curriculum?' 'How much influence do the syllabus and examination have on teachers and their classroom practice?' and 'What relationship is there between pupil performance in the examination and the award of grades?'

In order to investigate these questions a theoretical model of the functioning of the teaching and assessment of an examination syllabus was drawn up. The model was constructured around the use of educational objectives because they outline the goals and purpose of education and are discernable in some form or other at each stage of the process.

Taylor and Richards (1979) point out the potential importance of objectives in drawing up any curriculum programme: (2)

---

(2) Examination syllabuses can be considered to be curriculum programmes in this sense because of their established influence in the secondary school sector.

> ..... the curriculum serves a purposive function which is broad in scope ..... The intended ends of studying subjects, the different ways of learning which they help to develop, the skills and capacities engendered by learning exercises, are the objectives of the curriculum.
> (Taylor and Richards, 1979, page 13)

Christopher (1969) identified their role in the context of the examination system:

> So far as syllabuses are concerned it has been accepted that if these are to play their full part in the educational process each must include, for the information of teachers, pupils and examiners alike, a clear statement of the abilities which the examination based on it is designed to test, and, as far as practicable, of the weightings which will be given to each ability.
> (Christopher, 1969, page 9)

The specific role of objectives in producing examination papers is pointed out in Schools Council Examination Bulletin 27:

> ..... objectives are essential information without which an examiner cannot begin to operate.
> (Schools Council Examination Bulletin 27, 1973, page 12)

A Theoretical Model Describing the Processes of Teaching and Assessment of a Mode 1 Syllabus

The Mode 1 format (syllabus and examination designed and moderated by the examinations board) was chosen for investigation. At levels of public examining 'O' and 'A' level GCE and CSE, the Mode 1 format is the most commonly used. Mode 3 (syllabus and examination designed by the school and moderated by the Board) is also popular in some schools and/or subject areas but the number of

candidates entered for this mode are small by comparison. Mode 2 (syllabus designed by the school, examination and moderation carried out by the Board) is seldom used.

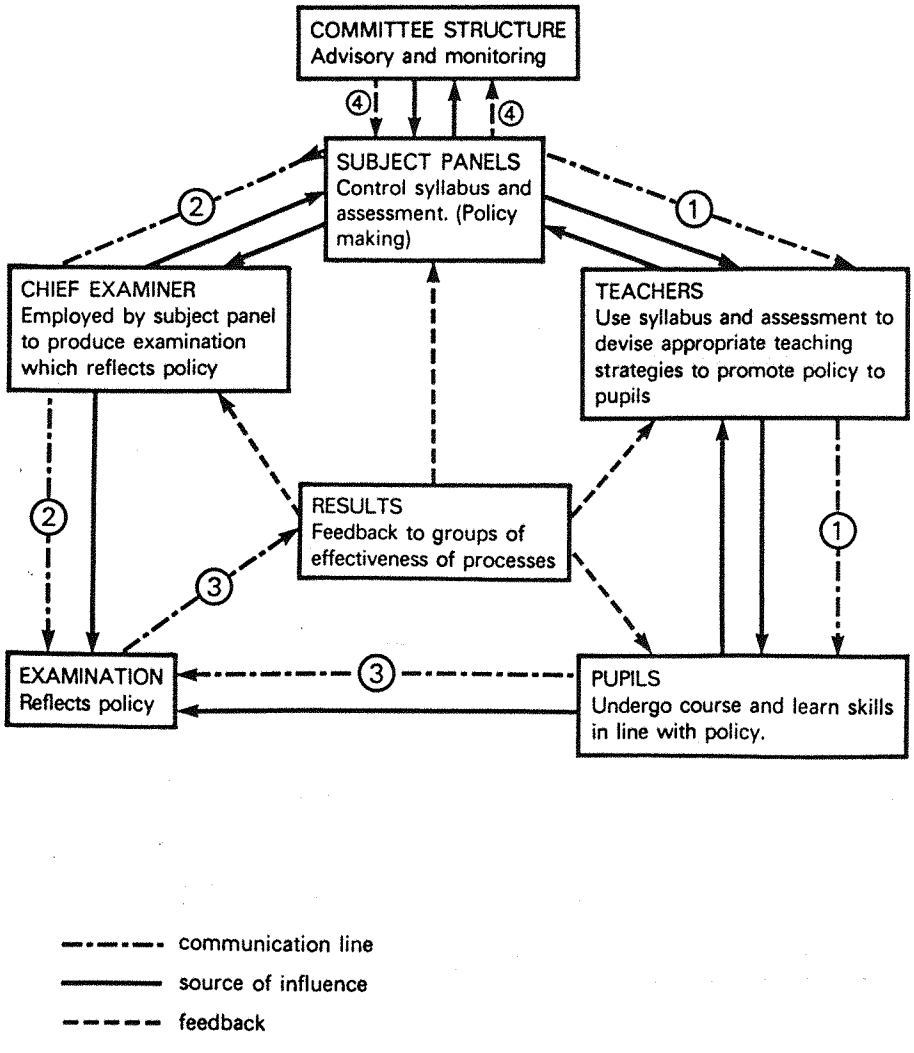
The model described in this section is based primarily upon information from and the views of the staff of the Southern Regional Examination Board (SREB). Information provided included minutes of meetings and other documents as well as discussions with Board personnel and subject panel members. This information has been complimented by the author's personal experience as a teacher involved in Mode I teaching and examining. The model which emerges proved uncontroversial and widely acceptable in the field. Discussions with members of other examination boards suggested that it represents a fairly typical form of operation. However this description of the process of teaching and examining represents the official description the staff of the Board gave. It explains the relationships between examiners, teachers and pupils. It became clear when collecting the information on which it is based that many of the groups and individuals participating in the process were aware that it may not describe too closely what actually happens. The model, then, represents what was intended to happen and the research was designed to clarify what does happen.

Figure 1.1 (page 10) shows the relationships which exist between the various elements which make up a Mode 1 teaching/examining system. It indicates the sources of influence and feedback between these elements and outlines four main lines of communication which are the basis on which the system may be thought to operate. Three kinds of interaction are described in the model. Communication lines represent the kind of interaction where information is transmitted from one person or group of people to another. It also includes transmission of this information into more concrete forms such as an examination paper in line 2 for example. Each communication line is discussed in more detail below. Source of influence lines have some overlap

FIGURE 1.1

INDICATING THE PROCESSES OF COMMUNICATION

INVOLVED IN TEACHING AND EXAMINING A MODE 1 SYLLABUS



with communication lines, but also imply a degree of decision making or advice. The source of influence lines indicate areas where an exchange of ideas is possible. The third interaction, feedback, is restricted to feedback which arises from the examination results, although it is recognised that many other channels of feedback are also in operation, for example between pupils and teachers. The feedback lines indicate which groups the pupils' performance and results are likely to influence.

Communication line 1 represents the way in which the objectives are perceived and used by teachers. (This is considered in detail in Chapter Four.)

Communication line 2 represents the way in which the objectives are translated into an examination. (This is considered in detail in Chapter Six.)

Communication line 3 represents the way in which the objectives are reflected in pupils' achievement. (This is considered in detail in Chapter Six.)

Communication line 4 represents the way in which the objectives are defined and amended by the Board. (This is considered in detail in Chapter Five.)

1. The Model in Theory

The four communication lines indicate the way in which, in this case, the objectives are perceived and used by the various groups in the system.

Communication line 1 deals with the way in which the teachers perceive and use objectives. The teachers receive information from the subject panel in the form of a syllabus which contains a statement of objectives. This syllabus indicates to the teacher the emphasis on various aspects of teaching which the subject panel expects and which will be examined. It also provides the teacher with an outline of the content which it is anticipated she will cover in her teaching.

The teachers then use their knowledge and experience of their teaching groups to implement the examination syllabus through appropriate teaching strategies. Depending on the emphasis placed on the examination syllabus objectives by the teachers, and on other factors, the pupils will, to a greater or lesser extent, acquire skills which are consistent with those outlined by the subject panel.

Communication line 2 deals with the processes involved in producing an examination paper which matches the syllabus objectives. The subject panel recommends a chief examiner whose responsibility it is to produce an examination which assesses those objectives which the subject panel has drawn up for the syllabus. To help the chief examiner in this task the subject panel also provides an objectives/assessment grid which indicates the percentage of marks which are to be awarded to each objective. Chief examiners use their experience and expertise to write questions which require candidates to show evidence of their achievement of the syllabus objectives. By this process it is intended that the examination paper will be constructed in a way that is intended to reflect the syllabus objectives in the proportions defined by the subject panel as closely as possible. By making teachers and examiners aware of the syllabus objectives it is hoped that the pupils' learning outcomes will largely match the objectives which the examination assesses.

Communication line 3 represents the way the pupils' achievement reflects the syllabus objectives. By taking the examination and receiving grades the pupils provide feedback to a number of groups. Firstly, their results provide feedback to themselves about their level of achievement in the examination relative to others. Secondly, the results provide information to teachers concerning the effectiveness of their teaching strategies. Thirdly, their answers to the examination questions provide information for the chief examiner and the subject panel about the quality of the examination. It should be possible through all of this to discover something about whether or not an attainment of the original syllabus objectives has been demonstrated by the candidates in the examination.

The last communication line represented on the diagram, communication line 4, deals with communication within the structure of the Board. The role of the Examinations Committee is to maintain and advise the individual subject panels in their task of writing and assessing the syllabuses. The subject panels consist of practicing classroom teachers who consult with other colleagues through Consortia (local groups of teachers) to arrive at decisions, and it is intended that this process will allow the Board's policies to be kept in line with classroom activity. In the case of objectives, for example, it is expected that subject panels will be influenced by teaching activities which go on in classrooms throughout the region.

2. The model in practice

This research has set out to examine how closely the processes of communication, influence and feedback which operate in practice, reflect the theoretical assumptions made in the model. There is some evidence that the use and understanding of objectives may be of particular significance in this respect.

Taylor (1970) suggested that teachers were less concerned with the use of objectives when they planned courses than with content and developing pupil interest. This view was supported by Kelly and Monger (1973) in a review of the Nuffield Biology programme. If this is so then the use of objectives as a form of communication of purpose between the Board and teachers may not be appropriate. Kiemer (1981) supports this finding:

> ..... studies indicate that teachers do not plan with regard to objectives, the way they had been taught.
> (Kiemer, 1981, page 22)

Kiemer's evidence is important because it relates to much more recent research yet points to the same conclusion as the earlier work. Taylor's research was carried out before the use of objectives in curriculum planning, teaching and examinations was widely used in Britain. However Kiemer's work ten years later suggests that even with training in the 'correct' use of objectives in these situations teachers fail to use them in the classroom as expected. Francis (1981) studied the way in which teachers and their pupils prepare for 'O' level Mode 1 examinations. He identifies the use of past examination papers as an important aspect of their preparation. Again objectives seem to play a very limited role in communicating what will be assessed to either teachers or pupils.

Another area where research has identified mismatches between theory and practice is associated with the production of valid examinations. Willmott and Hall (1975), Fairbrother (1975) and Duckworth and Hoste (1975) all encountered problems related to identifying what skills or objectives an examination question assessed when trying to establish what certain examinations were assessing. These studies raise questions relating to the feasibility of writing examinations which accurately reflect the weightings given for each objective in the syllabus. Finally

Raven (1971) identifies significant mismatches of opinion about what objectives pupils, teachers and parents thought were important. Such mismatches might also exist between the objectives promoted by the Board and the other groups involved in this process.

The questions these researchers have raised that are relevant for the present study include:- 'Do objectives facilitate or enhance communication between the Board and teachers and examiners?' 'Is it possible to produce valid examinations in terms of the objectives set for a syllabus?' and 'What is the balance of influence between the designers of the syllabus and the users (teachers and pupils) in producing objectives?'

This project was designed to investigate the answers to these questions by examining a specific course of study and discusses the discrepancies which arise between the theoretical model and the practical situation.

Terminology and the Use of Validity

1. Terminology

In concluding this introduction it may be useful to clarify some of the terms commonly used. In the reporting of the research findings the term curriculum is used to describe the total activities of the teacher and pupil in undertaking a two or three year course of study leading to a public examination. The term syllabus refers to the examination syllabus, set and examined by the Examination Board (Mode 1), which comprises aims, objectives, content areas and details of the objectives which will be assessed in the final examination with an indication of the total marks allocated to each objective.

Educational objectives are considered in this study to be statements of purpose identifying skills, attitudes or behaviours which are to be taught or learnt or assessed through the medium of the examination syllabus.

2. Use of Validity

This research is mainly concerned with the content validity of the examination being studied i.e. "whether or not it samples adequately the domain which it is supposed to measure" (Jupp and Miller, 1980, page 36). In this study the domain under investigation is the domain of objectives specified in the syllabus. No attempt is made to consider the content validity of the examination with respect to syllabus topics.

CHAPTER TWO

EDUCATIONAL OBJECTIVES IN EXAMINATION SYLLABUSES AND CURRICULUM DEVELOPMENT: A HISTORICAL PERSPECTIVE

Introduction

Before embarking on a discussion of the methodology which was employed it is useful to consider the evolution of the objectives approach to curriculum and examination syllabus development. How has such an approach come to exist? What alternative approaches to curriculum development using objectives exist? Why are objectives perceived as facilitators of communication? Why have objectives been incorporated into examination syllabuses? These questions can be answered to some extent by tracing the historical development of an approach to curriculum development which has much in common with the model proposed earlier, that is the rational planning model, first proposed by Ralph Tyler in 1949. This chapter describes the rational planning model and discusses the profound influence which it has exerted in the fields of curriculum development and assessment over the last thirty years.

Tyler's Rational Planning Model for Curriculum Planning

Tyler's model was based on a precise definition of purpose for an educational programme. This purpose was to be drawn out by addressing four major questions:

(1) What educational purposes should the school seek to attain?

(2) What educational experiences can be provided that are likely to attain these purposes?

(3) How can these educational experiences be effectively organized?

(4) How can we determine whether these purposes are being attained?

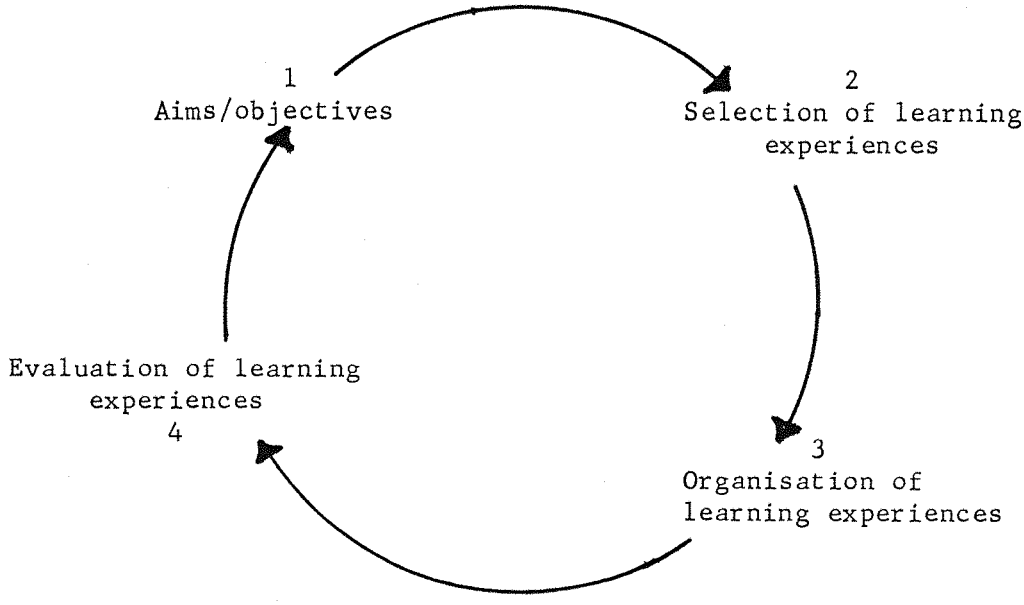
(Tyler, 1949, page 1)

Tyler goes on to suggest that these questions can best be answered by defining educational objectives:

> ..... if an educational program is to be planned and if efforts for continued improvement are to be made, it is very necessary to have some conception of the goals that are aimed at. These educational objectives become the criteria by which materials are selected, content is outlined, instructional procedures are developed and tools and examinations are prepared . ..... Hence, if we are to study an educational program systematically and intelligently we must first be sure as to the educational objectives aimed at.
> (Tyler, 1949, page 3)

Tyler's model for curriculum planning can be divided into four main areas as follows:

The 'Tyler' Model for Curriculum Planning



(Taylor and Richards, 1979, page 64)

It is a dynamic model, and each stage is defined with respect to the aims and objectives which have been prespecified. It is often referred to as the "rational planning model" and clearly there are parallels with the model being tested in this research investigation.

Tyler's model has influenced the way in which objectives have been used for a period of over forty years. The reasons for its continued influence are discussed in the following section and provide background information which relates to the way in which objectives are currently perceived and used.

It is always difficult to trace all the factors which have contributed to the development of ideas over a period of time and all too easy to suggest cause and effect relationships in too simplistic a fashion as Waring (1979) points out :

> The changes that take place in society are, inevitably closely interconnected. There are many different areas of change ..... Since all are interdependent, it is impossible, without distorting the picture, to isolate any one area in an attempt to show how it has led to, or resulted from changes in others.
> (Waring, 1979, pages 4 and 5)

However the adoption of the rational planning model can be traced to a number of significant factors which are worth considering.

The Influence of Tyler's Rational Planning Model

In addressing this question it is more appropriate to look at the adoption of the rational planning model in America and Britain separately. Firstly because the American experience was some ten to fifteen years in advance of the British adoption and secondly because the British adoption is quite curious in the light of the American experience.

1. The American Educational System and the Rational Planning Model

The following sections outline four major factors which contributed to the adoption of the rational planning model in America in the 1950's and 60's.

1.1 Conditions of Change

Firstly the model was available at a time when change in the system of education was considered important. It therefore offered an available solution to a current problem.

The years leading up to 1950 had seen the American education system develop along child centred lines, a "Romantic curriculum" (Davies 1976). This trend was not without its critics. MaCarthyian influences, concern with the level of standards (Richmond 1971) and unfavourable cross cultural comparisons (Holmes 1977) all contributed to a growing discontent with education in the late 40's and early 50's. This resulted in a movement to change existing policy. The final push, put forward by some as the single factor which promoted a change in American educational policy at the time, was the successful launching and operation of Sputnik 1 by the Russians in 1957. Their success was interpreted by some as evidence of the failure of the American educational system to produce able scientists. The unprecedented move of making defence finance available to education in the National Defence Education Act of 1958 indicates the level of concern which existed about the quality of education in America. It demonstrates the lengths to which the government was prepared to go to 'upgrade' the educational experience of children. New programmes particularly in the sciences were commissioned and Tyler's model apparently provided a mechanism by which they could be devised.

1.2 The Input/Output Model

A second factor in launching Tyler's model as a panacea for the country's 'failing' educational programme was its close parallels with the input/output models of efficiency which had proved effective in industry. This approach is described by Lawton (1983) as :

> ..... an industrial or engineering model - treating human beings as if they were mere products to be run off an assembly line ....
> (Lawton, 1983, page 17)

Although Tyler was subsequently criticised for this emphasis, in the early 1950's, the notion of manipulating an educational programme in much the same way as a business problem had considerable appeal.

1.3 The Move Towards Scientism

> 'Scientism' may be defined as the view that the inductive methods of the natural sciences provide the only possible source of knowledge about human beings and social questions.
> (Lawton, 1983, page 23)

Scientism in this sense was popular in America at the time when Tyler's model was outlined. The scientific approach to problem solving (i.e. problem identification, hypothesis formation, research method, results and conclusion) had much in common with the rational planning model.

These last two points indicate the way in which the adoption of Tyler's model, as a way forward in new curriculum development, was strengthened by its parallels with two other ideologies which were popular at the time.

1.4 The Appeal to Reason

Finally, and possibly most importantly, was the apparent logic of the rational planning model:

> ..... the argument for specifying objectives is a disarming one because it implies logic and 'who can argue in favour of irrationality?'
> (Stones, 1972, page 9)

The definition of objectives in a logical manner might appear to be what all teachers are doing most of the time in their day to day activities. To make their objectives more explicit seems to be a simple step forward which will improve communication of ideas between individuals involved in the same task.

So the rational planning model, with its focus on the determination of objectives as facilitators of communication, became a popular and accepted method of working in the fast expanding curriculum development field.

In conclusion this brief documentation of the rise of the rational planning model provides a historical perspective indicating some of the factors which made its adoption acceptable. Its subsequent popularity seems therefore unremarkable until one further fact is brought to light. It appeared to be singularly difficult to achieve in practice what the model proposed in theory. This point in itself is not unusual, what is curious is the amount of time and energy which has been spent in trying to <u>make</u> it work.

2. The Problems of Implementation

The underlying hypothesis for development and research in this area has generally been that the rational planning model was appropriate. The problems of implementation lay squarely with the users, mostly teachers, who for some reason were unable to get the model to work in the anticipated way. These reasons included inexperience, misinterpretation, lack of training and even thinly veiled allusions to deliberate sabotage. This view remained dominant for many years and still has some support today. It is true that towards the end of the 60's there were murmurings about the possible inappropriateness of the model. Some of these related to the technical difficulties of implementation and are discussed more fully in the following section of this chapter. However some critics, such as Eisner (1967), Atkin (1968) and Stenhouse (1970), contested the appropriateness of the model on philosophical and educational grounds. Their reservations centre around a number of issues implicit in the rational planning model which can be summarised as follows:-

(i) It is not always possible or advantageous to prespecify educational outcomes. Some of the most important outcomes of a teaching process may be unexpected.

(ii) Certain subject areas, particularly those involving elements of appreciation (e.g. creative arts) or value judgements, or personal social development, embody objectives which cannot easily be specified with the precision necessary in a rational planning approach.

(iii) Objectives can be a constraint on the teaching process. They may act directly to limit the breadth of a teachers activity in the classroom.

More insidiously there is as Stones (1972) puts it:

> .....the danger that objectives will be chosen by the extent to which they can be readily measured rather than by the extent to which they are derived from our needs and philosophies.
> (Stones, 1972, page 6)

All three of these criticisms of the objectives/rational planning approach tend to act in a way which results in teachers being limited in their teaching to the most obvious, measurable objectives. The main thrust of criticism levelled against this constraint is that these objectives may not necessarily be the most educationally worthy or appropriate.

In the late 60's these criticisms were still tentative and it took a further five or more years before they became seriously debated and before alternative methods of working were beginning to develop. So research in the 60's and early 70's was centred largely on technical improvements geared to facilitate the implementation of Tyler's theoretical model.

The vast quantity of research and the debates which took place in the curriculum field at the time underline the esteem with which the model was held. The vigour with which solutions to the problems of implementation were sought is testimony to the deceptive simplicity and logicality of the model. The solution to the problems always seemed tantalisingly close.

3. American 'Solutions' to the Problems of Implementation

From the 50's through to the early 70's American research in this field was focused largely on identifying ways of facilitating the introduction of Tyler's rational planning model. Initially

the problem of implementation was defined in terms of the inability of classroom practitioners to draw up suitable objectives and considerable effort was made to find ways in which the task for teachers could be made easier. In 1956 Bloom published his now famous taxonomy of cognitive skills. This was designed to both help teachers draw up appropriate objectives and subsequently to assess whether or not their teaching strategies had been effective in promoting them. Although Bloom's taxonomy was designed to facilitate both the determination of objectives and their subsequent assessment, it was the latter aspect which he emphasised. Use of the taxonomy has, however, focused more on the former aspect so that Blooms categories have influenced the determination of curricula in a wide range of subjects including Mathematics (Wood, 1968), Science (Eggleston and Newbould, 1969) Organic Chemistry (Whitfield, 1969), Special Studies in Science (Fox, 1969) and History (Eggleston and Lobel, 1969). Davies (1976) sees this change of emphasis in a positive light:

> What Bloom and his colleagues had seen as a contribution to the teacher as a test maker and evaluator has become a major stepping stone in an awakened interest in the development of curriculum and teaching .....
> (Davies, 1976, page 55 - 56)

It is interesting to speculate whether a method for derivation of objectives basically constructed with assessment in mind is the most appropriate basis for curriculum development. Indeed although Blooms categories were adopted to form the basis of many sets of curriculum objectives they did not solve the difficulties which dogged the implementation of the rational planning model, so that despite Bloom's definitions and categorisation teachers and curriculum developers still found objectives difficult to determine and interpret. Still pursuing the line that the barrier to implementation lay in the

unsatisfactory specification of objectives further steps were taken to improve their quality. Groups of experts were used to draw up appropriate objectives for teaching programmes. This was particularly apparent in the National Scientific Programmes developed in the months following the launching of Sputnik 1. At around the same time a second area of expertise was developing in relation to the specification of objectives. This was not directly linked to education but occurred in the emerging science of psychology. The strong links in America between psychologists and educationalists described by Wood (1968) as a "continuing dialogue" provided a medium within which assessment, became closely linked with behavioural activities. Assessment being the interest of the educators and theories of behaviour being the interest of the psychologists at the time.

In a more recent article Wood (1982) goes on to outline some of the effects which the association of the two disciplines of psychology and education has given rise to in the context of educational measurement. He considers that of late there has been a change in emphasis towards a 'concern with content overriding statistical considerations' (page 130). However when Tyler's model was being promoted the climate was very different. Wood (1982) describes it as:

> ..... professional test constructors consistently overriding the requirement of classroom usefulness. (Woods, 1982, page 120)

The psychometric need to have statistical information for analysis began to overshadow the more humanistic elements of testing in an educational setting. One outcome of this marriage of interests was a move to reduce pupils' achievement to readily measurable outcomes which were amenable to such analysis. In the context of the rational planning model and the specification of objectives this gave rise to the behavioural objectives movement.

The pros and cons of this approach have been discussed at length and are well documented elsewhere (Hamilton, 1977; Macdonald-Ross, 1973). In this context it is sufficient to point out that the behavioural objectives movement was characterised by highly specific and precise objectives, relating to observable behaviours in students. In practice it did not solve the problems associated with the implementation of the rational planning model and in many instances the unwealdy nature and number of the resulting objectives was a further barrier.

In the event neither Bloom's taxonomy nor the behavioural objectives movement was successful in facilitating a practical application of the rational planning approach to curriculum development. In fact concentrating so single-mindedly on one aspect of the rational planning model i.e. the production of objectives led to a specialisation of expertise in this area. The specification of objectives was taken out of the hands of teachers, the users of the curriculum, and given over to 'experts'. This constitutes a major shift from Tyler's original conception. He described a holistic process where the specification of objectives, selection of materials, organisation and assessment were all carried out by the same individual or group. The move to employ different groups in the various stages cut across this holistic pattern and introduced a barrier of communication. It has also resulted in some of the most complex barriers to implementation since the difficulty of communicating ideas unambiguously between groups or individuals is notoriously difficult. The perceptions, past experience and motivation of those involved in any act of communication will influence their interpretation of the situation and their subsequent action. If different groups of individuals are responsible for different parts of curriculum development then it is likely that each will have different interpretations, perceptions and expectations of it.

By the end of the 60's Tyler's rational planning model was no more effective as a method for curriculum development than it had been earlier. Indeed if anything the problems surrounding its implementation in the classroom appeared to be more complex than had at first been envisaged.

The American experience in this field of implementation raises issues which are fundamental to this research namely: 'Do objectives serve in any capacity to communicate purpose between individuals or groups involved in teaching or examining?' 'Is the rational planning model for curriculum development workable?' In tracing the problems which faced researchers and teachers trying to implement this model in America a clearer picture of the difficulties surrounding implementation is given than can be gained by looking at the British situation in isolation. This is because the problems encountered in Britain mirrored the American experience and British 'solutions' took American responses into account.

4. Rational Planning and Curriculum Development in Britain

The American experience in the curriculum development field was some fifteen years in advance of British interest mainly because the 50's and early 60's saw Britain grappling with the move to comprehensivisation from the traditional tripartite education system. The interest in developing more appropriate curricula stemmed largely from this change in our system of secondary schooling and was consequently several years later. However, as in America a changing educational situation was a major factor in prompting its adoption.

4.1 Conditions for Reform

New courses for the new educational system coupled with dissatisfaction with the traditional vocational/academic divide provided motivation for change and in 1963 a national body responsible for the review and reform of curricula was formed, The Schools Council. Both the motivation and commitment to reform the curriculum were evident. All that was lacking was expertise. Not surprisingly the wealth of experience in the American literature provided an easily accessable and readily available resource which was eagerly harnessed.

4.2 Adoption of the Rational Planning Approach

With hindsight the most remarkable thing about the adoption of the rational planning model in Britain was that it ever took place at all. Firstly because the writing was already on the wall as far as the problems of implementation of the model went. Secondly because the British education system was not directly comparable to the American one particularly in respect to the kind of holistic curriculum planning which Tyler had advocated. It is interesting to speculate a little about the reasons for the adoption of a rational curriculum planning approach in the face of these two apparent deterants.

The apparent lack of concern, shown by British advocates of the rational planning model, about the difficulties of implementation is probably due to a number of inter-related factors. One of the most influential was the apparent logic of the model which has already been discussed. Those who were involved in reviewing developments

in America were obviously impressed by the rational planning approach which was strongly endorsed by other influential writers of the early 60's such as Taba (1962). Many British educationalists, such as Wheeler (1967) and Kerr (1968), had no hesitation in promoting such an approach for curriculum development. They were supported by Wiseman and Pidgeon (1970) in their report for the influential National Foundation for Educational Research (NFER). There were those who cautioned against the adoption such as Stenhouse (1970), who pointed out the limitations of the practical application of the theory:

> American curriculum workers, who have far more experience than Europeans, have been forced by contact with practice into some ruefully realistic reflections on their planning strategies.
> After a decade of work it became apparent that other factors than aims were involved in developing a curriculum that provided the desired articulation or sequential relationships.
> (Stenhouse, 1970, page 78)

However these warnings carried little weight at the time and the rational planning model was introduced and applied in a wide variety of settings. In the same article Stenhouse himself put forward a theory of why the rational planning model continued to be used despite obvious difficulties of implementation:

> Unfortunately, the objectives model has been advanced dogmatically, and this has placed pressure on those who wish to work along alternative lines. In part, the pressure in America has come from funding agencies, which are able by the use of the objectives model to operate an oversimplified but comforting payment-by-results system in making curriculum research and development allocations. The dogma is, however, not confined to this

> setting; and in Europe too the objectives model is often advanced naively and yet confidently, even assertively.
> (Stenhouse, 1970, page 74)

In this statement he hints at a factor which was influential in the adoption of the model in Britain namely the lack of any practical alternative. At this stage although the problems of implementation were, well established and the model had its critics, their position was still tentative. This had the result that, as Stenhouse suggests, few alternative methods of working in the curriculum development field were available. The need in Britain at the time was to be seen to be doing something positive in curriculum development relatively speedily. In the face of these factors the pressures to adopt the rational planning approach increased.

Viewed in this context the reasons for the adoption of the model as an initial way of working can be rationalised to some extent. It is more difficult to understand why the obvious differences between the system of education which the model was designed to fit and the British educational system failed to have any restraining impact on the adoption. This point is rarely discussed yet it is surely relevant to the way in which objectives are used in the British system today.

4.3 The Teaching Assessment Divide

The British secondary education system has traditionally been divided into teaching and assessment. Two distinct activities which are obviously linked but which are under the control of quite different groups of people with differing aspirations. That is not to say that individuals may not be involved in both processes, as indeed some are, but the huge majority of teachers have little or no direct contact with the assessment procedures which are controlled by examination boards. If this situation is compared with Tyler's model described earlier, where the same individuals are expected to take part in each stage of the cycle, the discrepancy between the two systems seems obvious. The fundamental point to be made here is that within the British system any attempt to use a rational planning approach to curriculum development and implement it was certain to encounter problems of communication by virtue of the division between teaching and assessment. This might have been perceived in advance as a serious stumbling block in the path of the adoption of the rational planning model in Britain but it appears never to have been envisaged as problematic. Part of the explanation for this could be linked with the way in which the American perception of the model had changed between 1949 and 1970 where the involvement of the classroom teacher at every stage had been submerged with resulting problems of communication.

The following sections develop the effect which the split between teaching and assessment have had on curriculum development, and particularly the use of objectives, in Britain over the last fifteen years.

4.4 Curriculum Development and Teaching

In the early optimistic days of curriculum development it was evident that few problems were envisaged in implementing curriculum programmes within this split context. The assumption was that the curriculum objectives, materials and organisation would be under the control of teachers. The examining boards would devise tools of assessment appropriate to the new courses.

Many of these new courses were pioneered in the sciences under the auspices of the Nuffield Foundation and a look at some of their early problems serves to illustrate the difficulties of implementation which did in fact arise. The first problems centred around the definition of objectives and organisation of relevant materials. Learning from the difficulties some of the national American projects had encountered when they employed only academic experts in the field in this role, the Nuffield Foundation chose a mixture of academics and teachers to devise objectives and materials. The problem of implementation still persisted. Kelly and Monger (1973) in an evaluation of Nuffield 'O' level Biology course materials state :

> The visits to schools tend to conform the views; the objectives (= "aims") rarely seemed to be used as guidelines for the work and the activities and content of the course were rarely discussed in relation to them.
>
> (Kelly and Monger, 1973, page 705)

Becher (1981a) discussing the problems of communication and implementation of the Nuffield Projects compares the curriculum development programme to a hi-fi system where the curriculum is the sound track, the school the play back equipment and the teacher the presenter and commentator.

He describes the problems encountered as follows:

> To make matters worse, teachers showed a strong tendency to interpose their own personalities between the message of the curriculum programme and its intended recipients; ..... in terms of the hi-fi metaphor the playback equipment was often sub-standard and the presenter had a regrettable tendency to sing loudly and out of tune over the meticulously recorded sound track.
>
> (Becher, 1981a, page 22)

Problems of definition and communication through objectives and the individual effect of the classroom teacher were evident in the British context as strongly as in America. The issues of the communication role of objectives and the suitability of the rational planning model were again called into question. By this time though the critics of the rational planning approach were more assured in their criticism and the model began to be seriously challenged.

Criticism of the Rational Planning Approach

Three major areas of concern with the rational planning approach can be identified. Firstly it does not take into account the complexity of the classroom situation. Any given curriculum plan is likely to be influenced by numerous factors relating to the particular situation in which it operates. School constraints such as streaming, timetabling, room allocation etc may all have an effect as will the perceptions and expectations of the pupils. The rational planning model where objectives, content, organisation and assessment follow in a linear and predetermined order makes no consessions to the 'real' situation:

> ..... the notion of a grand design of a school curriculum, conceived as a utopian blueprint, cannot cope with changing school situations.
> (Sockett, 1976, page 86)

Secondly the rational planning model is based on a set of prespecified objectives. The way in which such objectives are determined has already been discussed along with the difficulties associated with the task. In the normal teaching situation however the philosophical rational for the promotion of certain objectives and not others is not made clear to the practitioner. Becher (1981b) points out the important role which practitioners have in any implementation:

> It is the practitioners who ultimately determine whether a policy directive is successful, for it is they who translate ideas into actions. This is a further reason for attending carefully to the realities of the teachers' working context and the pattern of their professional values ..... (my italics)
> (Becher, 1981b, page 153)

Again the rational planning model which takes no account of individual teachers 'values' is bound to run up against problems of implementation if teachers perceive the course objectives to be at variance with their own. Any curriculum design which embodies a set of 'given' objectives will obviously encounter this problem.

Finally the model does not seem to take sufficient account of the way in which teachers operate in the classroom. Taylor's (1970) early work suggested that most teachers begin their course or curriculum planning with respect to content and pupil interest only considering aims and objectives afterwards. Trying to impose a completely new approach i.e. beginning with objectives will require considerable discussion and motivation before it can be successfully implemented and again the rational planning approach left little room for this.

All three of these points apply to the rational planning model which was being used in curriculum development work in the 1960's and 70's. It is worth stressing the fact that this was a modified model compared to Tyler's original and in fact some of these problems would not have arisen to the same extent if the same teachers had been involved at all stages. The late 70's and early 80's have seen the development of practical alternative models for curriculum development. Models which centre on the 'realities' of classroom activities and tend towards the use of slow piecemeal change within this context rather than sudden drastic change (Skilbeck, 1976). Other models are emerging which begin with the content and methods to be taught rather than the objectives to be achieved, for example the 'process' model (Stenhouse, 1975).

These new models in turn have their own problems but their great advantage over the rational planning model is that they do attempt to take into account the realities of classroom practice. Understanding such realities is of course a difficult area and one which this research addresses in a specific context; that of examinations. These alternative ways of working in curriculum development have their critics who prefer to trust in the rational planning approach (Hirst, 1975; Walton, 1976). However it must be recognised that the rational planning approach has not solved many of its problems in over forty years despite considerable research and effort. Alternatives must surely deserve significant attention and discussion. Against this background it is disturbing to note that the assessment side of curriculum development is still well and truly locked into the rational planning approach with its emphasis on the attainment of prespecified objectives. The situation is particularly worrying when it has been so obviously influential in the development of the new 16+ examination proposals which potentially could have profound effects on the school curriculum for a good many years to come.

Objectives and Assessment Within the British Examination System

The division between teaching and assessment in Britain has allowed separate development of curriculum issues to take place in each camp. The curriculum/teaching camp has concentrated largely on the problems of implementation and innovation described previously whereas the curriculum/assessment camp has worked along the lines of improving assessment tools. The latter camp is under the exclusive control of a number of powerful, largely autonomous bodies, the examination boards. The function of these boards is to standardise and award certification of achievement in examinations at 'O', 'A' and CSE levels.

In the late 60's and early 70's the examination boards were faced with the task of assessing many new curricula which were being developed as a result of the curriculum/teaching involvement in curriculum development. They were also coming under criticism for the limited, largely cognitive skills which their examinations were traditionally assessing, see Crossland and Amos (1961 and 1965) and Spurgin (1967). In these circumstances the boards were forced to investigate the validity of their traditional Mode 1 examinations and to ensure that new examinations were valid with respect to the new curricula. As early as 1963 the Schools Council Examination Bulletins had proposed the use of objectives as a mechanism to help ensure content validity. As objectives were a common component of the new curricula of the time the examination boards began to use objectives related to content areas to define blue prints for their examinations. In some situations such as the early Nuffield science examinations, the objectives were defined by the curriculum designers, academics and practicing teachers. The examination boards reflected these objectives in their assessment. This was how the rational planning model was envisaged as operating; the curriculum dog wagging the examination tail. However in practice many of the curriculum objectives were

difficult to assess, particularly within the traditional model of written papers which had been the forte of the academic examination board. A tension arose between the curriculum designers and assessors which was often resolved by separating objectives into two categories, teaching objectives and assessment objectives. The former were the concern of the teacher, the latter of the examination board. It neatly sidestepped the difficulties of assessing awkward objectives, often dealing with emotions or affective skills, which were felt to be important by curriculum designers. It also meant that the examination boards could restrict the objectives which they assessed and concentrate on those which were more applicable to traditional models of assessment i.e. cognitive skills.

The Schools Council was quick to recognise the trend and warn against it :

> A distinction has frequently been made between teaching objectives and examination objectives. We do not recognise the propriety or the need for this distinction. It may be that there are some teaching objectives the attainment of which a particular examination does not measure, but this simply draws attention to the short comings of that examination as an instrument of a particular course of study.
>
> (Schools Council Examination Bulletin 27, 1973, page 12)

Unfortunately the examination boards chose to ignore such warnings possibly because of the massive problems of constructing truely valid examinations for many of the liberal, affective objectives. They were powerful enough to tread the more comfortable path of selectively assessing much more traditional cognitive skills. They also had another source of control. Although some curricula had the benefit of independent funding bodies such as the Nuffield Foundation the majority did not. The traditional subject approaches had been derived over long periods of time but few objectives or aims were in evidence. These courses, by far the most predominant, were therefore ripe to be brought under the control of the examination boards. Many

boards set up panels of teachers and others to consider and devise objectives for these Mode 1 courses. Not surprisingly the majority of objectives were drawn up with some consideration of the limitations of the examination system in mind. Many of the subject panel members, teachers or not, were closely involved in the assessment activities of the board and therefore not anxious to create more problems for themselves than necessary. Difficult philosophical issues could always be resolved by producing aims which were liberal and objectives which were specific to the limitations of traditional assessment and writing off the difference to teaching and assessment objectives.

Numerous examples of this sidestepping of the issue can be found in examination syllabuses. It seems to have become acceptable to point out that the examination is concerned only with certain aspects of the wider teaching process:

> The syllabuses are examination syllabuses and they seek to give an indication of the material on which the question papers will be based and not to prescribe the depth to which any particular topic should be taught.
>
> (Northern Ireland Schools Examination Council, 1980, page 18)

> The notes for guidance indicate how certain items in the syllabus will be interpreted for examination purposes.
>
> (Associated Examining Board, Biology 'O' level, 1981, page 231)

> It is stressed that this is an examination syllabus outlining those points on which questions may be set. It is hoped that this will not preclude a wider and more radical study of contemporary chemical material and practice.
>
> (Associated Lancashire Schools Examining Board, 1980, page 10)

This was something of a naive hope given the recognised effect which examinations have on teaching. Powerful social factors put the attainment of above average grades in examinations at a high premium. Teachers therefore cannot afford to ignore the interpretation put on the syllabus by the examination board for assessment purposes.

In the assessment of courses objectives can be seen to have taken a quite different role to those in curriculum design. They have been used as a validation tool for examinations defining the skills which a given examination assesses:

> Many authorities (Quoted in Wiseman, S. (1961) Examinations and English Education, University of Manchester Press) emphasise the need to identify the 'goals', 'outcomes' or objectives of a course of study as a prelude to the construction of an examination.
>
> (Secondary Schools Examination Council, Examination Bulletin No. 3, 1964)

They have however been powerfully restricted to those objectives which can be assessed by traditional examination techniques. Even if examinations can be considered valid in terms of the assessment objectives stated in the syllabus. Whether they are valued in terms of the wider curriculum is another, much more important, question.

Summary

The preceding sections have discussed the way in which the use of objectives as part of the rational planning approach to curriculum development have been perceived and used over the last forty years. Three main issues arise from these discussions which are addressed in this research. Firstly 'do objectives facilitate communication of purpose between groups or individuals?' Secondly 'is the rational planning model a sufficiently good description of what happens in the teaching/examining process in Britain to be used to try to modify or improve practice?' Thirdly 'does the use of objectives by

examination boards ensure the production of valid examinations?'

Each of these issues is considered in the following chapters to increase awareness of the way in which the teaching and examining process is currently operating in Britain. They also serve to highlight some issues which are of importance in the proposed new 16+ system. These might include:-

1. The way in which newly defined national criteria and assessment objectives might be perceived and used by teachers.

2. Will it be possible to match the predetermined grade related criteria for assessment to individual pupil achievement on examination papers?

CHAPTER THREE

METHODOLOGY

Introduction

In Chapter One the purpose of this research was described as seeking to further understanding of the complex processes involved in the teaching and examining of a CSE Mode I Biology syllabus. This kind of research requires a methodological approach which will provide information, describe perceptions and facilitate interpretation. These can then be used to build up a picture of how the system operates and where control and pressures for change or resistance to change exist. In order to guide the collection of relevant data a model of the theoretical processes which might be considered to operate has been drawn up. The model focuses on the roles which objectives are 'offically' perceived to play within the system as a means of drawing out information from those directly involved. This can then be used to illuminate the way in which the system 'actually' operates. Real experiences and practical problems are compared with the theoretical model in order to enhance understanding of the processes involved. The model provides one account of how the system operates. In it can be found an answer to such key questions as 'what role do objectives play in the communication of purpose throughout the system?' 'Who controls the syllabus and decides upon its objectives?' 'How closely do examinations match the syllabus objectives?' and 'What effect do examinations have on classroom teaching?' What is interesting but methodologically complex to discover is the extent to which this account matches actual practice.

Subjectivity and Objectivity in Research

Dealing with an educational process which is operating in practice will often involve the collection of data of a subjective nature. The information which any individual gives describing their personal experience is, inevitably subjective. Any attempt to collect data which could be described as 'objective' in a narrow sense, i.e. free from personal bias or interpretation, has little to offer in enhancing understanding of the working of the processes addressed in this research. It is therefore important to adopt a methodology which takes account of the subjective nature of the research and at the same time offers acceptable levels of rigor.

Recent educational research has increasingly been concerned with attempts to understand and evaluate the processes of education at work in more than a statistical way. It can incorporate qualitative as well as quantitative aspects, both contributing to further understanding and explanation. This move to incoporate the 'subjective' in research has necessitated alternative methodologies, a shift away from a purely natural science paradigm to incorporate paradigms that have been developed within certain branches of the social sciences.

Hamilton and Parlett (1977) have described this distinction as being between an "agricultural - botany paradigm" :

> ..... designed to yield data of one particular type, i.e. 'objective' numerical data that permit statistical analyses.
> (Hamilton and Parlett, 1977, page 7)

and a "social - anthropological paradigm" which:

> ..... takes account of the wider context in which educational programmes function. Its primary concern is with description and interpretation rather than measurement and prediction.
> (Hamilton and Parlett, 1977, page 10)

The advantages of incorporating the latter research stance, which promotes explanation of an effect, include the fact that it offers more information on which to base decision making and policy changes. The former stance tends to evaluate specific techniques or policies, but only within the narrow context in which they are studied. A second advantage is that the realities of teaching and learning are clearly dependent on the personalities and experience of those involved and as such must be taken into account, not minimised. Despite these advantages, much criticism is levelled at the new approaches and the more 'objective' paradigm is often favoured. Parlett and Dearden (1977) attribute this tendency to the fact that:

> (The agricultural - botany paradigm) .....
> presents itself as objective, reliable,
> quantitative and value-free ....
> (Parlett and Dearden, 1977, page 5)

These are laudable attributes, but can such a statement be validated for educational research? It has been questioned even within the much more recognisably objective field of the pure sciences. This question has been central to much debate in the field of sociology where the distinction between the natural and social science approach is well documented. Britten (1973) makes several pertinent points in his discussion of the objective - subjective dichotomy. He begins by pointing out that:

> ..... many natural scientists have long ago
> openly declared the metaphysical under-
> pinnings of some of their assumptions.
> (Britten, 1973, page 15)

and goes on:

> ..... what is defined as objective will
> depend very much on <u>who</u> is doing the
> defining. It also depends on <u>when</u> and
> <u>where</u> the defining takes place. .....
> Thus, conceivably there might be different
> versions of what constitutes the objective.
> ..... The distinction between the

> objective and the subjective is based on a false dichotomy. ..... To assume that there are two parallel ways of knowing is a gross over-simplification. The objective and the subjective are opposite sides of the same coin. There is no subjective without the objective and vice versa.
> (Britten, 1973, page 16)

By raising these issues Britten extends a powerful criticism of the search for scientific objectivity in research. It follows that the 'agricultural - botany paradigm' cannot be seen to fulfill the attributes with which it is aclaimed and is just as "suspect" in these areas as is the 'social - anthropological paradigm'. Indeed application of the former paradigm without recognition of its limitations can lead to interpretations which are often misleading and oversimplified. Britten makes a further point in relation to the objectivity of sciences:

> The fact that scientific knowledge is never certain but is subject to the laws of probability indicates that 'scientific objectivity' is related to human decisions about the levels of confidence that are acceptable for the purposes of research. It is these human decisions that generate doubts about the claim of a purely objective science .....
> (Britten, 1973, page 17)

This statement questions the claim of the agricultural - botany paradigm to be both quantitative and value free. These characteristics are not consistent with even the most rigorous scientific approach. Decisions about the acceptable levels of confidence and what to record or not record are value judgements made by those who are involved in the scientific experience. They must be influenced by the perceptions and interpretations which the individual makes and as such are subjective in terms of Brittens 'coin' analogy. In the social sciences there has been a long tradition of developing alternative methodologies which take subjectivity into account and may therefore be more appropriate to the study of social issues than the "objective" natural science paradigm.

Using a Range of Methodological Techniques in Research

The advantages and disadvantages of various techniques have also been recognised as important:

> Social scientists have come to abandon the spurious choice between qualitative and quantitative data; they are concerned rather with that combination of both which makes use of the most valuable features of each. The problem becomes one of determining at which points they should adopt the one and at which the other approach.
>
> (Merton and Kendall (1946) in Cohen and Manion, 1980, page 26)

The same stance has been taken up more recently in educational research and is described by Nisbet (1980) who identifies five 'styles' of educational research methodology. (Details of these are given on page 48.) Nisbet goes on to suggest that all these ways of working may have some value in educational research. He concludes:

> ..... my position is that no one of these styles is 'right', and none is altogether 'wrong'. The most effective research employs a variety of strategies, across the spectrum.
>
> (Nisbet, 1980, page 7)

This use of a range of appropriate research techniques has also been advocated by Wrigley (1976):

> It is as if many researchers have instinctively felt that the pitfalls (of logic and statistical technique in respect of educational research design) ..... might be avoided by a return to more subjective methods and the employment of a new variety of observational techniques ..... We should use eclectic methods, objective and subjective, precise or rough as appropriate.
>
> (Wrigley, 1976, page 4)

..... I suggest that the trend of the past fifteen years has been the emergence of a range of styles, which have added greatly to the power of educational research methods. I use the word 'range', but perhaps it is better described as a 'spectrum' -

1	2	3	4	5
Experimental Method	Exploratory Survey	Curriculum Development	Action Research	Open-ended Inquiry
Empirical Educational science	Fact finding as a basis for decision making	New syllabus content and method. Field Trials and evaluation	Interventionist	Grounded theory Participant observation Illuminative evaluation

The agricultural model

Experiments to improve your products by manipulating treatments

The anthropological model

Go and live there and see what it is like.

because a spectrum has no sharp boundaries, ...

(Nisbet, 1980, page 3)

His direct reference to the use of subjective research methods emphasises the positive contribution which such methods can make and goes some way towards dispelling the more commonly held notion that subjectivity in research is both undesirable and should be eradicated.

This study has developed a methodology which employs a range of techniques. In terms of the descriptions embodied in Nisbet's five styles, the principal techniques used tend to be those associated with 'Curriculum development', 'Action Research' and 'Open-ended Inquiry', although other aspects of the research derive more easily from the 'experimental method' and 'exploratory survey'. Each technique used has been chosen for its particular strengths in respect of the information to be gathered; each contributes to the building of an overview of the teaching and examining process in action. Thus techniques such as semi-structured interviewing and observation are used in conjunction with questionnaires and differing treatment techniques. The precise use of these techniques is discussed in more detail in the following section. However at this point it is necessary to discuss how the information arising from the use of these various techniques can be meshed together in an informative way.

Hamilton and Parlett (1977) describe illuminative evaluation as using a variety of techniques in the course of a single piece of research and outline the way in which the findings from diverse techniques can be used to advantage:

> Illuminative evaluation is not a standard methodological package, but a general research strategy. It aims to be both adaptable and eclectic. The choice of research tactics follows not from research doctrine, but from decisions in each case as to the best available techniques: the problem defines the methods used, not vice versa. Equally no method (with its own built-in limitations) is used exclusively or in isolation; different techniques are combined to throw light on a common problem. Besides viewing the problem

> from a number of angles, this 'triangulation' approach also facilitates the cross-checking of otherwise tentative findings.
> (Hamilton and Parlett, 1977, pages 13 - 14)

This process of triangulation has become an accepted research method (Cohen and Manion, 1980) for validating or identifying mismatches in the collected data. In some instances data collected by two or more differing research techniques will be supportive, enhancing the reliability of either finding alone. In others mismatches will be evident which require further explanation. This tends to reduce the possibility of drawing erroneous conclusions from insufficient evidence.

In the context of this research all the research techniques are aimed at clarifying the role, or roles, which syllabus objectives play in the teaching and examining of a Mode I CSE syllabus. The process is complex and necessitates the use of a range of techniques. Although each technique has been chosen in order to clarify the role of objectives in one particular aspect of the process it is not easy to dissociate their role in one context from their role in another. It is therefore likely that in collecting information about their role in, for example teaching, information may present itself which has a bearing on another aspect of the research, for example the objectives stressed in the examination. Such information can be used in conjunction with other material collected on the way objectives are reflected in the examination, to build up a better picture of their actual role in these processes. Each phase of the research therefore has a potential contribution to make to enhance or contest the findings of other phases. Triangulation therefore offers a method of enriching the findings from each separate research strategy. The discussion of the results of the research are presented in the later chapters of this thesis. Wherever possible, pertinent research findings are grouped together to illuminate a specific aspect of the teaching/examining process. These research findings may come from a variety of sources but focuses on one aspect of the role of objectives.

At this point however it is useful to outline the major techniques which were employed to generate information and data. The rationale for choosing each technique will be outlined and some of their advantages and disadvantages discussed. In some cases specific details of procedures will only be touched on here but are described, in more depth in the subsequent chapters.

The Research Techniques Used in this Study

1. Data Collection by Questionnaire

Two forms of questionnaire were used. The first was designed to collect factual information from a large number of schools. The second to collect more subjective information on the use of objectives by Biology subject panel members and examiners. Since the rationale for and procedures employed in the design of these two forms of questionnaire were different they will be considered separately.

1.1 Fact Finding Questionnaire

This questionnaire was sent to all schools which entered candidates for SREB Biology Mode I CSE in 1980. There were a total of 261 centres. The large number of schools involved made a postal questionnaire the most effective method for collecting the data required. The nature of the data which was concerned with factual information about the school and the organisation of Biology teaching was also suited to this type of approach.

The questionnaire was pilot tested using teachers in local schools, and modifications were made before the finalised forms were sent out. (Appendix I) The questionnaire was distributed with a covering letter which served to inform head teachers and Biology staff of the nature of the research. The completed questionnaires were used to select schools and teachers for further involvement in the research. The return of 77% was high for a questionnaire survey of this type. Of these returns 82% indicated that they were willing to participate further in the research.

The data was used to draw up an idea of the variety of school contexts in which CSE Biology Mode I was taught. Finally twelve schools (18 teachers) were selected for further participation.

This number was chosen because it gave a range of school contexts which reflected those found in the larger survey, and to comply with the time which was likely to be available for the next stages (interviewing). The schools were chosen on the basis of the following criteria: number on role, age range, status i.e. comprehensive, bilateral etc, associated 'O' level Biology syllabus taught, number of CSE Biology candidates entered for 1981 and number of staff willing to participate further.

1.2 Questionnaires to Elicit Information from Subject Panel Members and Chief Examiners

These two questionnaires were designed to provide more subjective information on the way in which individuals perceived the function of objectives in syllabus and examination design.

The questionnaires were drawn up and pilot tested prior to being sent out. While both recent Chief Examiners completed and returned their questionnaires only 50% (6/12) of the subject panel members completed theirs. The information which was collected from these questionnaires is recorded in appropriate places in the subsequent chapters.

1.3 Questionnaire Design

All the questionnaires were drawn up bearing in mind their specific function and the general advantages and disadvantages of this technique. The former would include the possibility of speed and wide coverage combined with relatively low expenditure of both money and time and the reduction of bias caused by personal interactions. The latter include the difficulties of following up ambiguous or unusual responses, unexpected, though profitable, lines of enquiry and of motivating respondents to return questionnaires. The rationale for choosing questionnaires for these aspects of the research has been indicated and the design of each has been drawn up with reference to relevant educational research manuals. (e.g. Youngman 1978, Tuckman 1972.)

2. Data Collection by Interview

Interviewing is a well recognised technique in educational research, providing an adaptable method for eliciting information. (See Lovell and Lawson (1970); Wragg (1978); Cohen and Manion (1980) and Bynner and Stribley (1979).) A range of interviewing techniques exist, but in this research all the interviews were of a semi-structured nature. Semi-structured interviews are characterised by a series of key questions which have been designed to elicit relevant information. The interviewer is at liberty to ask subsequent questions (probes) or seek further information or explanation from the respondent in the light of answers to these key questions:

Borg (1963) describes one of its advantages as follows:

> (The semi-structured interview) .....
> often permits gathering valuable data that could not be successfully obtained by any other approach.
> (Borg, 1963, page 223)

Merton and Kendall suggest that focused interviews (analagous to semi-structured interviews) are valuable in "interpreting discrepancies between anticipated and actual effects":

> Quite frequently, for example, the experimenter will note a discrepancy between the observed effects and those anticipated on the basis of other findings or previously formulated theories. ..... some effort must be made to interpret such "contradictory" results. But the difficulty here is that of selecting among the wide range of post factum interpretations of the deviant findings. The focused interview provides a tool for this purpose.
> (Merton and Kendall, 1956, page 8)

The semi-structured interview therefore provides a mechanism whereby the individual situations which teachers find themselves in can be explored. Explanations for discrepancies between the way teachers said they perceived objectives and the way in which they appeared to use them can also be unfolded.

Chapter Four will present the results of the interviews and discuss some of the issues concerned with their specific design and implementation in more detail.

3. Analysis of Examination Paper

The 1981 Biology Mode I examination paper was analysed to identify the objectives which it assessed and the proportion of marks awarded to each objective. Some of the problems associated with this type of analysis have already been raised in Chapter Two. Wherever possible precautions were taken to minimise lack of consensus caused by misunderstanding or misinterpretation by those analysing the paper (scrutineers).

The paper was analysed on the face validity of the question, that is what they appear to be assessing. This was necessary because each question item may test a range of objectives in a range of candidates. For example item X tests knowledge for candidate A, deducing for candidate B, guesswork for candidate C etc. However, for this research, it was important to try to establish the objective or objectives each item was likely to assess for the majority of pupils. This was achieved by using teachers experienced in this Mode I Biology course, or similar courses, as scrutineers. Deale (1975) points out the rationale for such a step:

> If a teacher judges, from his experience, that a test looks right for a particular purpose intended, then there is a reasonable chance that he is on the right lines.
>
> (Deale, 1975, page 29)

On this basis three separate analyses were carried out with respect to three differing sets of criteria for analysis. This procedure was adopted in order to identify firstly whether or not any one of these methods resulted in better agreement between individual scrutineers. Secondly whether there were any patterns of agreement between the three analyses. The three sets of criteria for analysis were (I) Blooms six cognitive categories, from which the syllabus objectives were derived (five scrutineers) (II) The syllabus objectives as written for the 1981 examination (five scrutineers) and (III) An independent categorisation (six scrutineers).

In each case the scrutineers worked independently analysing each question with respect to the criteria which had been supplied or were to be derived. In the first two analyses the scrutineers were given precise information about the way they should go about categorisation. The instructions had previously been pilot tested for comprehension and ambiguity. In all three analyses it was possible for the scrutineer to define the questions in alternative terms if they felt that the categories which had been provided were inappropriate. It was also possible for them to make comments on individual questions if they felt some further explanation was needed.

4. The Analysis of Completed Scripts

Fifteen of the eighteen teachers who were interviewed had candidates who were entered for the 1981 Biology Mode I CSE examination. They all agreed to allow the examination scripts of these candidates to be used to provide data on pupil performance. The scripts were recalled through consortium secretaries providing a total of 330 completed scripts for analysis.

The marks which had been awarded to each candidate on each part of each question were extracted. These were used as data for investigating the overall teaching groups performance in terms of the original objectives. In addition, the performance of grade I and grade 4 candidates across the whole sample was studied. This was in order to examine whether or not 'grade descriptions' could be produced to describe their achievement as distinct groups in relation to the original objectives.

It is important to stress that the data collected from the scripts were purely numerical in nature. No attempt was made to investigate the quality of the candidates answers to the questions, except in terms of the number of marks[1] they were awarded. This approach was adopted partly because many decisions concerning the drawing of grade boundaries and grade awards are determined on a largely numerical basis. It was also adopted because concentrating on a quantitative distinction between groups of candidates facilitated comparison between them.

---

(1) It should also be noted that no attempt was made to check on the accuracy of the marking of the scripts, and the marks used were those awarded in the examination marking process.

5. Additional Methods of Data Collection

These techniques were used, as appropriate, for the collection of other relevant data which has not been mentioned so far. This included:-

1. Historical information relating to the introduction and specification of objectives at a general Board level and at the Biology subject panel level.

2. Information concerning the communication and decision making processes which operate within the Board's structure.

3. Additional information on pupil performance with respect to grade awards and moderation procedures.

All this information was provided by the professional staff of the Board who gave access to the minutes of meetings, training documents, grading sheets and marking schemes. They also allowed informal discussion which was most helpful both in determining the way in which the Board operated and in identifying where relevant information was likely to be recorded.

Some of the data such as the final grades candidates were awarded was largely factual. It formed an essential element of the research without which any interpretation of pupil performance would have been impossible. Other data such as the historical background pertaining to the introduction of objectives into the syllabuses provided material which proved particularly valuable. It was used to supplement data gathered from other sources and subsequently with assisting in the interpretation of the research findings.

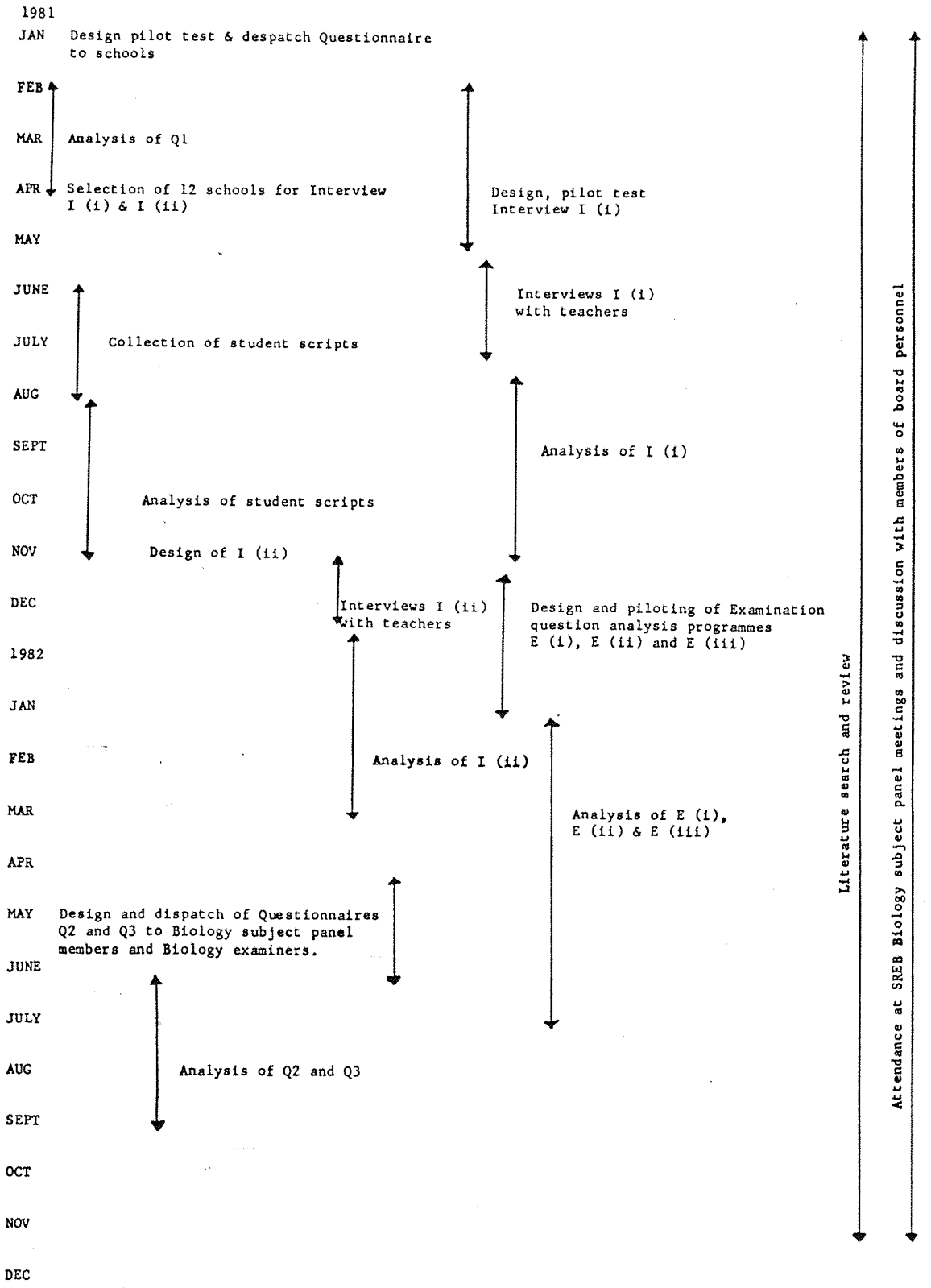
The Employment of Specific Research Techniques in the Rolling Strategy of the Research

In the preceding sections the techniques used in the research have been described in discrete terms. However the research followed a rolling strategy where each technique grew from the previous experience and research findings of the project. In practice the research techniques developed alongside each other and influenced and were influenced by other aspects of the work. For example the form of the second set of interviews with teachers was determined by the responses to the first set of interviews, the analysis of pupil's scripts, and information received from the minutes of meetings held at the SREB.

Figure 3.1 shows the overall pattern of the research strategy which was used in the project. It indicates the timing of each phase of the research and shows, in a diagramatic form, the order in which the discrete research techniques, were used. Presenting the pattern of the research programme in this form makes clearer the bearing which each technique had within the rolling strategy.

FIGURE 3.1

DESCRIPTION OF THE TIMING OF INDIVIDUAL RESEARCH TECHNIQUES OVER THE PERIOD OF THE PROJECT



Questionnaire Q1 Appendix 1
Interview I (i) Appendix 4
Interview I (ii) Appendix 5
Examination question analysis programmes See Chapter Six
E (i) Classification using Blooms Taxonomic gps
E (ii) Classification using Syllabus objectives
E (iii) Classification using independent categories
Questionnaire Q2 Appendix 2

Summary

Specific details relating to the precise implementation of some of these techniques are discussed in subsequent chapters where procedures, and controls can be considered more fully and more meaningfully in context. However this chapter serves to indicate the range of methodological techniques which have been employed in the research. Some such as the semi-structured interviewing stem from the 'social-anthropological' approach to educational research. Others such as the survey questionnaire were from the 'agricultural-botany' paradigm. Each technique has been chosen for the specific contribution it makes to the collection or verification of data and its advantages and disadvantages over other techniques carefully considered.

The techniques which have been used reflect the range of activities which form an integral part of the process of teaching and examining. The investigation of this process from a number of different, but closely associated, perspectives provides a wealth of data which can contribute to a better understanding of the way in which it operates.

A number of the techniques were preconceived as necessary to the research, others were adopted in response to situations that arose and questions that became apparent as the project developed through its various stages. In this respect the research followed a rolling strategy where decisions concerning techniques and appropriate methodological stances were taken as the research developed. In the following chapters the results are reported in a form which often draws on the findings of a number of the research strategies that have been outlined. This presentation of the results does not accurately follow the rolling strategy of the project, but has been arranged in order to relate the various strands of the project together in a constructive, comparative and critical way.

CHAPTER FOUR

TEACHERS PERCEPTIONS OF THE ROLE OF OBJECTIVES IN THE TEACHING AND EXAMINING OF A MODE I CSE SYLLABUS

Introduction

In Chapter Three the methodologies which were used have been discussed as discrete techniques. An indication of the way in which these techniques were used in the rolling strategy of the research has been outlined. This chapter and the following two chapters present the main findings of the research. This chapter deals with the way in which teachers perceive and use objectives in the teaching and examining of the SREB Mode I Biology CSE course. The syllabus details including the objectives for the course, the examination weighting and the content to be covered are given in Appendix Six. In effect this chapter examines the processes embodied in communication line 1 [1] of the theoretical model presented in Chapter One.

Most of the information presented here was gained from semi-structured interviews with teachers which took place in their schools. The interviews attempted to identify the teachers' perceptions of objectives and the way they used objectives in their day to day activities in the classroom.

The Interviews

The interviews inevitably generated a great deal of information which was pertinent to other aspects of the research and gave insights and clarification of many of the wider processes outlined in the model

---

(1) The way in which teachers perceive and use objectives.

and this evidence is included in other chapters. However the focus of the first interview (Appendix Four) was specifically related to identifying how familiar the teachers were with the syllabus objectives and what objectives they felt pupils achieved after completing the course. It also probed into difficulties concerned with teaching the syllabus and the effect of the examination on teaching activity.

The second series of interviews were more focussed. There was a core of questions relating to the teachers' objectives identified in the first series of interviews, the teaching techniques which were used and the teachers' training or experience in the field of assessment. (See Appendix Five for a list of the main questions that were covered.) However much of the time was spent in looking at individual pupil's examination scripts and discussing the teaching group's performance on the 1981 examination.(2) The second interview also provided an opportunity to follow up points raised in the first series of interviews with individual teachers.

This chapter specifically focuses on the rationale for selecting schools and teachers for interview and then identifies some of the considerations which were taken into account in drawing up the interview schedules before going on to present the results of the interviews themselves.

Selection of Schools and Teachers for Interview

Twelve schools were chosen. None of these schools could be considered as a 'typical' school in the sense that it embodied a core of characteristics which could be recognised in all the other schools which responded to the questionnaire. Realistically every school is

---

(2) The script analysis was carried out between the two interviews and teachers had had a chance to look at their pupils' scripts before the second interview took place.

unique. By using a number of schools it is possible to highlight the uniqueness of each specific situation while at the same time allowing patterns or trends between schools to be more evident. The twelve schools, in which interviews were conducted, provided a range of conditions in which the teaching and examining of Mode I CSE Biology took place. Whilst no individual school, or group of schools could be held to be representative of the whole population which was covered by the questionnaire, the twelve schools did embody elements which were characteristic of the larger sample. In the same way the eighteen teachers interviewed presented both common and varied responses to questions.

In presenting the findings of the research there is a concentration on identifying both patterns which were common to the majority of schools and more individual characteristics. The purpose is to provide information which can be recognised and evaluated by other readers in the light of their own experience.

Selection of a Semi-Structured Interview Technique

The semi-structured interview format was chosen because (i) it offered more opportunity for clarification of responses than the more structured format in which there is a strict adherance to question order and wording; and (ii) it provided more of a framework than the open interview which allows exchanges between interviewer and respondent to follow any line which develops. The semi-structured interview falls between these two extremes on what could be considered as a continuum, from rigidly structured to completely open interviewing. In this particular instance there were a number of predetermined questions for both interviews (Appendices Four and Five). The wording and order in which they were delivered by the interviewer was kept as close as possible to the original. However if questions were answered as part of the response to other questions

earlier in the schedule, they were not necessarily repeated unless the interviewer felt that further clarification was necessary.

The semi-structured interview provided a mechanism for interviewing where it was possible to clarify ambiguous points, follow up interesting 'one off' statements and clarify or ask for more information where necessary. At the same time it allowed the course of the interview to be guided in such a way as to provide information on a prespecified range of questions. This latter element was particularly valuable given the time constraints imposed on the interviews by the structure of the teachers' school day and their availability.

Interviews with Teachers: An Outline of some Technical Details

Powney (1982) indicates the significance of the technical detail of research interviews:

> ..... educational research reports usually make assumptions about a shared view of what constitutes an 'interview' .....
>
> In reading a research report we want to believe the researchers' story; we want to feel confident that the results obtained were reasonable in the circumstances and that therefore the conclusions and implications can also be justified as a basis for debate. ..... The 'interview' is sensitive to many variables and it's difficult to believe the researchers story when the sensitive variables have been ignored or at least not reported.
> (Powney, 1982, page 2)

she concludes:

> ..... researchers must make explicit the context, purpose, procedures and approach to reporting interviews for them to be valid sources of data.
> (Powney, 1982, page 5)

Listed below are some of the main characteristics of both series of interviews conducted in this research.

1. None of the teachers interviewed were previously known by the interviewer.

2. Each teacher was interviewed twice in their own school setting. There was a six month gap between the two interviews.

3. The teachers interviewed were made aware that no respondent's information would be identified with a named individual or school.

4. All the interviews were tape recorded and edited by the interviewer. Transcripts were returned to the teachers for revision and comment.

5. The data collected from the first interview was analysed before the second interview was designed. (3)

These general features help to set the context of the interviews however many of the variables to which Powney (1982) refers arise from the specific techniques by which the interviews are conducted. Gorden (1980) outlines a range of 'tools, concepts and principles' which help to maximise the flow of information between the interviewer and the respondent. These were used as a basis from which to draw up the specific techniques used in this research and therefore need to be mentioned. Gorden (1980) deals in detail with the technical issues of 'facilitating' and 'inhibiting' information flow with respect to a

---

(3) This enabled the second interview to be responsive to particular issues raised both by the first interview and the script analysis which had been carried out in the interim period between interviews.

number of factors. In each case an attempt was made to maximise facilitators of communication and minimise inhibitors. Consideration was given to:

(i) The preliminary information exchanged between the interviewer and the respondent before the interview began i.e. status of interviewer, purpose of interview etc.

(ii) The wording and order of the interview questions.

(iii) The use of probes to encourage and clarify discussion.

(iv) The timing and situation in which the interviews were carried out. Including such things as the seating arrangements etc.

(v) Non verbal communication between the interviewer and respondent.

(vi) Methods of recording the interview.

(vii) Verification of the interview data.

(viii) Minimisation of 'bias'.

(ix) Confidentiality.

Although much can be done to enhance the flow of communication by careful preparation of the interview schedule and planning, success also depends on the experience of the interviewer. To this end a quite extensive pilot programme was used to verify the interview schedule and provide the interviewer with appropriate experience of interviewing and feedback.

How do Teachers Perceive and use Objectives in their Teaching?

Reporting the responses to questions on an item by item basis does not present the data in the most coherent form. It is more useful to identify a number of issues which arose from the interviewing and consider each issue in turn with reference to the data from the range of techniques employed. In some instances the teachers' comments or perceptions indicated areas of mismatch between the theory outlined in the mode in Chapter One and the teachers' day to day classroom practice.

The issues which arose from the interviewing can be grouped under a number of question headings as follows:

1. What perceptions do teachers have of objectives?

2. How do teachers use objectives in their day to day activities in the classroom? i.e. What role do they perceive them to play in the teaching/examining process?

3. What objectives do the teachers themselves have when they teach the subject? These may include ideas relating to the role of Biology within a wider school curriculum not just an examination syllabus.

4. How do the teachers own objectives compare with the syllabus objectives chosen by the Board?

1. What perceptions do teachers have of objectives?

The definitions which the teachers gave of objectives were very wide ranging:

> It's the sum total of everything, my experience and so on, to deal with the topics as I feel it ought to be done.

> A global aim that you are trying to achieve throughout your teaching of the subject. An ultimate goal.

> ..... an objective is something that you can actually measure, you could actually see that you had done it, or you hadn't done it.

The majority of definitions tended to be more general and the measurable element was only mentioned in one or two cases. The range of specification in the descriptions mirrors the debate which has taken place over the years trying to distinguish between aims and objectives.(4) The range of descriptions which the teachers gave indicates that an objective may be perceived in a number of different ways by teachers. Part of this difference may be related to the personal experience of the teacher. Indeed the majority of teachers said that they had no formal or informal training in the use of objectives. Their descriptions tended to be less precise and may derive from the fact that the word objective has an applicable meaning in normal usage which is different from its use by educationalists. Those few who had some

---

(4) In general terms an aim provides the philosophical rationale for a curriculum while an objective translates the aim into more concrete terms often related to measurable and/or behavioural qualities to be induced in the learner.

training in the use of objectives in curriculum development either from their pre-service training course or some in-service or further degree work, used a more specific definition. This was often behavioural, relating to skills or behaviours which could be assessed and measured. In these latter cases the teachers were using the term objective in a more specific educational sense. Using an everyday word as a technical term with a much tighter and more specific meaning and vice versa often results in some confusion. It can result in a range of translation, interpretation and perception as demonstrated here. (The problem is found in many other areas of study.)

These differences in perception are likely to influence the way in which teachers use objectives in their day to day activities and the kind of objectives which they identify for the curriculum. These two aspects are now considered.

2. How do teachers use objectives?

Some of the teachers comments indicate the way in which they use objectives on a day to day basis:

> I'm not sure if most teachers take a lot of notice what's written in at the beginning of the syllabus. I would imagine that most teachers would read them, but they'll turn on fairly quickly to page 2 of the booklet to see what they're supposed to teach.

> I've never analysed each lesson to analyse which objectives are being tested.

> I don't have any clear objectives on a day to day basis.

None of the teachers who were interviewed used objectives as a major element in their planning of lessons, although this is an approach which is often stressed in may pre-service courses. Thus it would appear that one of the fundamental roles which is often ascribed to objectives in a rational planning theory i.e. that they are essential starting points for teaching and planning (see Tyler, 1949; Kerr, 1968; Hirst, 1975) can be questioned. Some competent and experienced teachers do not seem to work from this premis and yet remain effective in preparing lessons and pupils for assessment. The next logical question to ask is what is important to teachers in planning their lessons? The interview responses suggested an emphasis on content:

> I tend to look at they syllabus, I'll say 'I've got to teach this' .....

> I keep a close eye on the syllabus as well as the exam papers to get an idea about the work that I should be doing but I haven't read the objectives.

These findings then call into question the role of objectives in terms of starting points for lesson planning, a role which is implied in the model described in Chapter One. Much more notice is taken of the content of the syllabus suggesting that the teachers are operating in much the same way that Taylor (1970) and Kiemer (1981) described.

However the model also suggests another role for objectives, that of communicating the purpose of the syllabus, indicating what skills the pupils should achieve and in what proportion these will be assessed. So while the objectives may be functioning rather inadequately as aids to individual lesson planning and day to day classroom activity, they may yet still play an important role in communicating the purpose of the course to teachers. In this sense they are influencing the way in which

the content of the syllabus is actually taught in general terms. One way of establishing whether the syllabus objectives are being used by teachers in this way was to ask them if they could remember what they were; the majority of teachers could not:

> I can't recall the objectives off hand because they're probably a mixture in my mind with all the things that I teach.

> No, I don't know what the SREB objectives are.

> I don't remember what they are off hand.

These responses were typical of those given by nearly all of the teachers, one or two gave some of the objectives but none of the teachers gave any indication that they were fully conversant with them.

These indications suggest that the syllabus objectives were not used by the teachers to plan lessons neither did they facilitate the communication of purpose or assessment between the board and teachers. It is therefore questionable whether communication line 1 as described in the model i.e. the communication between the board and teachers is actually operating in practice as the theory suggests. The differences in perception that the teachers have as to what objectives are i.e. how they are defined by them therefore becomes largely immaterial. By and large the teachers responses indicated that they did not use the syllabus objectives at all. However the differences in perception may play a more significant role in determining the objectives which the teachers felt to be important.

3. What objectives do teachers themselves have when they teach the subject?

Although the way in which teachers used objectives was obviously at variance with the theoretical use that has been proposed it was also apparent from the interview responses that the teachers did have quite clear ideas about what they felt it was important to promote through the teaching of the subject. In other words they had quite definite purposes in mind when they were teaching. In order to identify the kinds of objectives that the teachers held questions were incorporated into the interviewing schedule to probe this area from a number of different perspectives. The teachers often alluded to the objectives they held or promoted when answering other questions. In the interview three main lines of inquiry were followed (a) what are your main objectives when you teach this course? (b) what skill, attitude or behaviour is it important for the children to gain in following this course? and (c) when they have completed the course what does the average CSE candidate take away in terms of skills, attitudes or behaviour? Interspersing other questions between these during the course of the interview, served to separate these questions in the minds of the teachers. Their direct responses to these questions supplemented by additional pertinent information given in response to other questions is summarised in the following three tables.

TABLE 4.1

WHAT ARE YOUR MAIN OBJECTIVES WHEN YOU TEACH THIS COURSE?

	No. of times mentioned by different people
Practical ability	14
Data handling	10
Body of knowledge	8
English/maths ability (3 each)	6
Interest	5
Relevant knowledge (for pupil)	5
Application of knowledge	5
Develop critical approach	5
Carrying out instructions	5
Experimental design (hypothesis formation)	5
Thinking for themselves	4
Drawing and interpreting diagrams	4
To achieve good grades/pass exam	4
Develop scientific thinking/method	3
Use and find information	3
Discussion of results	3
Observation	2
Ability to understand what is being asked	2
Project work	2
To understand how things work	2
Biological principles	2
Note taking	2
Appreciation of living things	2
Drawing conclusions	1
Reasoning	1
Neat and tidy work	1
To have a go	1
Behave in a socially acceptable way	1
Develop a more open-ended approach	1
To get out of the classroom more	1
Provide a general framework	1
Summarising	1
Relationship of man to rest of world	1

This table (page 74) identified 33 different objectives which the teachers felt they had in mind when they were teaching the syllabus. It is interesting to note that while some such as Practical ability, Drawing Conclusions and Summarising, are included in the syllabus objectives others such as Interest, Project Work and Developing an Open-Ended Approach are not. Neither is there much connection between the objectives which the teachers mentioned most commonly and the weighting given to each of them in the syllabus. Although the headings in this table have been generalised it was noticeable that the teachers defined their objectives in very general terms, none were described in terms of the criteria by which the attainment of objectives should be measured. In terms of the specification of objectives, none were precise and many were open to a wide range of interpretation such as "developing an interest in the subject". Many of them also reflected objectives in the affective domain and the psychomotor domain as well as the cognitive. They dealt with the acquisition of emotional and subjective skills, practical dexterity skills as well as knowledge based skills. The table, then, indicates a number of objectives which practicing teachers identified as being important to them when they taught the course. While appreciating that some were obviously individual personal objectives the list does give an overall feeling for the range of objectives which were held and it would appear that practical ability, data handling, acquisition of a body of knowledge etc. were in the minds of many teachers when they taught the course.

Table 4.2 and 4.3 (pages 77 and 78) were compiled in the same way as Table 4.1 and were designed to probe further into the objectives which the teachers actually concentrated on in their day to day activities.

Comparing the tables provides a number of interesting points for comment and interpretation. Firstly it is interesting to note that both the subsequent lists are considerably shorter than the first. This may be due to the teachers lack of motivation to fully answer the question since it involved repeating information which had already been given. However because of the shift in emphasis which is implied in the questions i.e. teachers' objectives as opposed to what is important for children or what children actually achieve and the separation of the questions throughout a fairly lengthy interview, this aspect was hopefully minimised. Certainly there was no indication of lack of motivation from the respondents, none of the teachers made any reference to their earlier answers or made comments like "well as I said before". So some of the difference between the lists could be due to a mismatch between what the teachers would like to do, what they feel they should do and what they can actually do when teaching the course. Certainly the range of affective skills which were identified in the latter two tables was reduced although "interest in the subject" (not a syllabus objective) maintained a high position in all three tables. In contrast the cognitive and practical skills were emphasised more strongly and the terminology the teachers used became more precise. Table 3.3 indicating the skills the candidate achieves after completing the course, has quite a lot in common with the syllabus objectives. However there are still some notable additions such as development of interest, a critical approach and gaining confidence and items missing such as hypothesis formulation and experimental design.

TABLE 4.2

WHAT SKILL, ATTITUDE OR BEHAVIOUR IS IT IMPORTANT FOR THE CHILDREN TO GAIN IN FOLLOWING THIS COURSE?

	No. of times mentioned by different people
Man's role in society	6
Application of knowledge	6
Critical ability	5
Knowledge	5
Handle apparatus	4
Interest	3
Project work	3
Scientific method	3
Summarising	2
Observation	2
Appreciation of living things	2
Links topics together	2
Take measurements	1
Safety	1
Finding out for themselves	1
Health and human biology	1
Learning	1
Graph work	1
Co-operation (working together)	1
Communication of scientific ideas	1
To make children socially acceptable	1

TABLE 4.3

WHEN THEY HAVE COMPLETED THE COURSE WHAT DOES THE AVERAGE CSE CANDIDATE TAKE AWAY IN TERMS OF SKILLS?

	No. of times mentioned by different people
Knowledge	8
Practical skills	6
Interest	3
Use and interpretation of data	3
Human biology knowledge	3
Can carry out instructions	3
Critical approach	2
Apply scientific principles	2
Gain confidence	2
Summarising	1
Scientific approach	1
Work things out for themselves	1
Ability to learn	1
Ability to draw	1
Safety awareness	1

This attempt to identify the objectives which teachers held to be important and those which they promoted during their day to day classroom activities did indicate quite a wide discrepancy. Referring back to the model, the source of influence lines suggest that, in theory, all three of these tables should be roughly equivalent. These tables suggest that this is not a situation which is accurately reflected in practice.

This discrepancy raises the fourth question identified at the beginning of this section.

4. How do the teachers' objectives compare with the syllabus objectives chosen by the Board?

When the teachers were shown the syllabus objectives and asked to comment on them their reaction were very positive:

> So when I read these objectives, SREB objectives, I say 'Yes, these are the same as the kind of things I would like to promote'.

> I would have included all of these things in my teaching.

This kind of comment came from all the teachers, even although their own objectives were not reflected fully in the syllabus objectives list. Part of the reason for this may be with the way in which the objectives are stated in the syllabus. Their generality makes them hard to disagree with or to criticise:

> I think that most teachers would incorporate these in their teaching.
>
> In some senses they are an insult, a good teacher would do them anyway.

The teachers did feel that some of the syllabus objectives were much more difficult to teach than others, particularly applying scientific principles to new situations, formulating hypotheses and planning experiments to test hypotheses.

Yet the tables indicate that there is considerable mismatch between the objectives which the teachers hold and promote and those which the syllabus dictates. Some objectives not included in the syllabus are promoted while others which are included are not. Further evidence of the kinds of objectives which the teachers emphasised in their teaching was obtained by asking them to describe the teaching techniques which they used most commonly when teaching the course. Their descriptions of method fell into three main categories.

1. Theory lessons: characterised by 'talk and chalk' (teachers own description) and some discussion techniques.

2. Note taking: using a variety of source material including text books, information sheets and work sheets. These sessions were designed to allow pupils to make their own, largely factual, notes.

3. Practical situations: teacher directed practical sessions where pupils worked from work sheets, or oral or board written instructions.

These techniques reflect an emphasis on factually based knowledge, practical skills, following instructions and some use/interpretation of experimental or scientific data. In fact they reflect the skills that the teachers perceived their pupils to have after completing the course (Table 4.3) much more closely than those objectives the teachers felt they had for the course (Table 4.1). Techniques consistent with developing an interest in the living world and understanding the complex inter-relationships of plants and animals were far from common and seemed to happen almost by accident. In addition there were objectives, which were included in the syllabus objectives like applying scientific principles to new situations and formulating and testing hypotheses, which were perceived to be difficult to teach and which were not represented in the teaching methods the teachers commonly used.

This evidence confirms the view which the teachers expressed and indicates that only a restricted number of objectives are promoted during the teaching of the course and that these objectives tend to be the same ones for all the teachers who were interviewed. This uniformity occurs despite the very wide variety of objectives which the teachers perceived to be important. The question then arises about what pressurises teachers to focus on more or less the same restricted objectives for their teaching which often go against their individual notions of what is important?

The teachers often related their difficulties in realising some of the objectives to a lack of time:

> Sometimes there are things (problems) that came up in a practical situation but we haven't got time to spend allowing them to think about things like that because we've got the rest of the syllabus to get through.

> To cover aims like free interpretation of data and making their own conclusions you have to have a lot more time. There is too much content.

> I think as the syllabus has got fuller and fuller so I have become more didactic. It sticks in the throat a bit, but one has to cover the syllabus and almost hope that they're going to pick up these other skills as they go along, which is terrible really.

There was very strong feeling that because the syllabus content was very long and detailed and there was no choice on the examination written paper, there was little alternative but to teach the content of the course to the exclusion of other skills. Even the practical skills which the teachers rated very highly became threatened by the lack of time:

> A lack of choice on the paper gears your teaching. You feel you have to cover everything and therefore you have a much more factual approach rather than a practical approach.

> Practical becomes a luxury a lot of the time, mainly in time.

Some teachers felt that 'objectives' like formulating and testing hypotheses and developing an ability to apply principles to new situations were possibly beyond the capabilities of an average CSE candidate. Others felt that they could be developed if there was sufficient time to do this:

> With the new Biology course (merger of Alternative A and Nuffield) you've still got to get over a lot of factual material rather than what you think they ought to be learning ..... Objectives 3 - 6 are difficult things to do. This is one of the

> problems. But they can be done at a certain level with ordinary CSE children. You can get them to plan an experiment, to test a hypothesis, provided it's a very simple single variable type situation.

But the responses also revealed other factors which teachers felt strongly influenced the way in which they taught. One which was common to many concerned the influence of the examination :

> You hope at the end of the course the children are going to know something about the subject that you are teaching them, but you can't get away from the fact that at the end of the course you want them to pass an exam.

> I think the main objective is to get them through the CSE exam. That's what they think I'm here for and that's what their parents think I'm paid for. Certainly as far as the school is concerned it's to get them passed an exam. My main objectives are to pass on, and widen an interest.

> I suppose that's wrong but I've been guided by the exam and governed by the exam. But then, so are the children in the school.

> Whether they pass or fail that is what they are going to have to live with.

One of the overriding purposes of undertaking the course is to pass the examination. A number of the teachers regretted this fact. A more detailed analysis of the assessment which the candidates undertook in 1981 is given in Chapter Six, however it is clear that it largely rewards knowledge and understanding of facts, graph/data handling and interpretation and some practical skills.

This fits very closely indeed with what the teachers teaching methods suggest goes on in the classroom. In many cases the teachers recognised the influence the examination had on their teaching:

> I use the objectives coloured by my knowledge of the exam, which I think is horrific really ..... I still think the exam dictates the approach to a Biology course.

> If the exam is testing things we're not teaching then we could ask for the exam to be modified, but I think, in fact, what usually tends to happen is that if things appear in the exam people begin to teach them which is really the other way round.

> The exam has influenced me quite a lot. I am very geared to teaching them what the examiners want. I find it's the only way they stand a chance of getting a good grade.

A further factor which clearly influenced the teaching of the majority of the teachers was related to the fact that they taught GCE and CSE candidates together in one group. Many schools operated this system partly because of timetabling arrangements but more often because by teaching the group a common core of Biology the decision to enter candidates for GCE or CSE examinations could be delayed until the January of the fifth year.

The teaching in the first stages of the Biology course was, therefore, likely to be geared towards the requirements of both GCE and CSE examinations, although most of the teachers felt that the two syllabuses were entirely compatible in terms of teaching method and content. SREB Mode I Biology was taught with AEB, Oxford and London GCE Mode I syllabuses with little apparant difficulty.

The teachers did suggest that 'O' level candidates had to exhibit better essay writing skills, link concepts more often, and apply information more commonly than in CSE, however the teaching of these skills was mainly undertaken by intensive past question work for both CSE and GCE in the last two terms of the course.

Summary

This chapter has concentrated on presenting information about the way in which teachers use and perceive objectives in their day to day activities. The evidence suggests that their perceptions and use of objectives varies considerably and is likely to be related to their own personal experience and training in the field of assessment. There is little evidence to support the theory that teachers use objectives as a starting point for lesson planning and teaching, the content of the lesson seems to have much higher priority. Finally there is a considerable discrepancy between the objectives teachers would like to promote, and those which they are able to promote in the context of teaching an examinable syllabus.

These findings do not support the idea of the teachers' use and perceptions of objectives which was proposed in the model as communication line 1. The theoretical premis is based on the notion of the syllabus objectives facilitating communication between the board and teachers so that what is taught and assessed is agreed as relevant and important by both parties, but is essentially controlled by classroom requirements i.e. teacher controlled. The evidence outlined in this chapter indicates that this is not the case for the SREB Biology CSE Mode I course. It would also appear that this is not an unusual

situation as previous research [5] has indicated similar discrepancies including the fact that objectives are not automatic starting points for the planning of lessons; that content is an important aspect of teacher planning; that objectives do not necessarily facilitate communication between groups; that examinations have a profound effect on the way in which teachers teach; that there is a mismatch between what teachers would like to achieve in the classroom in terms of objectives and what they actually promote. Having established that these issues apply to the teaching and examining of the SREB Mode I Biology course, this research goes on to attempt to explain these points within this context.

Referring back to the model proposed in Chapter One and bearing in mind the issues which have been raised from the interviews it is possible to identify two main areas of inquiry which might provide explanations or information which would assist in redefining the model. These areas arise from the interview responses and can be summarised in the form of two questions:-

1. <u>Why is there a mismatch between the teachers ideal objectives in teaching Biology and the syllabus objectives?</u>

   To investigate this question a historical perspective of the events which resulted in the definition of the Biology syllabus objectives is required, together with some evidence of the way in which the boards representatives i.e. subject panel members and examiners currently perceive and interpret and use the syllabus objectives.

---

(5) Discussed more fully in Chapters Two and Three.

2. What does the Biology Mode I examination assess in terms of objectives?

This can be approached by a question by question analysis of the 1981 Biology Mode I examination in terms of the objectives it assesses. This information is then used to further understanding in two ways :-

(a) What relationship is there between the teachers' objectives for the course and their pupils' achievement of objectives in the examination? To examine this issue the performance of each individual teaching group was analysed on a question by question basis in terms of their acquisition of marks. This analysis of marks was then related to the objectives being tested.

(b) Do candidates receiving different grade awards show characteristic patterns of achievement in terms of objectives?

These two main lines of investigation ((1) and (2)) form the basis of the following two chapters.

CHAPTER FIVE

PERCEPTIONS OF THE ROLE OF OBJECTIVES IN EXAMINATION DESIGN

This chapter investigates the way in which educational objectives have come to be an integral part of SREB examination design and syllabus specification, both in general terms and in the specific case of the 1981 Biology Mode I syllabus.

The introduction of educational objectives is the kind of process which is represented in the model in Chapter One by communication line 4.[1] It involves discussion and instruction between the levels of subject panels and committees. The nature of such discussions is outlined in the first section of this chapter. The latter sections consider issues such as the level of teacher involvement in the introduction and specification of objectives and the effect the objectives have had on the design of new examination syllabuses and examination papers.

A good deal of information relating to the way in which educational objectives were introduced can be established from the minutes of meetings. Two bodies were influential in generating and promoting the syllabus objectives, the SREB examinations committee and the Board's Biology subject-panel. In this chapter data from the minutes of these meetings is presented along with other relevant information to give an insight into the way in which the objectives were derived and instigated. In the context of this research the subject-panel

---

(1) Communication line 4. The way in which the objectives are defined and amended by the Board.

information which is relevant comes from the Biology sub-panel. (2)

It may be helpful to begin by describing the way in which the SREB administrative structure is arranged and to outline the terms of reference and composition of the various panels and committees which it embodies. Figure 5.1 (page 90) and Figure 5.2 (page 91) represent the structure of the SREB in a diagramatic form.

These two figures show the relationship of the examinations committee and the subject-panels to the rest of the Boards' management structure. The council has control of the management of all the Boards business, it has overall financial responsibility and keeps records of the work of all committees, panels etc. It receives advice from two major committees, the chairpersons and vice-chairpersons of which it appoints, these are the Examinations Committee and the Finance and General Purposes Committee. It may also appoint special committees to deal with particular issues. These are appointed and dissolved at the discretion of the Council.

The Finance and General Purposes Committee advises council on matters relating to (1) the remuneration and conditions of service of the Board's employees. (2) the determination of fees. (3) income and expenditure.

The Examinations Committee advises Council on (1) arrangements for the conduct of examinations; (2) appointments of examiners and moderators, after advice is given by subject-panels. It also approves arrangements for the adoption of syllabuses and ensures the maintenance of standards. The Examinations Committee is in turn advised by subject-panels and umbrella panels.

---

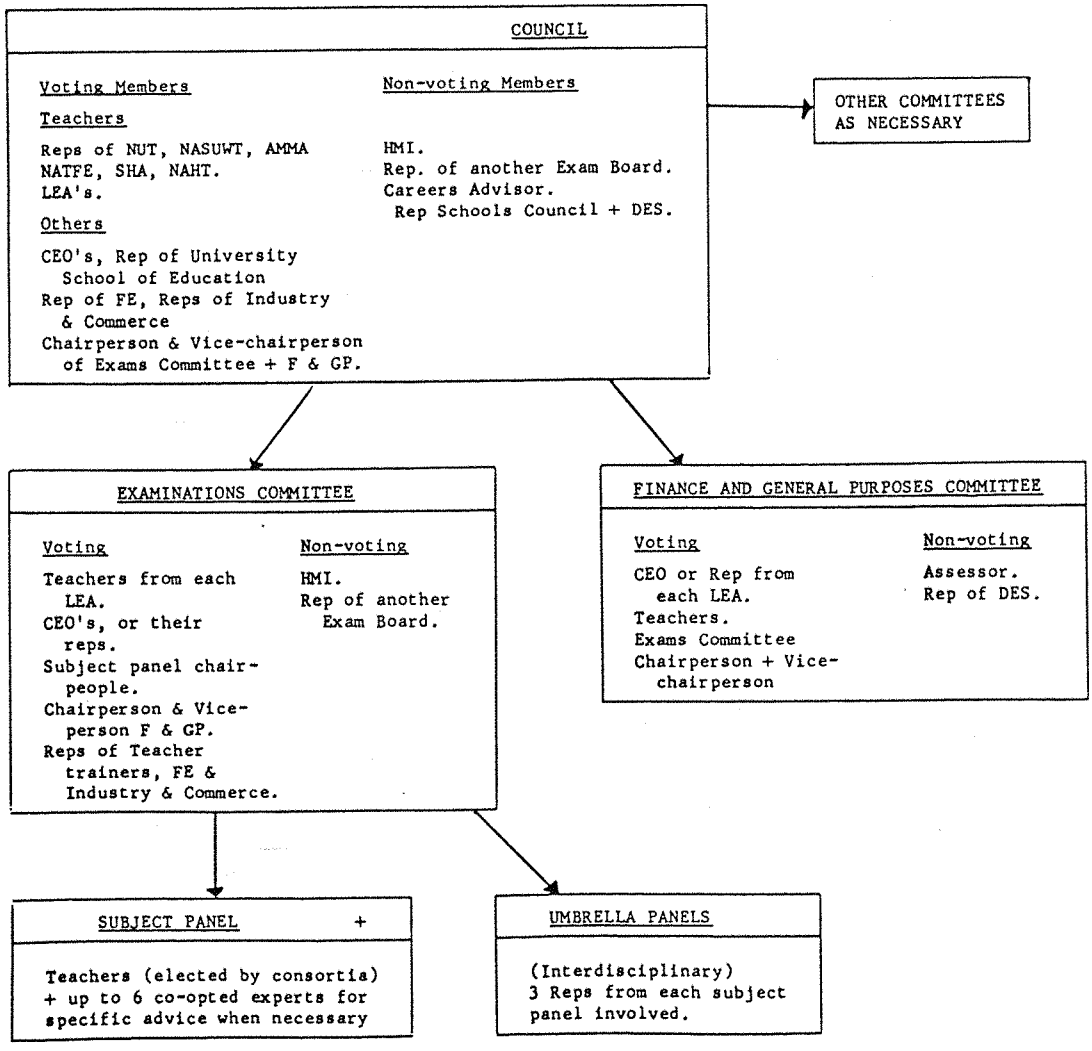
(2) Similar subject panels exist for all the other examinations which the SREB administer. While the role which the examination committee played was the same for all subjects the specific interpretation of the tasks set may well have been carried out in a different manner by the different panels.

FIGURE 5.1

COMMITTEE AND PANEL STRUCTURE AND FUNCTION OF

SOUTHERN REGIONAL EXAMINATIONS BOARD

MEMBERSHIP



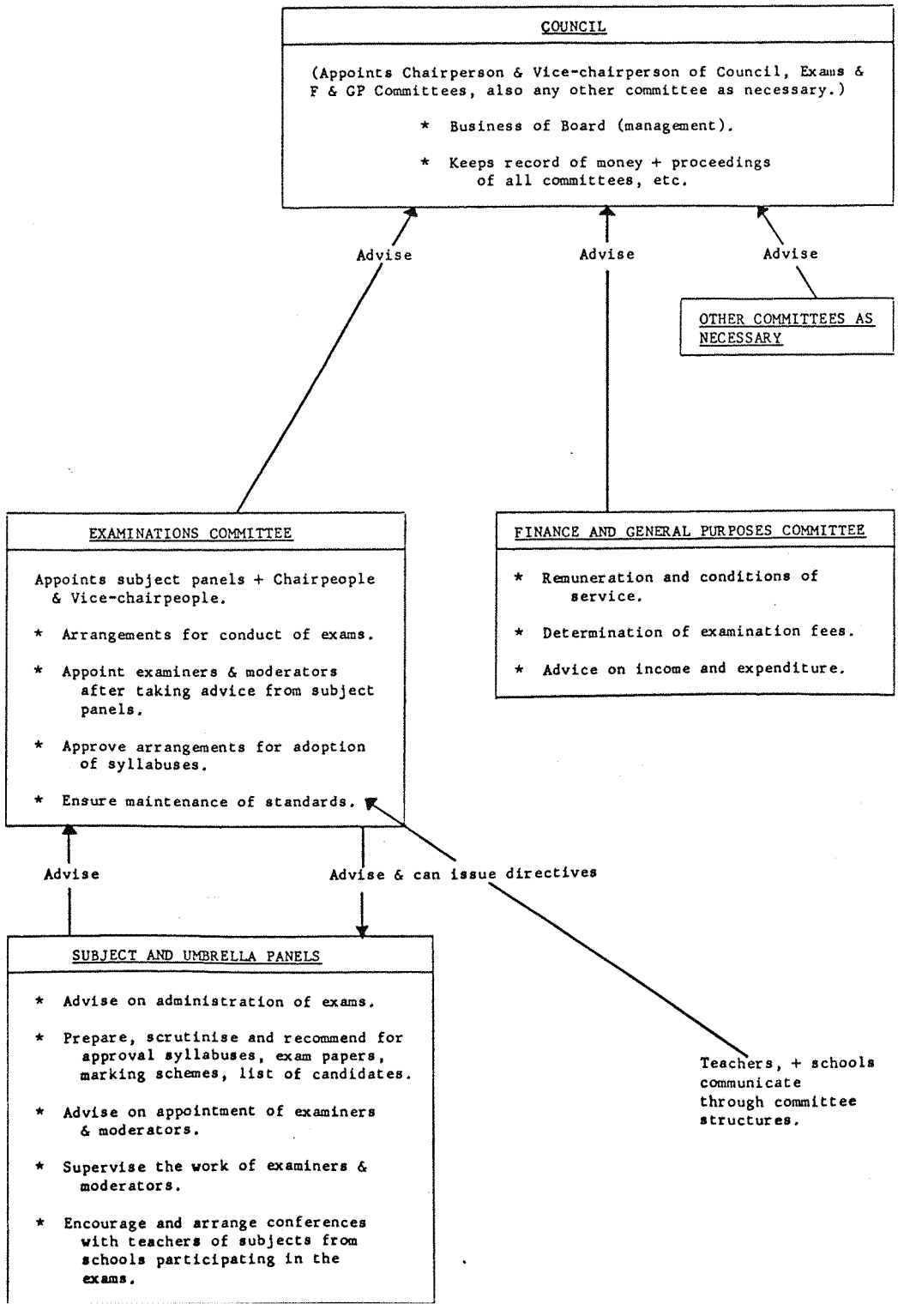
These descriptions detail those who are eligible to attend meetings but at any time the make-up of these panels and committees may vary depending upon whether individuals are able or willing to attend.

FIGURE 5.2

COMMITTEE AND PANEL STRUCTURE AND FUNCTION OF

SOUTHERN REGIONAL EXAMINATIONS BOARD

FUNCTION AND ADVISORY ROLES



The subject-panels deal with single academic disciplines whereas the umbrella panels are interdisciplinary and have representatives of a number of different subject panels. Both these panels (1) advise on the administration of examinations; (2) prepare, scrutinise and recommend syllabuses, examination papers, marking schemes and lists of candidates; (3) advise on the appointment of examiners and moderators; (4) supervise the work of examiners and moderators and (5) encourage and arrange conferences with teachers of subjects from schools participating in the examinations.

The subject-panels also carry out another important function by dealing with communications from schools and teachers although representations can be made through the other committees, which then pass information onto or ask for information from the subject-panels. Through this mechanism the Board keeps in touch with the viewpoints and needs of teachers and is in a position to alter its policy to mirror changes which stem from the classroom.

The involvement of teachers and the reflection rather than prescription of classroom practice has always been a major element in the ethic of the CSE programme. The Secondary Schools Examinations Council Bulletin No. 3 (1964) puts the point concisely:

> All assessments of educational achievement are an exercise in judgement. It is necessary to judge which aspects of a course of study should be examined, and by what methods. It is necessary to make judgements about the standards of performance which are to be expected, and about the descriptions to be attached to different levels of performance .....
>
> ..... In the examination for the Certificate of Secondary Education, responsibility for making these and other judgements will rest with the teachers from the participating schools. This is essential if the new examinations are to become a flexible instrument for assessing the changing work of schools rather than a means of stereotyping curriculum content and teaching methods.
>
> (Secondary Schools Examinations Council, 1964, page 4)

Teacher based control and policy decision making are central themes in the working of CSE boards. The evidence presented in this chapter seeks to establish the degree of control which classroom teachers actually have, and the way in which decisions about the introduction of objectives were taken. It addresses five main lines of inquiry (i) Were objectives requested by teachers? (ii) Are they determined by teachers? (iii) Are they flexible i.e. can they be readily altered to reflect changes in practice? (iv) Do they accurately reflect classroom practice and (v) What mechanisms are employed by the Board to ensure that syllabuses and examinations reflect teachers wishes?

The introduction of objectives as an integral part of syllabus design began in the SREB in 1974. It took place in two stages. The first stage involved the deliberations and decisions of the Examinations Committee. The second those of the Biology sub-panel.

The Introduction of Objectives as SREB Policy by the Examinations Committee

1974

One of the responsibilities of the Examinations Committee is to monitor and approve new or altered syllabuses. In January 1974 a new syllabus in the subject of Parentcraft was submitted by the Home Economics subject-panel. It was unusual because it contained a statement of the objectives for the course. This was not common practice and their inclusion may have derived from the influence of the rational planning model for curriculum design which was popular at the time. The minutes of the Examinations Committee, which approved the new syllabus, note the presence of the objectives. The minutes of the same meeting subsequently show that a recommendation to the following effect was made "each existing and new Mode I syllabus must include a statement of objectives".

The Examinations Committee has the power to issue directives on policy to its subject panels, consequently in the first half of 1974 each subject panel was asked to submit a statement of objectives both for their existing syllabuses and for any new syllabuses. The Examinations Committee established a standing sub-committee to approve these objectives.

The introduction of objectives into examination syllabuses as a general policy was apparently decided on and put into effect very rapidly. It may be useful to identify a number of factors which contributed to this major change being adopted so quickly. Firstly, the rational planning approach to curriculum development was generally found to be an acceptable way of working at the time. This meant that the derivation and specification of objectives was seen as an important step in the production of new curricula. Secondly a number of influential bodies such as The Schools Council and the National Foundation for Educational Research (N.F.E.R.) had established the links between curriculum development and examination syllabuses and assessment. They also strongly advocated the use of objectives in the design of good examinations:

> It should be clear by now that this (producing objectives of instruction) is the most important stage of any evaluation. Indeed, no evaluation is possible without it. If the aim is to assess, clearly it is necessary to know what is to be assessed.
>
> (Wiseman and Pidgeon, 1970, page 38)

Thirdly at least one influential member of the Examinations Committee was personally convinced of the value of objectives and supported and encouraged their introduction. A fourth element comes from the fact that the CSE boards had a desire to be seen to be developing new syllabuses which were relevant to the needs of their candidates, not just "watered down" academic courses. Introducting objectives was an attempt to ensure and demonstrate that the syllabuses had specific purposes related to their intended clientel. Finally a fifth factor

emerged from discussion with the Secretary of the Board concerning the interaction between the Examinations Committee and the subject panels.

The Examinations Committee were persuaded about the idea of including objectives in the boards syllabuses partly because of the enthusiasm of one member of that committee, who was supported by the Secretary to the Board but also by the educational climate at the time. Their direction to subject panels to write objectives was presented with the somewhat naive conception that they (the panels) would comply with it quite readily. There was little consideration given to the fact that the subject panels would not necessarily agree with the Examination Committee's conception of objectives as intrinsically good. Consequently little effort was put into explaining or promoting their strengths. The subject panels were expected to comply.

The Examinations Committee was therefore somewhat surprised by the reaction of some of the panels who refused to write objectives. This led to a confrontation between the Examinations Committee and certain subject panels (not Biology). The conflict centred on which of the two groups had ultimate control over decision making. The Examinations Committee finally proved to have more power than the subject panels over this issue and forced unwilling panels to write objectives despite their lack of commitment. The Examinations Committee continued to reinforce its commitment to objectives and its power over the panels by subsequently requiring panels to justify their examination papers in terms of their course objectives. The inclusion of objectives as an integral part of syllabus design was thus established.

The introduction of objectives into examination syllabuses in the SREB was caught up with the emerging roles of the Examinations Committee and the subject panels. The Secretary to the Board was of the opinion that the Examinations Committee and subject panels would, in any event, have engaged in a dispute about their relative authority. The introduction of objectives happened to be the issue which became the focus of this conflict. This factor, then, was a powerful one which ensured that objectives were written for each syllabus. It may have forced some panels to reflect on the educational issues related to the syllabuses and examinations they were producing, but this reflection was in an atmosphere which may not have been conducive to the development of well thoughtout objectives.

Clearly the introduction of objectives at this stage did not eminate from a groundswell of teacher opinion. It is true that teachers, in the form of subject panel members, were central in initiating the inclusion of objectives in the original parentcraft syllabus but this is a somewhat different level of teacher involvement than that implied by the Secondary Schools Examinations Council document (1964) quoted earlier in this chapter. The move to include objectives came, then, from an idea promoted by a few individual teachers not from a classroom based need expressed by the many.

In the light of these factors it is interesting to examine the way in which the Biology subject-panel set about producing objectives for their Mode I syllabuses.

The Derivation of Objectives - The Experience of the Biology Sub-Panel

To aid all subject panels in their task of writing objectives the Board produced and circulated two specially prepared documents. The first document was entitled "Question Banking" and set out the advantages of this process where question items which had been preclassified and/or tested on pupils, could be made available to examiners to assist them in the production of valid examinations. The document suggested that question items should be classified in terms of both topic and objective. Although perhaps a slightly tangential aspect of the use of objectives in examination syllabuses, this document and the ideas it promoted did emphasise the practical use of objectives in the context of examination design. The second document entitled "Defining Objectives" offered more direct advice on the processes and issues to be considered in writing a set of objectives.

Both papers present a well balanced discussion of some of the major issues related to writing objectives, including the necessity for a judicious use of taxonomies such as Bloom (1956) and the difficulties associated with establishing question banks and defining objectives. However balanced and useful these documents appear in retrospect, their actual value to the subject panels can be established more precisely by examining the experience of a subject panel implementing the Examinations Committee directive. The Biology subject panel minutes and other records provide a valuable account of the way in which the objectives for the Biology syllabuses were drawn up.

Minutes and other records relating to the introduction of Objectives into the Biology Syllabuses (2)

The Biology subject panel received the following directive in January 1974:

> The committee (Examinations Committee) agree that, commencing with the syllabuses for the 1977 examinations each existing and new Mode I syllabus must include a statement of objectives.
> (Minutes of 38th Meeting of the Examinations Committee, 18.1.74)

In practical terms this meant that a set of objectives had to be derived, submitted to the special steering committee for approval and incorporated into the syllabus specifications before the 1977 syllabus and regulations book was produced i.e. before June 1975. This gave the subject panels, which normally met three or four times a year, a little over one year to produce their objectives. The Biology panel reacted as follows.

June 1974

The minutes of the meeting record that there was some discussion relating to the production of objectives. Two papers were considered one produced by the South Eastern Regional Examinations Board and a second prepared by the Board's own Science panel. There is no mention of the two training documents "Question Banking" or "Defining Objectives". No further details

---

(2) The Biology subject panel dealt with three separate Mode I syllabuses in 1974. Biology Alternative A a 'traditional' Biology course; Alternative B a Nuffield based syllabus and Human Biology. One set of objectives were drawn up to cover all three syllabuses.

of the discussion are recorded. However some response was initiated because the minutes of the next meeting of the panel in September 1974 include a list of objectives. (Appendix Eight) This list is based on the six major classification categories of Bloom's cognitive Taxonomy of objectives (1956). Further discussion with the Board's subject officer who was involved with these proceedings indicated that this set of objectives was essentially derived from those used by another CSE board. The subject panel subsequently submitted these objectives to the steering committee for approval. In February 1975 the minutes record that the objectives had been accepted with a minor modification. The objectives were then included in the syllabus details for the 1977 examination..

In the thirteen months between January 1974 and February 1975 the Biology objectives were produced and accepted. In fact most of the discussion and decision making was carried out between June 1974 and February 1975. These brief entries in the minutes catalogue the derivation of the Biology objectives and also raise several points.

The Level of Discussion Concerning the Objectives

The minutes of the Panel frequently recorded their discussions in some detail. The brevity of the entries in the minutes relating to the derivation of the objectives suggests therefore that there was relatively little discussion about them. The two documents circulated by the Board "Question Banking" and "Defining Objectives" certainly raise issues concerned with drawing up objectives which might be expected to generate considerable and lengthy discussion. Yet the Biology objectives were drawn up very quickly suggesting that consideration of the purpose of the syllabuses, the best suited learning/teaching strategies and the most suitable content must have

been very brief if indeed they took place at all. In fairness to the panel it must be remembered that they were working to a very limited time schedule and that they were also having to carry out all their other panel duties at the same time as drawing up objectives.

If these facts are taken into consideration it is likely that some of the more fundamental issues were not addressed. Indeed if the panel had considered the purposes of their assessment and reviewed their existing syllabuses before deciding upon their objectives it is hard to see how they could have met the time limitations imposed on them. The task which they were set was therefore an unrealistic one. The derivation of syllabus objectives could not have been completed adequately in the time given. Their response to this situation was to search out and adopt objectives which seemed to be adequate as quickly as possible. Basing their objectives on those used by another Board provided a solution to the immediate problem.

Quality of the Objectives in Relation to the Syllabuses

Only one set of objectives was produced to cover three quite different syllabuses.(3) While recognising that there might be an area of overlap common to all three courses, it would be expected that the Nuffield based course might give rise to some quite different objectives than the traditional course. It would be unlikely that these differences could be adequately covered by a single set of objectives.

The appropriateness of the objectives is therefore called into question. Some attempt was made to take account of the course differences by giving different weightings to objectives. However the

---

(3) Biology Alternative A (Traditional Biology), Alternative B (Nuffield Biology) and Human Biology.

picture which emerges is one which suggests that the objectives were not drawn up with the individual courses in mind and that these weighting adjustments were somewhat arbitrary.

In conclusion it appears that the Biology objectives were drawn up to meet a time deadline set by the Board. They were not derived from a close scrutiny of the purpose of the courses or from the content of the courses, neither were they generated from classroom experience. Rather the objectives were adopted from another source with little consideration of their appropriateness and tacked onto the existing syllabuses. It is therefore not surprising that the links between the objectives and the syllabuses were frail and apparently of little importance. The following sequence of events indicates how weak the links really were.

Between February 1975 and April 1976 the Biology (Alternative A) syllabus was extensively reviewed and considerable changes were made to it as a result. Despite these fundamental changes in the syllabus no change was made to the course objectives. There is no indication either that these changes made the syllabus content more compatible with the objectives which had been derived in the previous year. Although the minutes give considerable detail of the content changes which were made there is no mention of the way in which these relate to the objectives. Indeed there is no mention of objectives with respect to these changes at all.

A second instance which tends to confirm the view that the panel members did not perceive the objectives as fundamentally important aspects of the syllabus, is described below.

Recently Alternatives A and B have ceased to exist being replaced by a single examination covering aspects of both syllabuses. Table 5.1 (page 102) shows how this amalgamation has been reflected in the objectives.

TABLE 5.1

SOUTHERN REGIONAL EXAMINATIONS BOARD

BIOLOGY A 1983

(Objectives)

Papers A and B combined - therefore objective assessment proportions combined and averaged:

Objective	Syll. A	Syll. B	T	Av.	Marks	T
1	45	30	75	37½	93/75	)
2	10	15	25	12½	30/25	)
3	15	20	35	17½	44/35	)200/
4	5	5	10	5	13/10	) 160
5)	5	10	15	7½	20/15	)
6)						)
7)	20	20	40	20	50/40	Grade
8)						
Totals	100	100	200	100	250/200	

The marks column shows two alternatives - one for a total of 200 for theory and the other a total of 160 - the latter is favoured on the attached blueprint.

A simple averaging of the differential weightings provides the format for the new syllabus. Again no major reconsideration of the objectives or their relative importance in the new syllabus took place.

These events make clear that objectives were not considered to be an integral part of syllabus design. More important were considerations of content and examination design. In the light of these findings it is not surprising to find the following entry in the Biology sub-panel minutes for September 1978:

> some teachers had misunderstood the objectives now in use.
> (SREB Biology Sub Panel Minutes, September 1978)

Clearly the objectives were not communicating sufficient information about the form of assessment to teachers. What is even more interesting and informative is the subject-panels response to this problem. From the minutes of the same meeting:

> ..... it was decided to draw up a "guidelines" booklet for use with the Human Biology syllabus (4)
> (SREB Biology Sub Panel Minutes, September 1978)

These guidelines documents provide more detail of the <u>content</u> of the courses on which the pupils will be examined. The subject panel members did not reconsider and review their objectives in order to clear up the misunderstandings about the syllabus. Instead they provided more information about the topics to be covered in teaching.

All of these instances, the speed of production of objectives, the alteration of syllabus materials without parallel changes in objectives and the clarification of syllabus materials using more

---

(4) A similar guidelines booklet for Biology Alternative A was produced in March 1979.

detailed content specification, point to the low level of importance which subject panel members attached to the objectives. A further aspect of the research was, therefore, to find out more about the perceptions which the subject panel members had about objectives. A questionnaire (Appendix Two) was designed and circulated to current Biology sub-panel members.

The Use and Perception of Objectives Held by Biology Subject Panel Members in 1982

The majority of the panel members held high positions within schools as heads of department and had considerable experience of teaching both in terms of length of service and in the range of pupils whom they taught. They all had current experience in teaching CSE Biology. Most of them had a number of years experience with differing aspects of examining at both GCE and CSE level, e.g. moderating, subject panel membership, examining, marking, etc. They identified a number of functions as being important roles which the subject panel fulfilled. The two most important aspects were concerned with the practical production and administration of the examination followed by syllabus and assessment revision and updating. Only one member of the panel had been involved with the original production of the objectives and there had been no recent discussion of them except in relation to the practical objectives 7 and 8 and the production of the practical assessment booklet.

The role which the objectives played was perceived differently by each member and ranged from a philosophical rationale for the course to a guide for assessment purposes. Only two of the members had had any training in relation to the function of objectives; one of these was a P.G.C.E. (Postgraduate Certificate in Education) input thirteen years before. The other was a series of seminars held in a University Department of Education. On the whole the objectives were perceived as reflecting

classroom practice but comments were made about the influence of the examination and a tendency for teachers to concentrate on knowledge at the expense of other objectives. There was also a feeling that the objectives were suitable for a Biology course although this was attributed to their generality in more than one case, i.e. they might be equally suitable to other subjects and indeed the Physics and Chemistry objectives are very similar.

The members felt strongly that the objectives were matched by the examination because of the presence of the objectives/assessment grid and the fact that the examiner worked to produce an examination to match the specification. (Details of the grid are given in Appendix Seven)

In the light of these responses it seems that a number of points can be made about the way that objectives are currently perceived and used by the Biology Subject-Panel.

(i) The objectives have not been fully considered in terms of their contribution to the syllabus since their introduction. There was considerable confusion about what they were meant to do. The only clear role they seemed to serve as far as the panel members were concerned was in relation to the objectives/assessment grid.

(ii) Their acceptability seemed to be based on the general nature of their specification rather than on their capacity to improve or clarify the syllabus for teachers, a point supported from the teachers' interviews.

(iii) Their effect on classroom practice was also felt to be secondary to other factors such as the examination itself and did not seem to affect teachers who still tended to concentrate on knowledge based skills.

(iv) There was a strong feeling that the examination was a valid reflection of the objectives/assessment grid.

These four points indicate that the subject panel members perceived the syllabus objectives to have a much more important role in examination production than in connection with syllabus design or teaching. The panel's perception of the weakness of objectives in respect to these last two roles has already been established by the way in which they used the objectives in relation to the syllabus and objectives/assesment grids (Table 5.1). A further piece of evidence came to light during a Biology subject panel meeting on the 1st November 1982 which clearly indicates the way in which the panel members use and perceive objectives. It also suggests a reason for the mismatches between the teachers objectives and the syllabus objectives identified in the interviews with teachers.

A school had requested an amendment in their Mode 3 assessment to include an extra objective relating to the motivation of pupils undertaking their Social Biology course. The request promoted quite a lot of discussion and it became clear that while the panel members could see that the objective was valid for the syllabus, it was not acceptable for inclusion because it could not be assessed or moderated within the current system. The request for inclusion was turned down.

This incident provides a good deal of information about the way in which the panel members perceived and used objectives. It confirms the predominance of their role in assessment over their contribution to the syllabus; it suggest that the objectives which are considered acceptable for a course are determined by whether or not they can be assessed by traditional means i.e. pen and pencil or practical examination rather than by whether they are valid for the syllabus; and finally it suggests that the existing examination system is not necessarily flexible to the requirements of teachers.

If these points are applied to the Mode I syllabus (and since the subject panel members are the same for Mode I and Mode 3 their perceptions are likely to be transferable) it provides an insight into some of the reasons for the mismatch of objectives. The interviews reported in Chapter Four identifed a number of objectives which the teachers held to be important but which were not assessed. Some of these such as "developing an interest in Biology" deal with the emotions and sensitivities of the pupils. It is easy to see that these may not be judged as suitable for inclusion because they are similar to "motivation" i.e. they are not readily assessable by traditional techniques. Other objectives like "developing a critical approach" or "the ability to identify cause and effect relationships" (dropped by the panel in December 1976) might be excluded because of a similar difficulty in producing examination question items to adequately assess them. This suggests that the examinations and assessments which are produced (and hence the objectives which were deemed to be acceptable) are determined largely by what the panel consider it is possible to assess. Within the current framework of procedures this will be confined to written or practical examinations which are norm referenced and capable of moderation. The fact that the Schools Council Examination Bulletin 27 expressly warned against such situations and noted that if a valid objective could not be assessed it reflected the inadequacy of the assessment <u>not</u> the objective seems to have had little effect on current practice. It should also be remembered that the subject panel members may not be fully aware of all the relevant developments in assessment techniques. They may reject objectives on the grounds of their being technically difficult to assess when techniques may exist which would render them assessable even although the adoption of such techniques might require significant changes in the present system.

Returning to the subject panel questionnaire responses, a further and related issue which arose was that of how closely the present examinations assess the syllabus objectives which currently exist. The subject panel members considered that the presence of the objectives/assessment grid ensured, to a large extent, the validity of the examination. This point was investigated further by asking the two most recent examiners their opinions of the relationship between the syllabus objectives and the examinations which they were required to set. This data was collected by means of a questionnaire sent to both examiners (Appendix Three gives details of the questionnaire)

The Examiners' Perceptions and Uses of Objectives in the Production of the Examination

Both examiners had a number of years experience of various aspects of examining at both CSE and GCE level. The retiring examiner (who set the 1981 examination) had set the Biology paper for SREB for the previous six years. The newly appointed examiner was in the process of setting the 1982 paper when the questionnaire was circulated. Both indicated that they had no specific training for the post of examiner and identified a number of areas including question production, assessment of readability and statistical analysis where they felt more advice or training would have been useful to them.

Both used the objectives/assessment grid as a blue print for the examination and thought that the objectives also served to give teachers some indication of the skills which would be assessed:

> Hopefully to inform the teachers of the motives of the examiners!

> I would have thought they gave teachers a guide as to how to prepare candidates for examination.

They felt that the syllabus objectives were suitable for a CSE Mode I course in Biology and that they could be adequately assessed at this level. However they expressed misgivings about their ability to accurately match the weightings given in the objectives/assessment grid:

> ..... sometimes I don't know which particular objectives are being tested and so it's difficult to work out whether or not I have met the specifications.

> I did try to set the questions in accordance with the grid. ..... but then one persons analysis of the objectives behind a particular question may not be the same as my own!

These examiners, who are both experienced, practicing teachers, did attempt to comply with the objectives/assessment grid but found that it was not always easy.

A more detailed analysis of the objectives which the 1981 examination assessed is given in the following chapter. However the examiners comments indicate that the relationship between the objective/assessment grid and the finalised examination may not be as clear cut as subject panel members thought it was.

The minutes of the meetings and the findings of the questionnaires indicate that the set of objectives produced for the Biology syllabuses have been largely ineffective in communicating information about the examination syllabus to teachers. At least part of this problem can be attributed to the fact that the objectives were tacked onto existing syllabuses and were not derived from any deep consideration of the purpose of the syllabus, it's content or it's likely teaching methods. Finally returning to the questions raised at the beginning of the chapter and answering them in the light of the research findings

illustrates the extent to which classroom activity and teachers requirements have influenced the objectives.

Were objectives requested by teachers? Yes, in the sense that the initial parentcraft course which gave rise to the general introduction of objectives, was proposed by teachers in their capacity as Board panel members. No, in so much as there was no consultation of the majority of classroom teachers before objectives were written for all courses. Were objectives determined by teachers? Yes, because those panel members who drew up the objectives were practicing teachers. No, because the panel members made no attempt to involve any larger sample of teacher opinion.

The difficulty of giving a straight answer to both of these questions arises from the same dilemma. That is can the teachers who act as panel members be considered to be representative of the teaching force as a whole? The CSE Boards would tend to give a positive answer for it is in this respect that they fulfil their requirement to be teacher controlled and in touch with classroom activity. Indeed there is a case to be made to this effect. Panel members do have the 'chalkface' knowledge which is required to ensure that examinations can be related to practice. However it is also true to say that these individuals are atypical of the majority of classroom teachers by the very fact that they sit on the Examinations Boards subject panel. They are faced with making decisions not only in the light of classroom practice but also in line with the Board's requirements. The introduction of objectives are illustrative of this dual role which subject panel members have.

The evidence given here clearly demonstrates that in this instance the requirement of the Board, i.e. the production of objectives in a short period of time, over-ruled any possibility of deep consideration the objectives which might be most appropriate to the course and to teachers. On balance the teachers who comprise subject panel members cannot be said to represent the classroom teacher because they are

subject to outside pressures which are often more compelling than their teacher status. This statement is confirmed by the activities of the panel members in rejecting the Mode 3 objective of 'pupil motivation' on the grounds that it could not be assessed within the limits of the current examination system. They clearly demonstrated by this action that the constraints of the examining system are more powerful in influencing their decision making than are the requirements of classroom teachers. These facts help to answer another of the questions raised at the beginning of the chapter namely Do the objectives reflect classroom practice and are they flexible? The answer to both parts must be no - at least not sufficiently and certainly not in the terms which the Schools Council hoped for. The final question which was posed related to the mechanisms which the Board uses to ensure that syllabuses and examinations reflect teachers wishes. The findings presented in this chapter would suggest that the mechanisms which the Board uses to this end are currently inadequate.

One final point needs to be made clear. The introduction of objectives in this fashion is not an isolated instance. In February 1975 the Examinations Committee issued a second directive to panels for their implementation. In this case objective/assessment grids were to be drawn up for all syllabuses by 1978 (i.e. by 1976 for inclusion in the regulations - guidelines booklet for 1978). Again the level of teacher involvement, other than panel members, was non-existant and again little guidance was given to the panels about the problems inherent in such an activity. (5)

---

(5) These are discussed more fully in the following chapter.

Summary

In conclusion there emerges a picture of a system of communication which is essentially governed by the dictates of the examination structure. Teachers, have relatively little influence on the determination of Mode I syllabuses, objectives or assessment techniques. In terms of the proposed model described in Chapter One communication line 4 dealing with the way in which the objectives are derived and amended by the Board is much more strongly influenced by the requirements of the examination system as defined by the Board than it is by the requirements of classroom practitioners.

CHAPTER SIX

AN ANALYSIS OF THE 1981 EXAMINATION PAPER AND OF THE PUPILS' PERFORMANCE ON THAT PAPER WITH RESPECT TO THE SYLLABUS OBJECTIVES

Introduction

This chapter is in two parts. The first describes the research strategies which were used to try to determine which objectives were being assessed in the 1981 Mode 1 SREB Biology CSE examination. In Part II this data is used in conjunction with quantitative information of pupil achievement. This is to determine whether (a) the classroom teachers' objectives had any identifiable effect on their pupils' achievement in terms of attainment of objectives and (b) whether there was any distinction between the kind of objectives a grade 1 candidate and a grade 4 candidate achieved.

Investigating these aspects of the teaching and examining process was undertaken to provide more information about the actual relationship between the syllabus objectives, the examination and pupil performance. In other words to explore more fully the practical realities of communication lines 2 and 3 as described in the model in Chapter One. (1)

---

(1) Communication Line 2 - The way in which objectives are translated into an examination

Communication Line 3 - The way in which the objectives are reflected in pupils achievement.

PART I

Determination of the objectives assessed by the 1981 Biology Mode I Examination (2)

Earlier attempts to analyse examination papers or questions in terms of the objectives which are being assessed have run into a number of difficulties. (Amos and Crossland, 1961 and 1965; Spurgin, 1967; Duckworth and Hoste, 1975; Fairbrother, 1975; Willmott and Hall, 1975 and Hoste, 1981) These can be classified in two main ways (i) Low levels of agreement between scrutineers about what objective a given question is assessing and (ii) Given these low levels of agreement, difficulties related to how to resolve the differences in order to produce an overall picture or evaluation of what the examination is assessing. In this phase of the research a good deal of attention was paid to the problem of agreement between scrutineers. If greater agreement is achieved subsequent problems are reduced.

Strategies used to maximise agreement between scrutineers

A number of explanations for the poor levels of agreement between scrutineers have been proposed by Fairbrother (1975). These have included poor understanding of the categories into which the questions were to be classified; insufficient explanation of the task to be undertaken or insufficient precision in stating objectives and the influence of other individuals' or group judgements. These explanations were taken into account when devising instructions for the scrutineers

---

(2) A copy of the 1981 Examination is included as Appendix Seven.

who were asked to classify the questions on the examination paper. (Appendix Nine gives details of the instructions provided for scrutineers.)

Each scrutineer undertook only one analysis of the 1981 paper, the instructions which they were given had been pilot tested for ambiguity and difficulty of interpretation, and the scrutineers also had access to the marking scheme for the paper and the researcher for advice. In addition it was made clear that (a) there was no need to classify particular questions if the scrutineer felt they did not fall into any of the categories provided, (they were at liberty to make an independent comment indicating their perception of what the question assessed) and (b) any one question might be assessing more than one objective and this was to be indicated.

Classification of Questions

Altogether three analyses of the 1981 examination were carried out, each analysis used a different set of criteria for classifying the questions. The first analysis used a classification system based on Bloom's Cognitive Taxonomic categories. Fairbrother (1975) and O'Brien (1982) have recognised the influence which this taxonomy has had on the specification of examination syllabus objectives generally. The minutes of the Biology subject panel reported in Chapter Five identify its influence on the derivation of the SREB Mode I Biology objectives. The classification categories used were

Method 1: Bloom's Taxonomic Categorisation

Category	Description
1	Knowledge
2	Comprehension
3	Application
4	Analysis
5	Synthesis
6	Evaluation
7	Other

(Other category to account for questions which scrutineers could not readily classify)

Descriptions and explanations of each of these categories were provided from Bloom (1956), Duckworth and Hoste (1975) and Gronlund (1970). (Details are given in Appendix Nine).

The second analysis was carried out using the Mode I Biology syllabus objectives as the categories for classification.

Method 2: CSE syllabus objectives categorisation

Category	Description
1'	Knowledge of facts and terminology as applied to Biology
2'	Ability to summarise or explain contents of a text.
3'	Ability to interpret and draw conclusions from information and evidence in form of graphs, tables, diagrams, etc.
4'	Ability to apply scientific principles to new situations.
5'	Ability to formulate an hypothesis from evidence available.
6'	Ability to plan an experiment to test an hypothesis.
7'	Other (As above)

The third analysis allowed the scrutineers to classify each question in accordance with their own interpretation of the skill, behaviour, attitude etc. which they felt was being assessed, so no predefined categories were provided. (In this last instance the scrutineers had no knowledge of the syllabus objectives.) In this case the scrutineers identified 32 different descriptions of the skills which the examination assessed. Some of these were closely related like knowledge, recall, recognition and memory and were grouped together for the purposes of the subsequent analyses. If similar descriptions were aggregated in this way for all thirty-two descriptions a total of ten categories emerged as follows.

Method 3: Independent categorisation

Category	Description
1"	Recall, knowledge of, recognise, remember.
2"	Reasoning, analysis, critical analysis of evidence, deduce a hypothesis, reason out, evaluation, appraisal, deduction.
3"	Design experiment, devising experiment, synthesis, construct.
4"	Use of symbolic representation, reading graphs, interpreting diagram or prose to solve problem.
5"	Make concepts, compare functions, compare and contrast, associate.
6"	Numerical calculation.
7"	Comprehension (understanding), interpretation of meaning, describe, explain.
8"	Application of knowledge.
9"	Select, pick out, discriminate.
10"	Conceptualise, have concept of.

The three different methods of categorisation were used primarily, to identify whether one or other method resulted in a higher level of agreement between scrutineers but also to provide more information about the range of objectives which were being assessed and to identify which of these, if any, posed particular difficulties of classification for the scrutineers.

Results indicating the level of agreement between scrutineers

The tables below indicate the percentage of the marks from the total examination paper on which pairs of scrutineers were able to agree the objectives which were tested. Each table shows the percentage agreements between scrutineers for one of the three methods of classification.

TABLE 6.1

% AGREEMENT BETWEEN PAIRS OF SCRUTINEERS USING METHOD 1

(Blooms Taxonomic Classification) (5 Scrutineers)

	B	C	D	E	Scrutineers
A	58	58	58	70	
B	X	55	62	43	
C	X	X	57	56	
D	X	X	X	72	

TABLE 6.2

% AGREEMENT BETWEEN PAIRS OF SCRUTINEERS USING METHOD 2

(CSE Syllabus Objective Classification) (5 Scrutineers)

	B'	C'	D'	E'	Scrutineers
A'	73	71	61	59	
B'	X	57	51	58	
C'	X	X	57	60	
D'	X	X	X	63	

TABLE 6.3

% AGREEMENT BETWEEN PAIRS OF SCRUTINEERS USING METHOD 3

(Independent Classification) (6 Scrutineers)

	B"	C"	D"	E"	F"
A"	20	21	51	33	52
B"	X	20	32	28	23
C"	X	X	35	19	31
D"	X	X	X	36	62
E"	X	X	X	X	33

A comparison of table 6.1 and 6.2 indicates that there was a higher level of agreement about which objectives were being assessed when the syllabus objectives were used as the criteria for classification. However there was a considerable range of agreement, some pairs of scrutineers agreeing on 73% of the questions while other pairs could only agree on 51%. Table 6.3 shows a much lower general level of agreement which is not surprising given that each of the six scrutineers chose their own categories for classification.

This third analysis, was an attempt to reduce the compulsion to fit most questions into the predetermined categories provided and a low level of agreement was therefore expected. It was interesting to note however, that these scrutineers showed a marked tendency to use terms of description which were very similar to Bloom's taxonomic categories, emphasising the profound influence the taxonomy has had. A more detailed analysis of the percentage agreements from tables 6.1 and 6.2 is given below where the number of items classified in the same category by a pair of scrutineers is given as a percentage of the total number of questions they agreed on.

Identification of the Kinds of Objectives Scrutineers Agreed on

TABLE 6.4

% OF TOTAL NUMBER OF AGREED QUESTIONS CLASSIFIED IN EACH CATEGORY BY PAIRS OF SCRUTINEERS

(Bloom's Taxonomic Categories)

Pairs of Scrutineers	1	2	3	4	5	6	Classification Categories
A/B	65	33	2	0	0	0	
A/C	56	35	8	0	0	0	
A/D	75	15	8	0	2	0	
A/E	68	22	10	0	0	0	
B/C	63	33	4	0	0	0	
B/D	81	15	4	0	0	0	
B/E	90	8	2	0	0	0	
C/D	63	20	17	0	0	0	
C/E	64	20	16	0	0	0	
D/E	80	11	9	0	0	0	

(5 Scrutineers)

Of all the questions which A and B classified in the same way 65% fell into the knowledge category, 33% were in the comprehension category and 2% in the application category etc.

TABLE 6.5

% OF TOTAL NUMBER OF AGREED QUESTIONS CLASSIFIED IN EACH CATEGORY BY PAIRS OF SCRUTINEERS

(SREB Biology Mode I Syllabus Objective Categories)

Pairs of Scrutineers	1'	2'	3'	4'	5'	6'	Combination Categories (3)
A'/B'	63	8	6	0	3	0	20
A'/C'	80	3	8	0	2	2	5
A'/D'	79	4	7	0	4	2	4
A'/E'	85	4	7	0	2	0	2
B'/C'	76	4	12	0	2	0	6
B'/D'	68	6	11	0	6	0	9
B'/E'	70	4	10	0	4	0	12
C'/D'	76	4	10	0	4	4	2
C'/E'	81	4	7	0	0	4	4
D'/E'	64	5	7	4	7	4	9

Both of these tables indicate the high proportion of questions which were classified in the knowledge categories in both classification systems. The items on which the scrutineers showed most agreement tended to be knowledge testing items. It was much less common to find good agreement between scrutineers on items classified as testing other objectives.

---

(3) Combination this category identified those questions which the scrutineers felt were assessing more than one objective and agreed on those objectives.

This trend was also evident in the third analysis. The relatively high levels of agreement indicated in Table 6.3 between A", D" and F" (A"/D" 51%, A"/F" 52% and D"/F" 62%) were largely attributable to their agreement of which questions assessed knowledge based objectives. Of the total number of questions on which A"/D" agreed 83% were in the knowledge category and for A"/F" and D"/F" the percentages were 87% and 88% respectively.

Summary of findings related to identifying what objectives were being assessed in the 1981 Biology Examination

None of the three methods of classification provided good all round agreement on the objectives which were being assessed by the examination questions. This was despite attempts which were made to control some factors such as misunderstanding of the task or ambiguity of the criteria for classification groups. It therefore seems probable that there are further factors which affect the way in which the scrutineers classify questions. One of these factors may be that the scrutineers are working on the face validity of the question i.e. attempting to interpret what objective the question is likely to assess. However the face validity of the question in terms of objectives may differ from the objectives it actually assesses. Hoste (1981) puts the point concisely:

> What an item looks as though it is testing may be quite different from what it is in fact testing.
> (Hoste, 1981, page 13)

Willmott and Hall (1975) have developed this idea further:

> In effect, the taxonomic content of an item would appear to be not so much a property of the question itself, but a property of the learning experiences of the candidate answering the question. Under

> these circumstances, it would seem to be a difficult, if not impossible, task for an examiner to write an item which would test the same ability in all candidates.
> (Willmott and Hall, 1975, page 120)

Working with the face validity of the questions presents problems of interpretation for the scrutineers. It necessitates a personal evaluation of the objective which the question assesses and this is likely to increase diversity of opinion. The validity of the question could be identified more precisely if detailed discussions with individual candidates were undertaken to identify which skills they actually used to answer each question. However this procedure would be likely to increase the range of objectives which were associated with any one question because of the diversity of each pupils experience, i.e. what is knowledge for one pupil may well be application or even guess work for another.

Working with a group of scrutineers identifying the face validity of each question is therefore a compromise. The scrutineers cannot unambiguously define <u>the</u> skill(s) or objective(s) which the question assesses, and in the light of the discussion above there seems little point in attempting to do this. Working in this context does however provide an indication of the range of skills which might be assessed by a question and this can be extended to give an idea of the kinds of objectives the examination assesses as a whole. This procedure is applied in the following section of this chapter. The description of the examination which is built up is then compared with the examination specification given by the objectives/assessment grid included in the syllabus.

Compiling a Description of the Objectives an Examination Assesses

The validity of an examination in terms of its assessment of objectives has often rested on the premis that examiners are able to produce examinations which reflect the criteria laid down in the objectives/assessment grid. (Details of this grid for CSE Biology Mode I are given in Appendix Six.) In order to corraborate this premis it is necessary to produce an overall description of the objectives assessed in the examination.

In the case of SREB Mode I examinations validity is controlled by (a) an examiner writing an examination which, in their opinion, complies with the requirements set out in the objectives/assessment grid and (b) a reviewer who uses their personal interpretation to establish that these criteria have been met. There is seldom the time or opportunity to subject the examination to a more independent or rigorous test of its validity.

Some research projects have attempted to analyse the objectives which examinations assess more fully. Where a number of scrutineers have been employed in this task there has invariably been a good deal of disagreement on which objectives are assessed. Examples of this can be found in Spurgin, 1967; Willmott and Hall, 1975; Fairbrother, 1975 and Hoste, 1981. In these cases some means of rationalising the disagreement between scrutineers has been necessary in order to produce a final description of the examination. Two techniques are commonly employed. These are the aggregation of opinion in which the opinion of each scrutineer is taken into account when drawing up the description. The other technique is consensus of opinion in which only the majority opinion is recognised. Both techniques are described and discussed below. The advantage of using either method is the same; it results in an overall description of the objectives which the examination assesses and hence allows an evaluation of the examination's validity in that respect to be carried out.

Aggregation Technique

Each question is classified by taking into account all the categories awarded to it by the scrutineers. These are then added together to give a profile of assessment for the examination, e.g.

Question X carries 8 marks.

Scrutineer A awards 6 marks for knowledge, 2 for understanding.

Scrutineer B awards 8 marks for knowledge, 0 for understanding.

Scrutineer C awards 4 marks for knowledge, 4 for understanding.

Total 18 marks for knowledge, 6 for understanding.

On this basis the question is deemed to have contributed 6 marks to knowledge and 2 marks to understanding.

The disadvantage of using this technique is that it may tend to overemphasise minority opinion. A situation can arise where a small percentage of the marks for the examination are awarded to a particular objective and yet it is not possible to identify precisely where on the examination paper these marks are allocated. This is because the marks have been awarded across a number of different questions, but by using the aggregation technique they become a significant category in the overall description.

Consensus Technique

Each question is classified with respect to the majority view of what the item is assessing. These are then converted to give a description of assessment for the examination, e.g.

Question X carries 8 marks.

Scrutineer A awards 6 marks for knowledge, 2 for understanding.

Scrutineer B awards 8 marks for knowledge, 0 for understanding.

Scrutineer C awards 4 marks for knowledge, 4 for understanding.

Total 18 marks for knowledge, 6 for understanding.

Overall majority of marks are for knowledge so the question is deemed to have contributed 8 marks to knowledge.

The disadvantage of using this technique is the converse of that above i.e. minority opinion is not taken into account at all. This may at first appear to be an irresolvable situation since it would seem that there was no satisfactory solution to the handling of minority opinion. However the context of the situation in which these two techniques are applied is important. Taking the aggregation technique first, problems arise because each minority opinion - no matter how extreme is taken into account and is represented within the final description of the examination. It therefore tends to maximise the importance of these minority opinions. The consensus technique minimises this tendency but problems arise when the consensus opinion is not clear cut. Questions where opinion is divided in such a way i.e. (with five scrutineers) 2 : 2 : 1 or 3 : 2 or even 1 : 1 : 1 : 1 : 1 for different objectives makes choosing the consensus opinion difficult. (The more scrutineers who are employed in the task, the more difficult it becomes to identify a consensus for some questions.) So using this technique tends to result in a number of questions which cannot be classified without using some kind of 'casting vote' technique.

Both techniques therefore have drawbacks which can be considered to be important or negligable depending on the particular circumstances in which they are applied. Unfortunately the final descriptions which result from the application of these techniques give no indication of these difficulties and tend to be used in a way which does not take their limitations fully into account. Despite their drawbacks such techniques are necessary if any overall description of the examination is to be produced so enabling a determination of its validity to be established. However it is important to take into account that the two techniques are based on quite different premeses and assumptions which may affect the final description of the examination which emerges. It is therefore interesting to compare the descriptions of the 1981 Mode I Biology examination which result from the application of these two techniques.

Descriptions of the Objectives Assessed by the 1981 Biology Mode I Examination

Each of the three classification methods provided data which could be used to determine an overall description of the objectives assessed in the 1981 Mode I Biology examination. In each case the levels of agreement between scrutineers was poor and it was necessary to use either the aggregation or consensus technique in order to arrive at any overall description of what objectives the examination assessed. In consequence six descriptions were derived.

The following three tables present the descriptions derived for the examination using the aggregation and consensus techniques on the data from the three classification methods. The aggregation technique description is presented as a single figure for each category but the consensus technique description is given at three levels as follows:- equal to or over 90% agreement, 75 - 90% agreement and 60 - 75% agreement. If there was less than 60% agreement on what the question

assessed it was not classified. The tables take into account the weighting of each question i.e. the marks awarded to it so that the overall description is given as a percentage of the total marks available for the written paper.

Table 6.6 (page 130) shows that the final derived description of the objectives which the examination tests is different depending upon whether the aggregation or consensus technique has been used on the data. This situation is more marked if the higher levels of consensus are used for comparison. Interpretation of the consensus technique description is difficult because it requires a decision to be made about the "acceptable" level of consensus i.e. is a 60% agreement acceptable or should a 75% agreement level be set? Even when this has been established quite a considerable proportion of the marks remain unclassified because they do not meet the set level. These must be allocated to some category if an overall description is to be derived so that validity of the examination can be established. The use of the aggregation technique reduces these problems but raises others. For example, category 3 is attributed 14% of the marks but when this is interpreted with respect to the consensus information it becomes clear that even at a 60% agreement level only 7.5% of this can be identified at an individual question level. The other 6.5% arises from isolated classifications made by individual scrutineers. So although the derived description of the examination indicates that 14% of the marks are awarded for this objective, looking back through the scrutineers' analyses of the question paper it would be difficult to identify where at least 6.5% of the marks for objective 3 were awarded. This tendency to overemphasise certain objectives in the final description is more marked with those categories where there is a small percentage of marks and the consensus levels are poor.

It is also clear from both techniques that the majority of marks are awarded in the knowledge based categories followed by comprehension and application. There appears to be very little assessment of objectives 4, 5 or 6.

TABLE 6.6

FINAL DESCRIPTION OF THE EXAMINATION DERIVED FROM BLOOM'S CLASSIFICATION CATEGORIES

WITH THE APPLICATION OF AGGREGATION AND CONSENSUS TECHNIQUES

Blooms Classification Categories Description (Category)	Description of exam derived using aggregation technique (% marks)	Description of exam derived using consensus technique at		
		$\geq$ 90% agreement (% marks)	$\geq$ 75% agreement (% marks)	$\geq$ 60% agreement (% marks)
Knowledge (1)	48	26.5	29	40
Comprehension (2)	33	0	10.5	33.5
Application (3)	14	0	2.5	7.5
Analysis (4)	1	0	0	0
Synthesis (5)	2	0	0	0
Evaluation (6)	0	0	0	0
Other	0	-	-	-
Unclassified		73.5	58	19

The final description of the examination which emerges from Table 6.7 (page 132) again depends on which technique is used to analyse the data. The consensus technique indicates that there was very little overall agreement on any of the categories except knowledge and a high percentage (23.5%) of the marks could not be classified even at the 60% agreement level. The aggregation technique indicates that categories 4', 5' and 6' are assessed to some degree but the consensus data also shows that it would be difficult to identify where these skills were actually tested on the paper.

The most marked difference between all the descriptions which were derived for the examination is shown in Table 6.8 (page 133). The aggregation derived description indicates an examination which assesses a wide range of skills but the consensus information shows how little agreement there was between the scrutineers. Again the only objective which seemed to be classified fairly consistently was knowledge and the other objectives which the aggregation derivation indicated were assessed were due to the amalgamation of individual scrutineer judgements across a variety of questions. Consequently it is again very difficult to identify, from the scrutineers analyses, where the majority of the 24.1% of marks awarded to category 7" were tested.

These three tables indicate the way in which the final description of the examination can be altered by the use of different techniques on the same data. The consensus descriptions were deliberately left incomplete because a 'casting vote' system was not considered appropriate to use on questions where opinion was split. However the majority of questions which fell into the unclassified category were assessing skills other than knowledge or understanding, i.e. the scrutineers judged them to be assessing some more complex objective but were not agreed as to which objective it was.

TABLE 6.7

FINAL DESCRIPTION OF THE EXAMINATION DERIVED FROM THE BIOLOGY SYLLABUS CLASSIFICATION CATEGORIES WITH THE APPLICATION OF AGGREGATION AND CONSENSUS TECHNIQUES

Syllabus Objective Classification Categories Description	(Category)	Description of exam derived using aggregation technique (% marks)	Description of exam derived using consensus technique at		
			⩾ 90% agreement (% marks)	⩾ 75% agreement (% marks)	⩾ 60% agreement (% marks)
Knowledge of facts and terminology as applied to Biology	(1')	59.7	32.5	51.5	59
Ability to summarise or explain contents of a text	(2')	3.7	0	0	1.5
Ability to interpret and draw conclusions from information and evidence in form of graphs, tables, diagrams, etc.	(3')	11.5	3	4	8
Ability to apply scientific principles to new situations	(4')	10.4	0	0	0.5
Ability to formulate an hypothesis from evidence available	(5')	6.1	0	0	4
Ability to plan an experiment to test an hypothesis	(6')	2.1	0	2	2
Other		6.4	0	0	1.5
Unclassified			64.5	42.5	23.5

TABLE 6.8

FINAL DESCRIPTION OF THE EXAMINATION DERIVED FROM THE INDEPENDENT CLASSIFICATION CATEGORIES WITH THE APPLICATION OF AGGREGATION AND CONSENSUS TECHNIQUES

Description	Independent Classification Categories (Category)	Description of exam derived using aggregation technique (% marks)	Description of exam derived using consensus technique at		
			⩾ 90% agreement (% marks)	⩾ 75% agreement (% marks)	⩾ 60% agreement (% marks)
Recall, knowledge of, recognise, remember	(1")	46.7	14	25.5	39
Reasoning, analysis, critical analysis of evidence, deduce a hypothesis, reason out, evaluation, appraisal, deducation	(2")	7.9	0	0	0
Design experiment, devising experiment, synthesis, construct	(3")	2.2	0	4	4
Use of symbolic representation, reading graphs, interpreting diagram or prose to solve problem	(4")	6.3	0	0	0
Make concepts, compare functions, compare and contrast, associate	(5")	2.1	0	0	0
Numerical calculation	(6")	1.4	0	0	3
Comprehension (understanding), interpretation of meaning, describe, explain	(7")	24.1	0	6	7
Application of knowledge	(8")	8.2	0	0	0
Select, pick out, discriminate	(9")	0.8	0	0	0
Conceptualise, have concept of	(10")	0.3	0	0	0
Unclassified			86	64.5	47

Overall the aggregation technique indicates the range of skills or objectives which the examination may assess although the list may be restricted since the scrutineers are only concerned with the face validity of the questions they classify. However what does seem to be clear is that the final description which is derived should be interpreted with care. The methods of classification and techniques of resolving poor agreement between scrutineers do have an effect on the final description of the examination which emerges.

Whereas the preceding three tables indicate the differences which can be generated by using either consensus or aggregation techniques on exactly the same data, Table 6.9 (page 135) indicates another way in which the final description can be affected. It shows the differences which are generated by using different classification criteria on the same examination.

Table 6.10 (page 136) compares the examination descriptions derived by using the aggregation technique on each of the three classification methods. In order to make the comparison of the descriptions more meaningful Bloom's taxonomic categories and the independent categories have been shown against roughly comparable categories from the syllabus objectives. Where the scrutineers indicated that objectives other than those in the syllabus were being assessed these are indicated against 'other' objectives. The aggregation technique was chosen to exemplify this comparison because the consensus technique did not give a full description of the whole examination. What becomes clear from all these derived description tables is the wide variety of descriptions which it is possible to produce for one examination. This has obvious implications for the establishment of the validity of the examination. According to the objectives/assessment grid the syllabus objectives should be assessed in the following proportions as indicated in Table 6.9 (page 135).

TABLE 6.9

% OF MARKS WHICH ARE ALLOCATED TO EACH SYLLABUS OBJECTIVE

ACCORDING TO THE ASSESSMENT/OBJECTIVE GRID

Category	CSE Biology Mode I Syllabus Objectives	% marks (4)
(1)'	Knowledge of facts and terminology as applied to Biology	59
(2)'	Ability to summarise or explain contents of a text	13
(3)'	Ability to interpret and draw conclusions from information and evidence in form of graphs, tables, diagrams, etc.	19
(4)'	Ability to apply scientific principles to new situations	6
(5)'	Ability to formulate an hypothesis from evidence available	6
(6)'	Ability to plan an experiment to rest an hypothesis	

(4) These % marks differ from those in the printed syllabus where the written paper only accounts for 80% of the total assessment (20% is practical). For analysis purposes the written paper was taken to represent the full 100% of marks.

TABLE 6.10

% MARKS AWARDED TO EACH SYLLABUS OBJECTIVE WHEN THE AGGREGATION TECHNIQUE WAS APPLIED TO THE THREE ANALYSES OF THE 1981 BIOLOGY MODE I EXAMINATION

CSE syllabus objectives	% marks awarded using syllabus objectives, categorisation & the aggregation technique	% marks awarded using Bloom's objective categories & the aggregation technique	% marks awarded using independent categorisation & the aggregation technique
1	59.7	48	46.7
2	3.7	33	24.1
3	11.5	14	6.3
4	10.4	0	8.2
5	6.1	2	7.9
6	2.1	0	2.2
Other	6.4	3	4.6

Given the diversity of the descriptions which were generated it is difficult to choose any one description against which the validity of the examination should be measured. Yet this is an important step in establishing the function of the objectivesand their role in the objective/assessment grid i.e. in determining whether communication line 2 (as described in the model in Chapter One) is functioning as theory suggests. Direct comparison between the derived descriptions of the examination and the objectives/assessment grid description were further complicated because

(i) the classification categories were not directly comparable in all three analyses

(ii) the reliability and validity of the derived descriptions of the examination paper are questionable

(iii) certain assumptions have to be made to arrive at any overall description of the examination paper when the scrutineers show such little agreement.

In these circumstances probably the most useful and valid comparison can be made between the syllabus objectives/assessment grid and the examination description derived from the scrutineers classification of items in terms of the syllabus objectives subjected to the aggregation technique. There are a number of reasons for this choice of comparison in attempting to establish the overall validity of the 1981 Mode I Biology examination.

(i) The categories for classification are exactly comparable whereas with either the Bloom or Independent classification some categories are not. Thus there is less complication or ambiguity introduced by having to pair up roughly equivalent categories.

(ii) The examiner wrote the examination to match the syllabus objectives therefore the questions should be specifically related to these objective categories. Any questions which are considered to assess other objectives than those in the syllabus can be more readily identified.

(iii) The aggregation technique does produce a complete description of the examination and while recognising that it should be interpreted with considerable care in the light of the previous findings, it does permit some estimation of the overall validity of the examination. The consensus technique, on the other hand, leaves a considerable percentage of the marks unclassified which makes direct comparison with the objectives/assessment grid impossible.(5)

---

(5) The use of a 'casting vote' given by the researcher in order to classify these particular questions introduces yet another variable in an already ambiguous situation and was therefore not considered acceptable in these circumstances.

The following table 6.11 presents data comparing the specified syllabus objectives with those from the scrutineers analysis of the paper.

TABLE 6.11

COMPARISON OF THE OBJECTIVE/ASSESSMENT GRID AND ONE OF THE DESCRIPTIONS OF THE OBJECTIVES ASSESSED IN THE 1981 BIOLOGY EXAMINATION PAPER

CSE Syllabuses Objectives	Objective/Assessment Grid Specification (% mark)	Description of paper derived by Using Syllabus Objectives Categorisation and the Aggregation Technique (% mark)
1	59	59.7
2	13	3.7
3	19	11.5
4	6	10.4
5 & 6	6	8.2
Other	0	6.4

The table indicates that knowledge based objectives are assessed in line with the specification. This indication is substantiated by the good incidence of scrutineer agreement in this category. So very few of the marks allocated to this category by using the aggregation technique were produced by spurious individual classification at variance with the majority classification of the question. This does not hold true for any of the other categories. Category 2 indicates a very low level of actual assessment compared to the suggested specification on the grid although every instance which was considered to be assessing this objective is reflected in the description. The scrutineers did make several comments on this category description indicating that they found it difficult to interpret and this may have contributed to its low overall score. Categories 3, 4, 5 and 6 are those where most disagreement between the scrutineers was found. The marks allocated in the derived description are therefore difficult to compare with the specification grid because they are made up largely from individual scrutineers assessments which do not form a majority view on any given question or question part. Finally the scrutineers identified 6.4% of the marks as assessing objectives which were not given in the syllabus specifications. Again this figure is derived from a number of individual classifications and should be interpreted in this context but it does indicate that there may have been a number of marks which were allocated to objectives which were not specified.

In conclusion several points can be made concerning the validity of the examination both from this specific comparison and using the evidence from the other analyses which were carried out.

(i) The examination does seem to assess a range of objectives which encompass those specified in the syllabus.

(ii) Within this range are a number of objectives which are not included in the syllabus specification. These would include numerical calculation, conceptualisation and drawing comparisons.

(iii) Of those objectives which were specified in the syllabus the majority of questions assessed knowledge or understanding based objectives. Those objectives which are usually considered to be more complex involving elements of creative or evaluative reasoning or critical consideration or transference of concepts are rarely assessed.

It was possible to establish a picture of the range and type of objective which was assessed, in candidates, by this examination i.e. its qualitative validity. However it must be stressed that (a) the examination would be likely to assess a different range of objectives for individual candidates which would be dependent on their personal learning experience and (b) the range of objectives was limited to the scrutineers' interpretations of the face validity of the question and therefore likely to be a minimal or restricted list. (i.e. assessment of guess work or deduction by elimination etc would not be made evident although these may well be the objectives which were assessed by particular questions for certain candidates.)

The quantitative validity of the examination i.e. how it compared to the objectives/assessment grid values was a much more difficult factor to assess. It appeared that an approximate value could be placed on the number of marks which were allocated to the attainment of knowledge based objectives but that this was not possible for other objectives because of the poor consensus concerning questions were assessing these skills.

In the light of the findings presented in this section it is difficult to envisage a situation where the validity of an examination, in terms of the objectives it assesses, can be established unambiguously. The presentation of analyses of examination papers which claim to evaluate such factors e.g. those recently presented in Education in Science (1982) [6] and Denny (1982) should be carefully scrutinised in terms of the assumptions and techniques which were employed before any interpretation of the results is considered or attempted.

It may also be misleading to assume that the objective/assessment grid enhances the quantitative validity of the examination in any respect other than the quantity of marks allocated to knowledge. Although this in itself may be a useful function since examinations have often been criticised for assessing this objective to the exclusion of all others. However it does cast some doubt on the role which objectives as represented in objectives/assessment grids have on the design and validity of examinations. Communication line 2 may therefore enhance the validity of the examination in qualitative terms but is probably not effective in quantitative terms. Yet it is the quantitative element which is perceived to be the most important and controllable by those who are using the system.

---

(6) Phillips, R. F. (1982) A description of a technique which can be applied to examinations to establish "whether the written examination papers test what they purport to test in terms of stated assessment objectives" (page 15) and resulting in an evaluation of whether this aim has been achieved. Carried out on 1981 Biology and Integrated Science (SCISP) written papers - Nottingham.

PART II

The Relationships Between Candidate Performance and the Attainment of Objectives

The second section of this chapter seeks to link the attainment of pupils to the objectives which were assessed in the examination. From the preceding section it is clear that an unambiguous statement of what objective each question or question part is assessing is unlikely to be forthcoming. Each question or question part is more likely to assess a range of objectives which will differ for each individual candidate. Nevertheless some estimation of the objectives most likely to be assessed can be gained by looking at the range of skills awarded to each question or question part by all of the scrutineers irrespective of the classification categories they were using. In some cases individual questions are classified in the same or very similar categories by all the scrutineers (knowledge and understanding based questions largely fall into this group) and so there is reasonable justification for considering that it is these skills which are most likely to be assessed by these questions. In other cases a very wide diversity of opinion is apparent and these questions can only be treated as likely to assess a range of skills. Occasionally there may be some limitation put on this so that only two or three objectives are associated with any one question and this can be helpful in reducing the range of likely objectives which are assessed by that question.

Wherever pupil performance is considered in terms of achievement in this section the objectives which are considered to be assessed by any question or question part have been determined in the fashion described above. In other words the opinions of all the scrutineers involved in the analysis of the 1981 Biology examination have been

considered to provide an indication of whether (a) the question is likely to assess a narrow range of objectives or possibly only one and (b) if this is not the case to indicate the range of objectives which might conceivably be assessed by that question.

The achievement of pupils is considered with respect to two main issues which pertain to the teaching and examining of Biology Mode I. Firstly do the objectives which the teachers hold and/or promote, influence their pupils performances and achievements in the examination? Secondly, does the grade awarded to a candidate depend on the achievement of particular objectives? This section then looks at the links between communication line 1 (teachers use and perceptions of objectives) and communication line 3 (pupils achievement in terms of objectives) in order to complete the investigation into the functioning of the model described in Chapter One.

In order to carry out these investigations it was necessary to collect data on pupil performance. 330 scripts were used to provide the data, they were the scripts of candidates whose teachers had been interviewed. Their scripts were analysed by recording the marks which each individual was awarded on each question or question part. This was carried out initially on a teaching group basis (varying from 12 - 37 candidates per group) and then amalgamated to provide data for the whole group (330 candidates).

Teachers' Perceptions and Uses of Objectives and their effect on Pupils' Examination Performance

Information from the teacher interviews was combined with the data from the script analyses to investigate this effect. In the first series of interviews the teachers had outlined the objectives which they felt they held when they taught the course and those which they felt they were able to promote through their teaching. In the second

interview further information was provided by their descriptions of their teaching techniques. By examining this information for each of the teachers who had candidates entered for the 1981 examination it was possible to draw up a list of the kinds of objectives which individual teachers felt they promoted during their teaching. These lists usually comprised two types of objectives, those which the teacher felt they ought to promote or wanted to promote and those which they felt they were able to promote. It was the second of these categories of objectives which were considered in this aspect of the work. This distinction was based on evidence from the interviews with teachers in which respondents often made qualifying or explanatory statements which separated their aspirations from their actual practice.

The second requirement was to identify the questions, and hence the objectives, or which teaching group had done particularly well or poorly. This necessitated the establishment of a "norm" in terms of achievement on each question or question part. This "norm" was determined by calculating the average percentage of marks gained on each question by the 330 candidates. The average performance of each teaching group was also calculated in the same way for comparison. Most of the teaching groups were set by ability, so teachers were often teaching either groups where only some of the candidates were likely to be entered for CSE i.e. a mixture of 'good' CSE candidates and 'O' level candidates or groups whose potential was seen in terms of poor to average CSE performance. Most teachers did not make a choice about which examination pupils would be entered for until the January of the year in which the public examinations were taken (after their mock examinations). Until then 'O' level and CSE syllabuses were amalgamated and taught as a common core apparently without difficulty.

This situation did have an effect on the average level of performance of the teaching group however since some groups' performances were largely grade 3 and above while others were grade 3 and below and yet others had a whole range of grades from unclassified to grade 1. To compare these to the "norm" and pick out individual questions or

question parts where the candidates as a group had performed particularly well or poorly required that an adjustment be made to compensate for the overall ability of each group.

The strategy used to make such adjustments is probably best described by giving a specific example as follows:-

Identifying 'Good' and 'Poor' Questions for an Individual Teaching Group

Figures 6.1 and 6.2 (pages 147 and 148) show the average performance on section A and B items calculated from all 330 scripts. Superimposed on them is the average performance for Teaching Group 304 (29 candidates). A number of items immediately stand out where Group 304's performance was significantly better or worse than the "norm" average. However before such items can be definitely identified the overall ability of the group must be taken into account. In this case Group 304 had an overall average score on the whole paper of 42.3%. This is compared to the average score for all 330 candidates of 45.6%. In order to identify 'good' and 'poor' questions accurately Group 304's data was moved up by 3.3% before comparison with the norm group. After this adjustment has been made it is possible to identify on which items group 304 did particularly well or poorly. Abnormally good or poor scores were identified, for all groups, as those differing from the 'norm' by more than $\pm$ 15% after adjustment. These questions were then identified in terms of the objectives they assessed as described previously.

Before the second interview the teachers were provided with a list of 'good' and 'poor' questions for their group and asked to consider why pupils had done well or poorly on them. It became clear at the second interview that most teachers had found little opportunity to consider the questions in detail. However when pressed none of the teachers related their pupils' performance to specific teaching of

FIGURE 6.1

GROUP 304's PERFORMANCE ON SECTION A OF THE 1981 BIOLOGY CSE EXAMINATION

COMPARED TO THE "NORM" PERFORMANCE (BEFORE ADJUSTMENT)

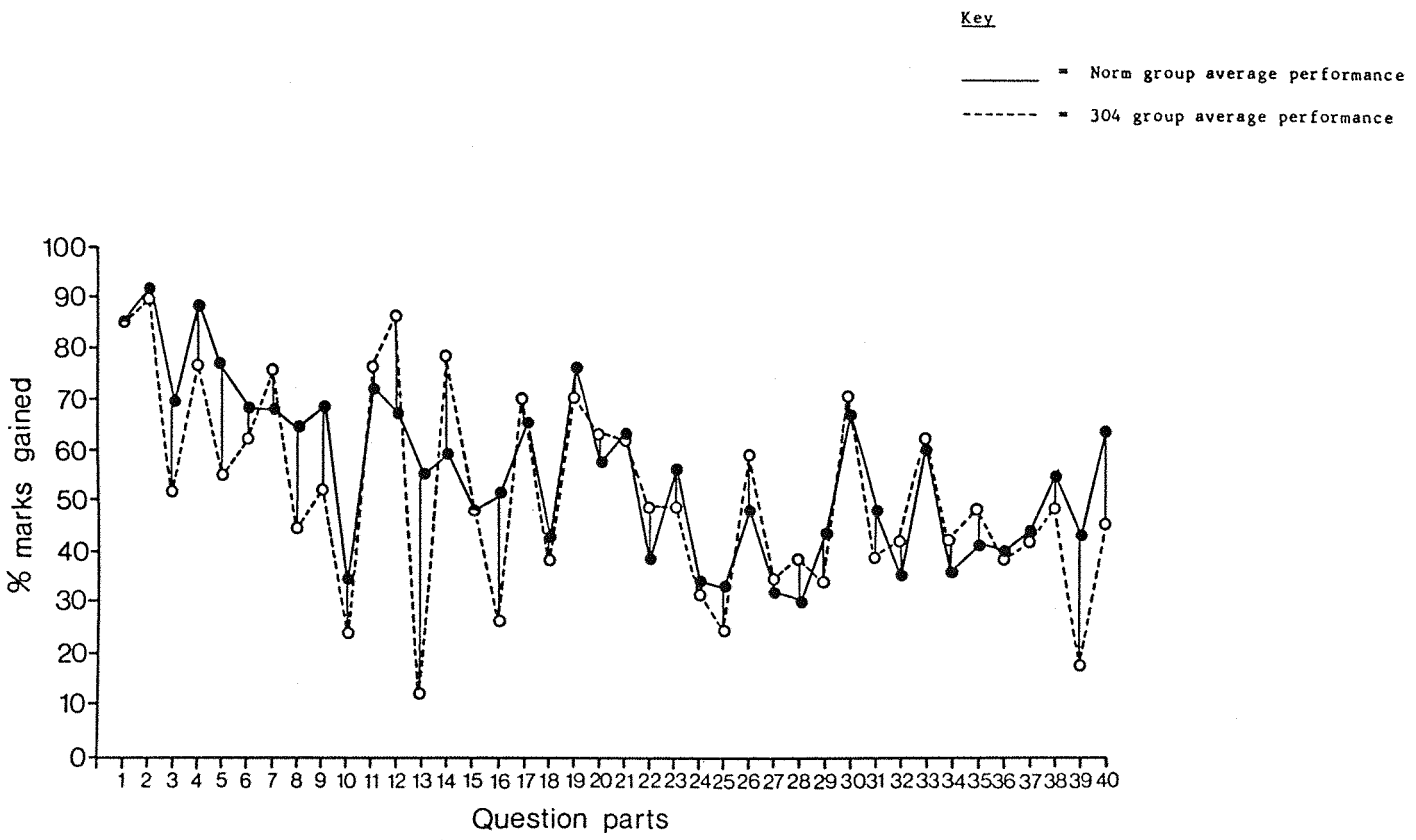
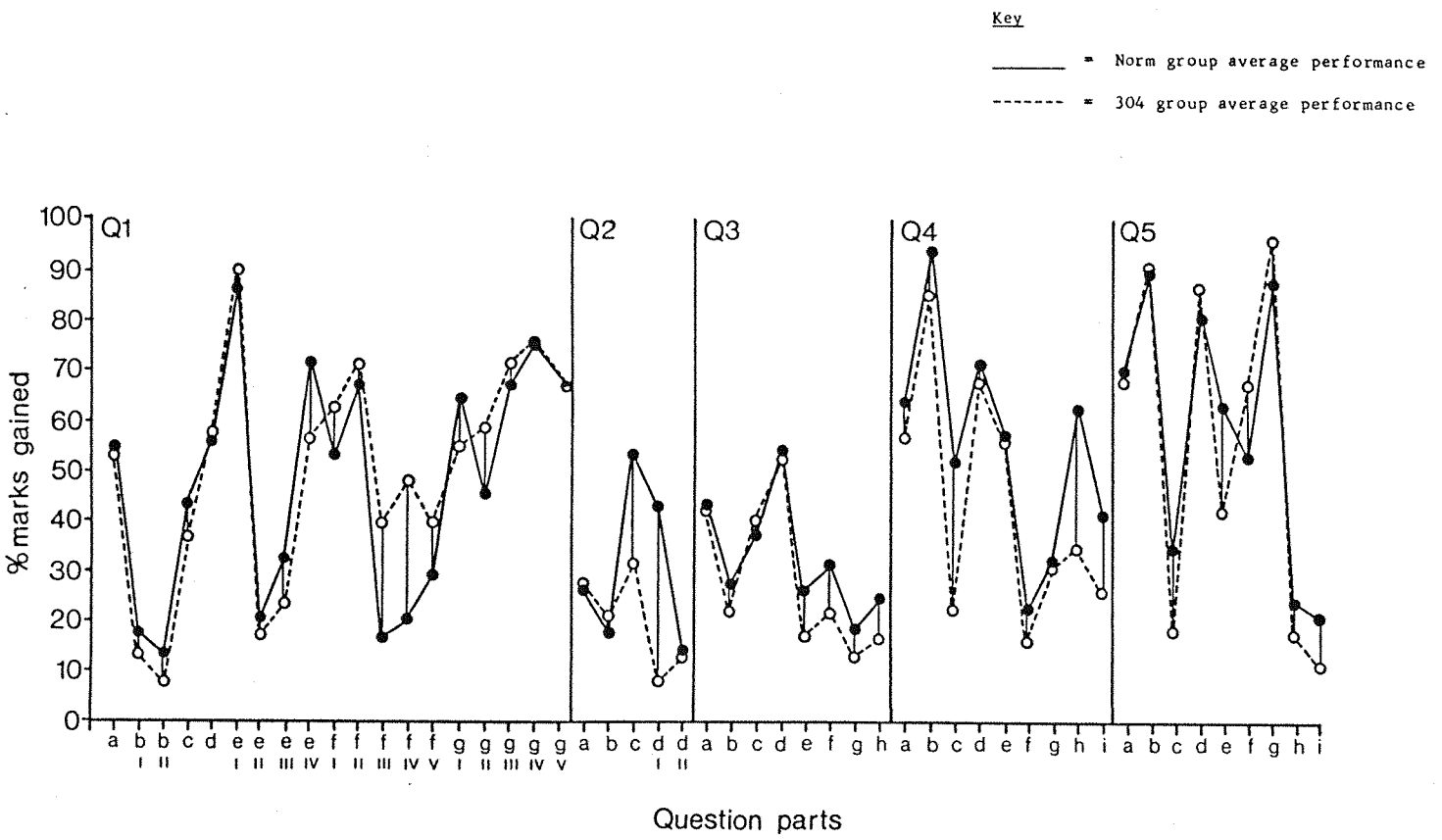


FIGURE 6.2

GROUP 304's PERFORMANCE ON SECTION B OF THE 1981 BIOLOGY CSE EXAMINATION

COMPARED TO THE "NORM" PERFORMANCE (BEFORE ADJUSTMENT)



objectives. They spoke almost exclusively of the topics which were tested by the question not the objectives. Comments like: "They find genetics hard" and "I always stress this topic in my teaching" were very common. A great deal of stress and importance was also laid on practice of past questions so that many of the pupils had seen similar questions from previous years' papers and practiced them before taking the examination.

One school did have a specific policy related to teaching the objectives which had commonly been assessed in the comprehension question. One question of this kind is included every year in Section B and questions are asked about a prose passage dealing with a biological subject. The teachers felt that in previous years their candidates had not achieved grades that might have been expected from their ability. This they thought was mainly due to their inability to master the necessary literary skills which were not usually covered in the Biology syllabus or, in this particular school, in other parts of the curriculum. The pupils were given a good deal of practice of similar comprehension exercises to prepare them for the examination question. The analyses of the teachers' groups' performances indicates that their pupils generally performed adequately on this question and the teachers felt that their programme of teaching had contributed to this state of affairs and had enhanced the general level of performance which was better in 1981 than in previous years. However, such clear cut cases of the relationship between the teachers' objectives, their teaching programme and examination performance were difficult to find. The interpretation of situations like this must also be tempered with the realisation that a large number of influences are likely to play a part in such relationships and some of the immediately obvious interpretations may not be entirely satisfactory.

However generally there was not sufficient information to identify whether or not the teacher's objectives had any influence. Therefore each teacher's objectives were listed from the transcripts and tapes as described earlier and compared to the objectives on which their pupils performed well or poorly. These selected items tended to include a whole range of objectives which were often included in both 'good' and 'poor' categories so that one group might do well on a question which appears to test application of knowledge and on another apparently testing the same objective, do poorly. Neither was there a clear cut relationship between the teachers objectives which were identified and the pupils performance. Obviously a number of factors are likely to cloud the relationships which might exist between these two factors. These would include the overall difficulty of the question, the language used, the topic on which the question was asked and hidden ambiguity in the question. On a wider level identifying any relationship is also likely to be complicated by the following facts:- that an average measure of the group's performance was used and not individual scripts; that achievement of objectives was only determined on a quantitative basis and the quality of the individual answers was not considered; that there was still some uncertainty in determining which objectives the teachers actually promote and in identifying the relative importance they gave to each one i.e. are data handling skills taught, weekly or termly throughout the course or as a block in a two year programme?

In conclusion, there was no clear pattern of influence which could be determined relating the teacher's objectives to their pupils' performance from this data. Nevertheless there was at least one instance where practicing specific skills such as comprehension did appear to make a difference to pupil performance.

It is likely that a more detailed study of this aspect of the work would provide more concrete evidence of any relationship between teaching and pupil achievement in terms of objectives. In terms of the model, the links between communication line 1 and 3 (teachers'

perceptions and use of objectives and pupils' performance in the examination) appears to be a very complex interaction of a whole range of factors, simple cause and effect relationships are not much in evidence.

Determination of Grade Related Criteria in Terms of Achievement of Objectives

The final section of this chapter examines the quality of a grade 1 and grade 4 performance in terms of the attainment of objectives which characterise each performance level. Although there is no specific mention of such a role for objectives in the model described in Chapter One, it is implicit in some of the feedback. That is to say that the award that a candidate receives is considered to represent a standard which may often be related, however tenuously, to the mastery of certain objectives. Whether this can in fact be substantiated from the data for the 1981 Biology examination is worth pursuing both to provide more information about the wider processes of teaching and examining and more particularly to provide information about the feasibility of linking grade awards to the achievement of ranges of objectives. The latter aspect is particularly relevant to recent proposals which have arisen from 16+ development work suggesting that grade awards should be linked with objectives in this way.

Two grade levels of performance were chosen for investigation, grade 1 and grade 4. Grade 1 represents the highest level of achievement in the examination and is considered equivalent to grades A - C (the former 'pass' grades) in a comparable 'O' level subject. Grade 4 represents the average performance level of the whole population eligible to take the examination i.e. including those who might be considered "non-examinable" in the subject. These two levels of performance might therefore show different characteristics of achievement in terms of the objectives which the candidates master. To

investigate this prospect two sets of data were extracted from the 330 script analyses to represent a typical grade 1 and grade 4 performance.

The selection of data which constituted a grade 1 or 4 performance was based on two main conditions.

1. The grades were determined by the candidates performance on the written paper only. The 1981 examination grade was awarded for performance on a written paper and a practical examination with a weighting of 80% : 20% respectively. However the practical is internally marked and assessed and no detailed information relating to pupils' mastery of objectives was available. The practical grades which the teacher awards are moderated and subsequently combined with the written paper performance to calculate the final grade awarded to the candidate. So in terms of mastery of objectives the only data which was available related exclusively to the written paper. For this reason a grade 1 and grade 4 performance was taken to be one where the final grade was not altered by the practical examination. The candidates who represented grade 1 and grade 4 achievements, then, were those whose written paper had been accredited to that grade and whose practical result had not subsequently changed it.

2. The grades were represented by a limited number of candidates whose score on the written paper fell in a relatively narrow range of marks. There tended to be a very wide range of performance, in terms of marks, which resulted in a grade 1 or grade 4 award being given. This was the case even after the adjustment of grades on the basis of practical ability had been excluded. The data which was considered to provide evidence of a grade 1 or grade 4 performance was restricted to those candidates whose score on the written paper was close to that for the grade 1/2 boundary and to the grade 4/5 boundary.

This criterion was chosen because the candidates marks were moderated by a number of different local consortia resulting in grade boundaries which varied from one teaching group to another. It was comparatively straight forward to identify borderline candidates in each group but more difficult to identify other narrow ranges of performance within the grades in the absence of local consortium moderation data.

Eighteen candidates fulfilled these condictions at a grade 1 level and thirty three at grade 4. The data from their individual performances were used to produce an average performance at each level for each question or question part as follows (a) Section A (the multiple choice questions) Each candidate either scored 1 or 0 for each question. By adding these scores together for each set it was possible to calculate the probability of a grade 1 or grade 4 candidate answering the question correctly and these values were then compared. (b) Section B (short answer questions) Here there was a much more flexible marking scheme and the overall percentage of available marks gained by each set was calculated for each question part. These two values were then compared.

The comparison of the grade 1 and grade 4 performance in terms of their achievement of marks on individual questions and the relationship of this to the mastery of specific objectives will now be considered in some detail.

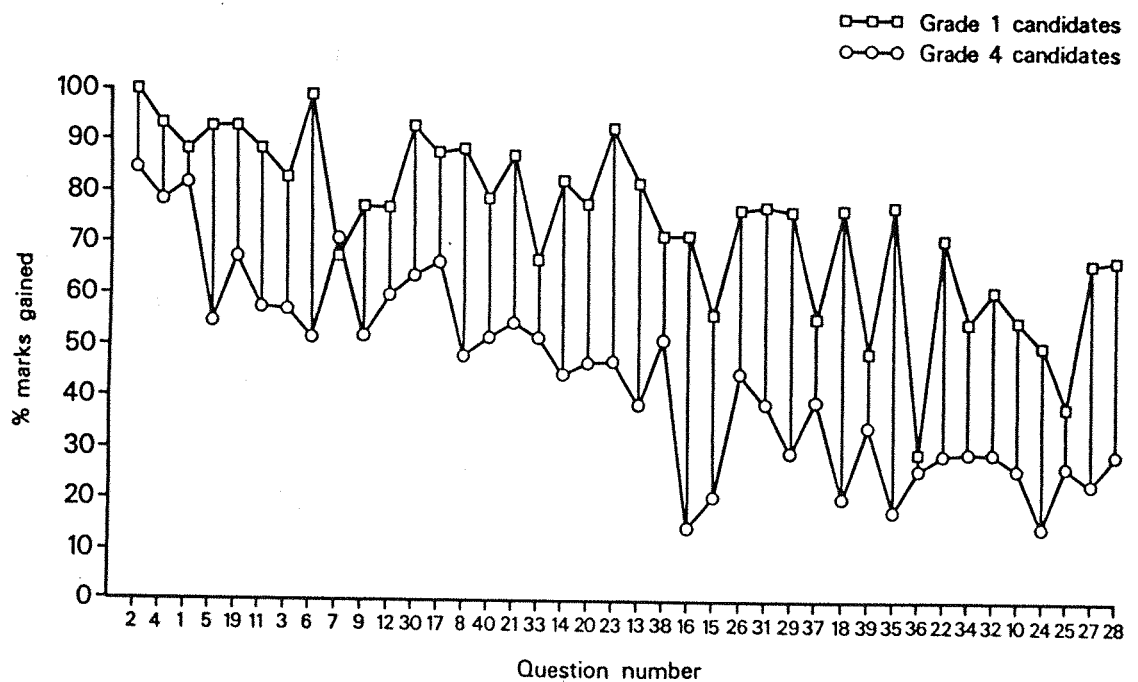
Section A: The Multiple Choice Questions

Figure 6.3 (page 154) indicates the difference in performance between the grade 1 candidate and the grade 4 candidate on the multiple choice questions. The questions have been arranged in increasing order of difficulty. This order was determined by the overall score achieved by all 330 candidates on each question. Those questions with the

FIGURE 6.3

% MARKS GAINED ON EACH MULTIPLE CHOICE QUESTION BY GRADE 1 AND GRADE 4 CANDIDATES

(QUESTIONS ARRANGED IN INCREASING ORDER OF DIFFICULTY)



highest scores are first followed by those with sequentially lower scores.

Almost without exception the scrutineers judged all forty of these multiple choice questions to be assessing mixtures of knowledge or understanding/comprehension. The main observation which can be made is that the grade 1 candidates consistently gained more marks than grade 4 candidates on these questions. Interestingly the difference in performance seemed to be relatively constant despite the increasing difficulty of the question. There was no evidence to suggest that the more difficult questions separated the grades more effectively than the easier questions. In terms of the mastery of these particular skills it seemed that the grade 1 candidates might be expected to pick up more marks generally than grade 4 candidates but there did not seem to be any particular kind of question which separated the two grades consistently. Taking one or two specific questions in detail question 7 and 36 are interesting because the grade 1 and grade 4 performances are very similar on each question.

Question 7 - To which one of the following classes does an organism with two pairs of wings and three pairs of legs belong?

A. Arachnid
B. Crustacean
C. Myriapod
D. Insect
E. Bird

Question 36 - Subsoil is usually infertile because it lacks

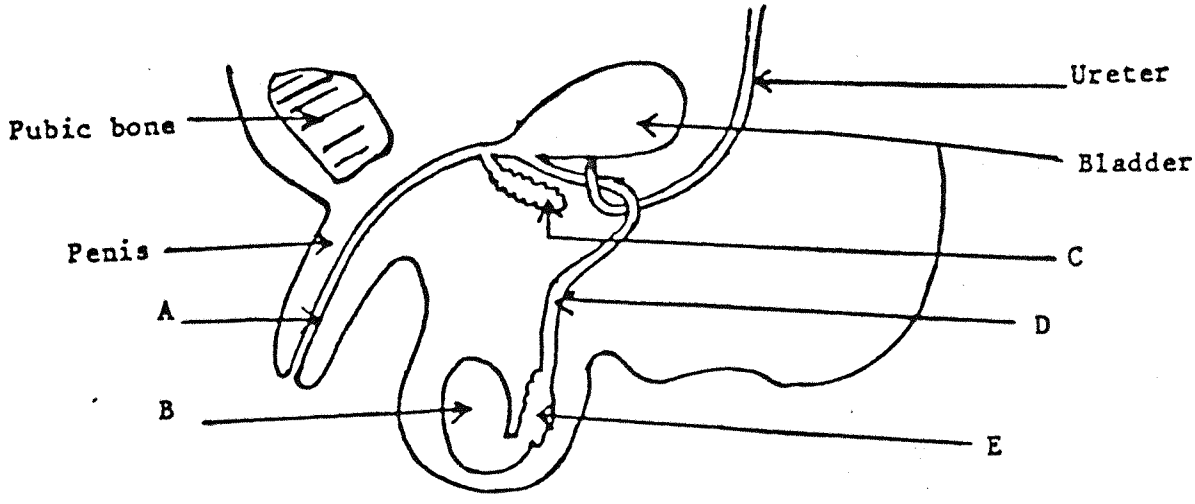
A. mineral salts
B. rock particles
C. humus
D. water
E. earthworms

Both questions were considered to embody a strong element of knowledge or recall and there does not seem to be any specific reason why the grade performances should converge on these two questions while other questions apparently testing similar skills give a wider separation. One explanation may be in the fact that the question does not assess objectives in isolation i.e. it probably assesses a range of factors in a complex interaction, these might include the wording of the question, the alternative answers which are supplied, question ambiguity, overall question difficulty and the topic. In these terms then the pupils' performance, whilst relating in part to the objective being assessed, is also likely to be influenced by a number of these other factors. Looking specifically at question 7 and 36 the topics tested may be more important than the objectives. Most candidates find classification characteristics (Q. 7) difficult to learn and soil (Q. 36) is an area which is dealt with quite superficially by many teachers. The reason for the convergence of performance here may therefore be to do with the fact that high proportions of the pupils, at both levels, simply guessed the answer in each case. In question 7 the percentage mark was higher because the candidates could eliminate at least one of the choices (E. Bird) so reducing the level of chance. In question 36 it was more difficult to immediately eliminate any of the alternatives. However further evidence from the candidates themselves would be necessary to substantiate such an explanation.

Question 16 shows the largest difference in performance between grades 1 and 4.

Question 16

Which arrow in the following diagram of the male reproductive system points to the urethra?



Again the question was classified almost unanamously as being a memory/recall question. The reason for the difference in performance is difficult to envisage even when considering the other factors. The diagram is one with which the candidates are likely to be familiar (it or a very similar variation is common in most text books); the topic reproduction is one which is normally covered thoroughly; the question itself does not appear to be ambiguous and the tube to be identified, the urethra, is a technical term which most candidates would be expected to be able to recognise and distinguish from the other labelled tubes. Again the only way to find out more detail of the reason for such differences would be to question individual candidates about their specific answers.

The multiple choice questions then appear to be assessing a narrow range of objectives which deal mainly with knowledge or comprehension based skills and grade 1 candidates seem to do better on these questions than grade 4.

Turning to the second section of the paper a much wider range of objectives seemed to be assessed.

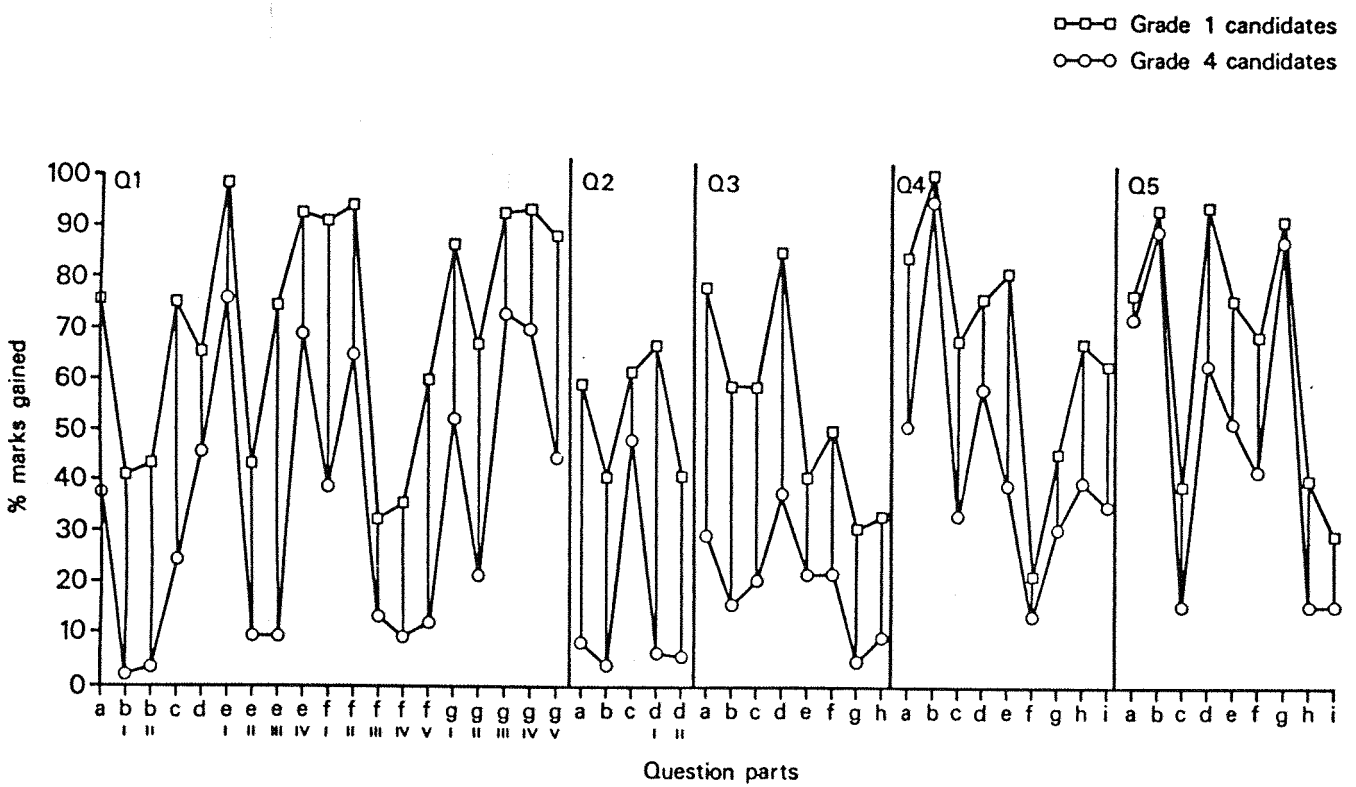
Section B: Short Answer Questions

Figure 6.4 (page 159) indicates the percentage of marks gained by an average grade 1 or grade 4 performance on section B of the paper. Each section B question was divided into a number of question parts to which a discrete number of marks were allocated in the marking scheme. The scrutineers classified each of these question parts separately in terms of the objective or objectives which they assessed. In many cases the question parts were linked to each other in some way for example answering different questions from the same basic information. So in this section more information was gained by keeping the question parts in their respective order as determined by the examination than in ranking them in order of overall difficulty.

This section was considered by the scrutineers to test a range of objectives. If a difference in mastery of objectives was to be detected between the grade 1 and the grade 4 performance it might reasonably be expected to be evident in this section. So for example the grade 1 performance would be considerably better than the grade 4 performance on question parts which were assessing objectives which grade 1 candidates could master but grade 4 candidates could not. Similarly on those question parts which tested objectives which grade 1 and some grade 4 candidates could both master (ostensibly easier objectives) the difference between the performances would be less marked.

FIGURE 6.4

% MARKS GAINED BY GRADE 1 AND GRADE 4 CANDIDATES IN SECTION B QUESTIONS



Looking at Figure 6.4 it is apparent that some question parts do indeed separate the performances of the two grade levels much more than others. However when these individual question parts are considered in terms of the objectives they are thought to assess a confused picture emerges. Examining some of these instances in detail serves to illustrate the point.

Question part 1d and 1e (iii) were both considered to be assessing mainly recall and understanding of basic principles. However the difference in the performance between grade 1 and grade 4 in the two parts was quite marked. 1d separated the two performances much less than did 1e (iii). This pattern could be seen repeated throughout section B so that in some cases grade 1 and grade 4 performances were similar and in other question parts apparently testing the same, or very similar, objectives the performances at grade 1 and grade 4 were quite markedly different. This situation applied equally well to question parts which were thought to be assessing other objectives than recall or understanding. 1f (iii), 1f (iv) and 1f (v) are suitable illustrations. Those were considered to be assessing a range of objectives including knowledge, data interpretation, critical reasoning and application. Although individual scrutineers differed concerning the proportions of marks allocated to each objective they were fairly consistent that the three parts were assessing similar skills in each case. However the graph indicates that each question part separates the grade 1 and 4 performance by a different degree although 1f (iii) and 1f (iv) are very similar. Question parts 2d (i) and 2d (ii) and 5a, 5b or 5g and 5e and 5d also show this effect. It was also possible to pick out other instances where the performances of grade 1 and grade 4 candidates were very similar for example 4b, 4f, 5a, yet the objectives which these seemed to be assessing were quite different. Interpreting data (4b), understanding and formulating concepts (4f), and selecting information from a text (5a). This indicates the wide variety of objective mastery which produces similar performances from a grade 1 and grade 4 performance.

The other two question parts which show marked convergence of performance i.e. 5b and 5g are considered to be assessing very similar objectives to 5a. This might be interpreted as an area where the performance levels were consistently similar in terms of the mastery of objectives but 5d and 5e also assess basically similar objectives and the separation of performance levels is much more marked.

On the section B questions it was possible to identify a range of relationships between the objectives which seemed to be assessed by particular question parts and grade performances. These included situations where the difference in the grade performance was consistent but the question parts seemed to assess a wide range of objectives. Conversely there were situations where the question parts were assessing similar objectives but the separation of grade performances were inconsistent. There were also instances where it was possible to identify consistent differences in grade performance which were repeated in other question parts assessing similar skills but these were much less evident. In summary:-

Difference in grade 1 and grade 4 performance	Objectives assessed by question parts
Consistent	A wide range
Very varied	Similar
Consistent	Consistent

Looking more generally at whole questions it seemed that some separated grade 1 and grade 4 performances much more effectively than others. Questions 1, 2 and 3 seemed to separate the performances more than 4 and 5. In general terms it was the first three questions which embodied more knowledge and understanding based objectives and questions

4 and 5 were assessing less of these skills. In other words where there is a reasonable proportion of knowledge or understanding based objectives grade 1 candidates do better than grade 4. When other objectives are being assessed the grade 1 and grade 4 performance become less predictable.

Question 5 is particularly interesting because many of the teachers who were interviewed and the scrutineers commented on it. It was a prose passage on which questions were asked. It was interesting to note that many teachers felt that the objectives it assessed related more to English Literature than to Biology and were critical of the inclusion of such questions bearing 25 out of 200 marks in a Biology examination. However, their main criticism was that such a question was likely to favour the more literate candidate, regardless of their biological ability, and place those candidates with some difficulties in reading at a disadvantage. In other words the teachers felt the grade 1 candidates would do very well on question 5 and grade 4 candidates very poorly. In such a situation candidates would gain or lose large numbers of marks (likely to affect grading) on a question which they felt was not assessing biological objectives. However, the analysis of the question shown in Figure 6.4 suggests that this is not the case. Grade 1 and grade 4 candidates performed well on this question and in fact in many cases there was much less separation of performance than in other questions.

In conclusion there does not seem to be any pattern or consistency of achievement of objectives which can be attributed to a grade 1 or grade 4 performance. Some questions which seem to be assessing very basic objectives separate grade 1 and grade 4 candidates more effectively than questions which seem to assess more complex skills. Much of this may be to do with the difficulty of the question part. It is relatively easy to conceive of a knowledge testing question which is more difficult than an interpretation question, e.g. question 7 which requires knowledge of the physical characteristics of a number of biological phyla and question 4b where the candidate had a simple

interpretation of experimental evidence to undertake which involving counting up the number of organisms. What is clear from this analysis, however, is that there is no simple relationship between the achievement of particular objectives and the final grade performance which is awarded.

Indeed the factors which have been identified as complicating the performance of candidates in answering questions i.e. question ambiguity, topic covered, question difficulty etc. are equally likely to have an effect in this situation.

Conclusion

Several points can be made in response to the questions which were raised at the beginning of this chapter concerning the functional role of objectives in examination design and their achievement as denoted by pupil performance. Firstly, writing examinations to match objectives/assessment grids such as those included in the SREB Biology Mode I syllabus for 1981 is a difficult task. Whilst the examination seems to embody a range of objectives which are included in the grid it is also true that other additional objectives are being assessed. The objectives/assessment grid may give a useful guideline to aid the examiner in the breadth of the objectives which she may try to assess, but it is also clear that precise quantitative values cannot be adequately matched on an objective by objective basis. The emphasis which is placed on this aspect of examination design is misplaced because each individual candidate is likely to use differing skills to answer questions depending on their personal experience. It is extremely unlikely that any question will consistently assess a given objective for all candidates and if this is widened to the level of an examination the specific percentages applied to each objective are unlikely to be achieved. What does become clear, however, is that

knowledge/understanding based objectives are more likely to apply to a wide range of candidates and there may be some value in attempting to put an approximate value on these skills since they seem to be more readily and reliably identifiable. This would result in a percentage identified with a range of other objectives which may be assessed by the remainder of the paper.

In terms of pupil performance on the examination with respect to the achievement of objectives a complex picture emerges. Pupils achievement in mastering objectives does not bear a simple relationship to the objectives which teachers appear to emphasise through their teaching. However it is also obvious from other studies in the curriculum development field that the teacher does play an important role in whether or not certain objectives are finally achieved by the pupils. What this research indicates is that the objectives which are promoted through the teacher are influenced by a great many factors.

Even when a teacher is committed to the transmission of an objective it is not necessarily evident in their pupils' achievement. The teacher's commitment to objectives is often seen as the major contributing factor in the transmission of curriculum objectives to pupil performance. However the results of this research would indicate a much more complex relationship which requires further study.

Finally the data emphasises the difficulty of characterising a grade 1 or grade 4 performance in terms of achievement of different objectives. It appears in general terms that grade 1 candidates are more likely to do well on questions assessing predominantly knowledge or understanding based skills whereas on questions assessing other objectives such as critical thinking, evaluation, synthesis of new ideas, application of knowledge etc it is much more difficult to predict how the two grade level performances will compare. It is also worth stressing at this point that the objective which the question assesses cannot be separated from other elements which make up the question such as the topic it covers, its ambiguity, and its overall

difficulty. These factors are likely also to affect the pupils performance. It is therefore unlikely that any grade performance can be identified solely in terms of objectives without taking these other elements into account in some form.

The identification of performance levels in terms of achievement of objectives has been a theme which has been developed recently as an aspect of assessment in the proposed new 16+ examinations. As part of their brief the working parties were asked to draw up typical grade descriptions at two levels grade 6 and grade 3. The Biology working party definitions are described below and are not unrepresentative of the kinds of descriptions derived by many other working parties.

There are eleven assessment objectives which are identified for the syllabus. The grade description for a grade 6 candidate is identified in relation to assessment objectives 1 - 5.

DRAFT NATIONAL CRITERIA FOR BIOLOGY - 16+

Assessment Objectives

1. To demonstrate knowledge of biological facts and practical techniques.
2. To use appropriate terminology in demonstrating this knowledge.
3. To demonstrate understanding of biological principles and practical techniques.
4. To make accurate observations and record them.
5. To present biological information coherently.
6. To analyse, interpret and draw inferences from a variety of forms of information.
7. To apply biological knowledge to the solution of problems.
8. To make constructive criticisms of the design of experiments.

9. To plan simple experiments to test given hypotheses.
10. To formulate hypotheses and to design experiments to test them.
11. To select and organise information relevant to particular ideas and to communicate this selected and organised knowledge cogently.

Grade Descriptions

Grade 6: the standard reached by the average student of Biology at the age of 16+ who may be expected to be familiar with a sufficient body of facts to be able to understand a straight forward biological statement or problem and be able to follow routine procedural instructions.

More specifically, the achievement shown by a Grade 6 candidate should relate to assessment objectives 1 - 5, and the candidate should demonstrate the ability to:

1. recall the more important facts.
2. recognise basic biological terms.
3. use a knowledge of biological processes and principles in familiar situations.
4. communicate basic information with sufficient clarity to make himself understood.
5. label given diagrams.
6. obtain simple information from given graphs, data and diagrams.

The grade 3 description is defined in terms of more complex performance related to objectives 1 - 5 and achievement in objectives 6, 7 and possibly 8 although this is not clear.

Grade 3: a student reaching this standard will be in possession of a cohesive body of facts, sufficient to allow insight into the significance of a biological statement or problem and will normally be able to draw valid conclusions from biological data.

More specifically, the achievement shown by a Grade 3 candidate should relate to assessment objectives 1 - 8, and the candidate should demonstrate the ability to:

1. recall facts and assemble them into a logical sequence.
2. use biological terms accurately.
3. apply knowledge of biological processes and principles to unfamiliar situations.
4. communicate clearly and accurately and use correct terms and units.
5. construct simple diagrams.
6. select and analyse information presented in a variety of ways.
7. criticise the design of simple experiments.

In identifying grade descriptions in this way two assumptions have been made.

(i) It will be possible to identify each question in terms of a single objective or group of objectives.

(ii) It will be possible to make quite fine distinctions of performance related to these objectives, i.e. recognise basic biological terms (grade 6) and use biological terms accurately (grade 3).

In the light of the findings illustrated in this chapter both of these assumptions are difficult to justify. So while, in theory, the award of grades may be linked to these descriptions there seems little likelihood of it being fulfilled in this way in practice.

CHAPTER SEVEN

CONCLUSIONS

Objectives in Mode 1 CSE Examination Syllabuses

This study set out to compare the functions which were ascribed to syllabus objectives by various authors with the way in which they were actually used in the teaching and examining of a Mode 1 CSE syllabus. The model identifying the perceived theoretical functions of objectives was constructed around four major communication processes. When research strategies began to unfold a description of the way in which teachers, subject panel members and examiners actually used objectives it became clear that the model and the practice did not match precisely.

An investigation of each of the communication lines provided evidence of the differences which existed between the theory on which the model is based and the activities of individuals working in the system. The investigation of communication line 1, the way in which educational objectives were used by teachers, highlighted the fact that teachers had little idea of what the syllabus objectives were. The direct influence which syllabus objectives had on the teaching processes used in the classroom did not seem to be very great. In more general terms however it was apparent that teachers did have specific objectives in mind when they taught the course, some of which overlapped with the syllabus objectives and some of which were not included in the examination syllabus. It also became evident that most teachers felt that they were constrained to teach a limited range of objectives. This range was determined by the kinds of skills the teachers identified in past examination papers. While teachers were

apparently unaware of the syllabus objectives from the explicit statements in the syllabus, they were greatly influenced by the objectives implicit in past examination papers. The practical application of syllabus objectives in the form of the examination paper, appeared to have more significance to teachers. Investigation of this communication line also indicated that it was difficult for classroom teachers to influence examination syllabuses directly.

The investigation of communication line 2, the way in which objectives are translated into examinations, involved probing the activities of examiners. The main finding in this context related to the difficulty, which examiners themselves identified, of matching examination papers to precise syllabus objectives and assessment specifications. Their view that the examinations they wrote roughly matched the specification grid was confirmed in general terms by the scrutineers' analysis of the examination paper. However it appeared that syllabus objectives could be used by examiners to extend the range of skills which were assessed in an examination. It proved much more difficult to write examinations which assessed the same skills in the same proportions for all candidates. However the validity of the examination was perceived to be based on an ability to match examinations to the precise specifications of the objectives/assessment grids.

The third communication line involved the way in which pupils' achievement is related to mastery of objectives. Investigation of this communication line emphasised the complex interactions which affect the way in which pupils perform in examinations. It did not prove possible to identify a positive link between the objectives which class teachers apparently promoted in their teaching and the class groups' performance on the examination. It became obvious that a number of other important factors related to the design of the examination question and the individual experience of the pupil are very important in this context. However a comparison was made of grade 1 and grade 4 performances and these were related to a

differential mastery of objectives. The evidence from this phase of the research suggested that grade 1 candidates consistently scored higher marks on knowledge and comprehension questions. However on questions assessing other objectives it was far more difficult to predict the relationship between grade 1 and grade 4 performances. In addition it did not prove possible to characterise a grade 1 or grade 4 achievement in terms of the different range of objectives mastered at each level.

The study of communication line 4 proved particularly interesting because it provided evidence of the influential nature of the subject panel's perceptions of objectives within the system. It became clear that this group primarily regarded objectives as a mechanism by which to construct valid examinations. This function influenced the quality of objectives which they were prepared to consider as acceptable for any given syllabus. The findings related to this phase of the research helped to clarify why there was a difference between teachers' preferred objectives for the course and those written into the syllabus. It also established that this group had control over the definition of the syllabus making it difficult for classroom teachers to influence it or initiate change. The most disturbing aspect of these revelations was that the objectives did not actually function in the way the subject panel members thought i.e. the examinations did not match the objectives/assessment grid, but the subject panel members were unaware of this.

In summary the research has indicated that the various groups involved in the teaching and examining of the Mode 1 Biology syllabus had differing perceptions and expectations of the role of the syllabus objectives. Some of these different perspectives were anticipated because the objectives were meant to serve a variety of functions. However even where two groups might be expected to perceive the same function for the objectives, the research has indicated that perceptions and uses differed.

In such situations difficulties for effective communication between these various groups arise. This is especially true when the differences in perception between the groups is not explicit. Each group was largely aware of it's own perceptions and use of objectives but largely unaware that this function may be perceived or used differently by another group. These differences between the groups may have remained unnoticed because the language which is used in communication between the groups is the same. In other words all groups use the term objective yet have a different understanding of that term.

Much of this problem stems from the fact that different individuals are involved in the various processes involved. It might be possible to minimise some of the problems concerning objectives if the same individuals were involved at each stage. In this way differences of opinion about the most important and valid objectives for the course might be addressed, the limitations of the forms of assessment used might be realised and the system might become more flexible to changing classroom needs. The separation of the processes of this teaching and examining system, never envisaged by Tyler, seems to have been a major contributing factor inhibiting the implementation of the rational planning model of curriculum development. Confusion and problems of communication between groups whose perceptions and uses of objectives are restricted to one aspect of the process seems to have hampered effective development. The whole situation is further complicated because the groups involved in the Mode 1 examination situation described here do not have equal status or power of control over the system. In this scheme of operation much of the power to change or restructure courses and examinations and hence objectives, lies with the members of the subject panel. Their perceptions and uses of objectives are therefore likely to have a much stronger influence within the system than other groups such as classroom teachers. While it is evident that the members of the subject panels are practicing teachers this research

has indicated that their role as designers and moderators of examinations can have a dominating effect on the decisions they take. In this case the limitations of the examination structure imposed clear constraints on the development, use and assessment of valid objectives.

If objectives are to function in practice, as originally suggested, explaining the purposes embodied in the courses being offered, relating directly to the content of courses and the teaching methods employed and being used as blueprints to draw up valid assessment tools it is clear that changes in the current system need to be made. All teachers involved in the process need to be aware of the contribution objectives can play, they also need to be able to instigate change in the objectives if they fail to operate adequately. The limitations of current examinations need to be made explicit and the implications of using them on teaching should be made clear. In effect if all teachers cannot be involved directly in all these processes i.e. if assessment continues to be Mode 1 orientated rather than Mode 3 orientated, then much greater effort needs to be made to explain the strengths and weaknesses of objectives within the current system. It would seem from this research that a good beginning could be made within the work of examination boards themselves.

Syllabus Objectives as a Curriculum Innovation

The research has been carried out with the primary aim of clarifying the functional role of objectives in a Mode 1 CSE syllabus, however it also provides evidence of the way in which a curriculum innovation has been put into practice. In this context the research highlights some of the difficulties inherent in such a task. i.e. translating a theoretical idea of what should happen into what actually occurs. In this instance it has been shown that the introduction of objectives was promoted from an examination board

committee, supposedly influenced by but technically outside classroom practice. The teachers who were to become one of the main users of the innovation were given little information about the reasons for its introduction or its intended function. As in practice they found that they were able to teach their pupils adequately to secure examination success without direct reference to the syllabus objectives there has been little requirement for teachers to pay much attention to them.

In this sense the innovation has had no direct impact on classroom practice. Such evidence supports the view that if innovations are to be functionally meaningful in classrooms every classroom teacher has to be convinced of the benefits of the innovation. Evidence of this is provided in the research in the way in which teachers recognised the importance of past examination papers and the way these influenced their teaching. Syllabus objectives stated indirectly in effect. Becher (1981b) underlines the strategies which can be employed by teachers resisting change because they are unconvinced of the benefits of changing their practice:

> From the stand point of the practitioner, there is a choice of response (to curriculum innovation) ..... which can span a considerable range. At one end of the spectrum, there is the option of outright conflict and refusal to comply. ..... Or, if it is thought wiser to avoid outright confrontation, the choice may be tacitly to ignore the official regulations. Some practitioners may prefer to play safe in terms of superficial compliance, of a kind often described as 'going through the motions'.
>
> (Becher, Eraut and Knight, 1981, page 152)

In the case of the introduction of syllabus objectives teachers have been able to ignore their direct presence in the syllabus and been influenced by their indirect presence in a changing examination format. For an innovation to have direct impact on classroom activity Becher (1981b) stresses the central role of the practitioner:

> it is the practitioners who ultimately determine whether a policy directive is successful, for it is they who translate ideas into actions.
> (Becher, Eraut and Knight, 1981, page 153)

The research clearly demonstrates that imposed directives even from fairly powerful educational organisations such as examining boards do not necessarily motivate teachers to change their practice. Sir Alec Clegg made the same point some seventeen years ago:

> The teachers' understanding is more important than any techniques which may be packaged up and handed to him.
> (Sir Alec Clegg (1967) in Maculre, 1968, page 25)

This shows that the concept of the importance of teachers' understanding has been recognised over a long period of time as an important factor in putting a theoretical innovation into classroom practice. Yet many instances have occurred such as those described in this research which clearly take little or no account of such knowledge.

Of more concern is the fact that new curricula innovations continue to be foisted onto schools without the necessary input to teacher education which would enhance their chance of effectively changing practice. The most recent instance of this kind of situation can be found in the deliberations which have resulted in the 16+ GCSE proposals for subject syllabuses.

The syllabuses for the GCSE have been devised by small groups, working parties, which have produced aims, objectives and assessment strategies for various syllabuses. They have worked to produce syllabuses conforming to national criteria. Such large scale projects are rare and are bound to have considerable influence on secondary school curricula. However it seems likely that the implementation of the new syllabuses will be prone to difficulties and confusion unless

there is a realistic attempt to involve and support all classroom teachers in the activity. At present there seems little likelihood of such a campaign. The new syllabuses seem likely to be misinterpreted or ignored by some in the style of Becher's "going through the motions" description. In effect many pupils experience of the GCSE syllabus may be remarkably similar to those currently offered under the GCE and CSE systems. This situation is even more likely to occur if the examinations at GCSE test similar skills to those currently emphasised at GCE and CSE.

Alternative forms of curricula innovation which involve large numbers of classroom practitioners do exist. They provide some evidence that teacher devised and controlled systems of assessment can function effectively, e.g. the Graded objectives in Modern Languages Scheme (GOML) described by Harrison (1982). In this scheme classroom teachers are concerned directly with all aspects of the teaching and examining process. The success of this particular scheme could be in part attributable to the central importance given to enhancing teachers' understanding of the whole process. However considerably more research in this area would be necessary before such a statement could be verified.

Recommendations and Implications

The research has indicated that there are often differences in perception concerning the functional role which objectives play in the teaching and examining of a Mode 1 CSE syllabus. Because of the way in which Mode 1 syllabuses are designed and validated this confusion can result in syllabuses which emphasise assessment objectives (i.e. those which are most easily tested in written and practical situations) rather than those which may be the most appropriate to certain teaching aims.

It is therefore of value to be aware that these differences may exist. Such understanding could facilitate a critical review of specific syllabus objectives in relation to the perceived requirements of any given curriculum area, the content of examination syllabuses, the design and validation of examination papers and the award of grades subject to the attainment of certain objectives.

In order to make syllabuses and assessment strategies more flexible to the changing needs of classroom teachers it would be valuable to maximise liaison between the Board's representatives and as many classroom teachers as possible. The SREB already has a consortium structure through which many teachers can be contacted. The primary function of this structure at present is to give teachers an opportunity to discuss the examination paper which their pupils have just taken. It could however be used as a vehicle for in-service activities aimed at improving contact and exchange of ideas through a much wider circle of teachers than at present are able to influence the form of assessment which takes place. In such a forum it would be possible to exchange views of the most appropriate contribution a given subject can make to pupils' curriculum experience and to consider the ways in which assessment might be made relevant to the most important aims of courses. Before such activities could be used to advantage it would be beneficial for those directly involved in syllabus and examination design i.e. members of subject panels to be made aware of the constraints and limitations of the system they operate. In particular it would be constructive to review syllabus objectives and their relation to the course content and examination papers at regular intervals. The function of objectives/assessment grids might also be reviewed and some consideration given to the degree of quantitative prespecification allocated to each syllabus objective.

Finally there are a number of recommendations which relate to the way in which objectives can be used to define grade descriptions. The most important of these is a recognition of the inappropriateness of current examination format for this purpose. If pupils' performance is to be compared to proficiency in certain skills then these must be unambiguously identifiable in the examination questions.

The difficulty of identifying such skills has already been outlined in this research and is supported by more recent work in this field by Kempa and L'Odiaga (1984) who state:

> a key issue to be considered as part of an exploration of criterion-referenced examining is whether examination tasks or subtasks can be validly assigned to particular skills/ability categories, irrespective of the format in which they appear or the content with which they are associated.
> (Kempa and L'Odiaga, 1984, page 60)

The results of their research study led them to conclude that:

> ..... a particular grade level cannot, in practical terms, be described, let alone defined, in terms of the presence of some abilities and the absence of others.
> (Kempa and L'Odiaga, 1984, page 62)

This problem seems to require immediate consideration if the GCSE notion of grade related criteria is to become a reality in the time span allotted. However even if this difficulty is overcome there is a further problem of adequately describing the differences which will separate grades. It will be necessary to describe the differences expected in performance very clearly for each grade level. Descriptions such as some of those outlined in the Biology 16+ draft criteria e.g. Grade 6 will recall the more important facts whereas Grade 3 will demonstrate a knowledge of biological facts and practical techniques will be very difficult to use if the examination form remains

similar to the GCE and CSE model. Furthermore if these two grades seem difficult to separate then the distinction of grades 4 and 5 will be even more demanding.

Critical Consideration and Future Research

Finally it is important to make clear that there were aspects of the research which have to be interpreted with due caution. The interviews with teachers in schools provide an example in which intervening factors caused some difficulty. In this situation it sometimes proved impossible to secure the required amount of time for the interview. Chance meetings with other staff or pupils, unexpected phone calls and even time taken to walk from one part of a school to another occasionally resulted in a significant reduction in the amount of time for which the teacher was available. These problems were most apparent in schools where more than one teacher was interviewed. In these instances it was sometimes necessary to omit some questions relating to general school organisation etc. to fit the interview into the available time. This was acceptable on the one hand because the information had often been provided by other members of staff. However it did mean that the subsequent interviewees had less time to "warm up" to the interviewing situation.

The most disappointing aspect of the interviews related to the teachers analysis of their pupils scripts and performance achievements. On reflection it has become evident that in order to generate information about the aspects of pupils' examination performances which were required it would have been necessary to provide teachers with much more support and time. Unfortunately this problem did not become apparent until the Autumn term of the school year following the 1981 examination. By this time teaching staff were under considerable pressure at the start of a new academic year. The pupils under discussion had often left school up to four months

previously and memories of them were not paramount in the minds of teachers. The delay between interviews, necessary to allow pupils examinations scripts to be analysed, did pose problems and should be taken into account if future research along similar lines is envisaged.

A further difficulty was also associated with the fact that the pupils who took the examination then left school almost immediately. This meant that they were not available to discuss their own performances on the examination. This pupil perspective would have been very interesting and valuable in attempting to understand more fully how communication lines 1 and 3 (1) in the model operated.

There are a number of other aspects of the research related to the identification of the objectives assess by the 1981 Biology examination which could be expanded in future research. The issue of agreement between scrutineers when categorising question items still remains a problem. One which is likely to be of major significance if the forthcoming GCSE examinations are to be certificated on the basis of achievement of grade related criteria as is currently proposed.

Finally the research related to the performance of Grade 1 and Grade 4 candidates in the examination is clearly only a starting point in an area of study which is again of central significance in the GCSE debate. This research concentrated on comparing average Grade 1 and Grade 4 performances but clearly it would also be of value to examine the variety of performance which might currently be associated with either of these grades and with Grades 2, 3 and 5. In particular the question of how practicable it is to distinguish between grades on the basis of achievement of certain criteria should be addressed. In 1988 examiners, it seems, will be faced with just this problem

---

(1) Communication Line 1 the way in which objectives are perceived and used by teachers

Communication Line 3 the way in which the objectives are reflected in pupils achievement.

when attempting to allocate GCSE certificates over a range of seven grades each of which may be specified in terms of the achievement of certain criteria.

There is a growing concern for the practical application of the GCSE proposals. Orr and Nuttall (1983) outline reservations about the difficulties associated with formulating grade descriptions and Kempa and L'Odiaga (1984) have demonstrated some of the practical difficulties of using objectives to define grade related criteria. This study has also added to the expanding body of evidence suggesting that the implementation of the GCSE system may not be as straight forward as some statements imply.

REFERENCES

ADAMS, R. M. and MURPHY, R. J. L. (1982) "The achieved weights of Examination Components". Educational Studies, Volume 8, No. 1, pp. 15 - 22.

ASSOCIATED EXAMINING BOARD (1979) Regulations and Syllabuses 1981. London: University of London Press.

ASSOCIATED LANCASHIRE SCHOOLS EXAMINING BOARD (1978) CSE Syllabuses 1980: Science Subjects.

ATKIN, M. J. (1968) "Behavioural objectives in curriculum design: a cautionary note". The Science Teacher, 35, No. 5, pp. 27 - 30.

BARDELL, G. S., FORREST, G. M., SHOESMITH, D. J. (1978) Comparability in GCE A review of the Board's studies 1964 - 1977. Manchester: Joint Matriculation Board.

BECHER, T. (1981a) "Curriculum Development - the fading vision". British Journal of Educational Psychology, Volume 41, pp. 22 - 24.

BECHER, T., ERAUT, M. and KNIGHT, J. (1981b) Policies for Educational Accountability. London: Heinemann Educational.

BLACK, H. and BROADFOOT, P. (1982) Assessment in the modern classroom: Keeping track of teaching. London: Routledge and Kegan Paul.

BLOOM, B. S. et. al. (Eds.) (1956) Taxonomy of Educational objectives: The classification of educational goals: Handbook 1 Cognitive Domain. London: Longman.

BORG, W. R. (1963) Educational Research: An introduction. London: Longman.

BRITTEN, A. (1973) Meanings and Situations. London: Routledge and Kegan Paul.

BROADFOOT, P. (1982) "The Pros and Cons of Profiles". Forum, Volume 24, No. 3, pp. 66 - 68.

BYNNER, J. and STRIBLEY, K. M. (Eds.) (1979) Social Research Principles and Procedures. London: The Open University Press, Longman.

CENTRE FOR EDUCATIONAL RESEARCH AND INNOVATION (1973) Case Studies of Educational Innovation. Paris: O.E.C.D.

CHRISTOPHER, R. (1969) The work of the Joint Matriculation Board. Manchester: Joint Matriculation Board.

COHEN, L. and MANION, L. (1980) Research Methods in Education. London: Croom Helm.

CONNAUGHTON, I. M. (1969) "The Validity of Examinations at 16-plus". Educational Research, 11, pp. 163 - 178.

CROSSLAND, R. W. and AMOS, R. (1961) "What do 'O' level examinations in Biology test". Biology and Human Affairs, 26 (2), pp. 38 - 41.

CROSSLAND, R. W. and AMOS, R. (1965) "Towards new 'O' level examinations in Biology". Biology and Human Affairs, 30 (3), pp. 35 - 39.

DAVIES, I. K. (1976) Objectives in Curriculum Design. Maidenhead: McGraw Hill.

DEALE, R. N. (1975) Assessment and testing in the secondary school. Schools Council Examinations Bulletin 32. London: Evans Brothers Ltd. and Methuen Educational.

DENNY, M. (1982) "Human Biology: a soft option in the Secondary School Curriculum?" Westminster Studies in Education, Volume 5, pp. 43 - 60.

DUCKWORTH, D. and HOSTE, R. (1975) Item banking: an approach through Biology. Schools Council Examinations Bulletin 35. London: Methuen.

EGGLESTON, J. F. and LOBEL, R. F. (1969) "Assessing attainment in History" in J. F. Eggleston and J. F. Kerr (Eds.) Studies in Assessment. London: English Universities Press.

EGGLESTON, J. F. and NEWBOULD, C. A. (1969) "Assessing attainment in Science at CSE level". In: J. F. Eggleston and J. F. Kerr (Eds.) Studies in Assessment. London: English Universities Press.

EISNER, E. (1967) "Educational objectives: help or hindrance?" School Review, 75, No. 3, pp. 250 - 60.

ELLIOTT, G. (Ed.) (1981) "The school curriculum in the 1980's". Aspects of Education, 26. University of Hull: Journal of the Institute of Education.

FAIRBROTHER, R. W. (1975) "The reliability of teachers' judgement of the abilities being tested by multiple choice items". Educational Research, 17, No. 3, pp. 202 - 210.

FORREST, G. M. (1971) Standards in Subjects at the Ordinary Level of the GCE, June 1970. Occasional Publication 33. Manchester: Joint Matriculation Board.

FORREST, G. M. and SMITH, G. A. (1972) Standards in Subjects at the Ordinary Level of the GCE. Occasional Publication 34. Manchester: Joint Matriculation Board.

FOX, D. M. (1969) "Assessing scientific ability through Science subjects". In: Eggleston J. F. and Kerr J. F. Studies in Assessment. London: English Universities Press. pp. 153 - 168.

FRANCIS, J. C. (1981) "Taking 'O' level GCE Examinations: The strategies employed by candidates and their teachers". Educational Studies, Volume 7, No. 3, pp. 165 - 175.

GOLDSTEIN, H. (1982) "Models for equating test scores and for studying the Comparability of Public Examinations". Educational Analysis, Volume 4, No. 3.

GOODLAD, J. and KLEIN, F. M. (1970) Behind the Classroom Door. Ohio: Jones, Worthington.

HAMILTON, D. et. al. (Eds.) (1977) Beyond the Numbers Game: a reader in educational evaluation. London: Macmillan Education Ltd.

HARRISON, A. (1982) Review of Graded Tests. Schools Council Examinations Bulletin 41. London: Methuen Educational.

HER MAJESTYS INSPECTORS OF SCHOOLS (1977) Curriculum 11 - 16 (Working Papers). London: H.M.S.O.

HER MAJESTYS INSPECTORS OF SCHOOLS (1979) Aspects of Secondary Education in England: A survey by HM Inspectors of Schools. London: H.M.S.O.

HIRST, P. (1975) "The Curriculum and its objectives: a defence of piecemeal curriculum planning" in The Curriculum. Studies in Education 2. Windsor: N.F.E.R.

HOLMES, B. (1977) "Science Education: Cultural borrowing and comparative Research". Studies in Science Education, 4, pp. 83 - 110.

HOSTE, R. (1980) "The construct validity of some CSE Biology Examinations: The evidence from multitrait - multimethod matrices". Journal of Biological Education, 14 (1), pp. 41 - 48.

HOSTE, R. (1981) "How valid are School Examinations? An exploration into content validity". British Journal of Educational Psychology, 51, pp. 10 - 22.

JUPP, V. and MILLER, P. (1980) GLOSSARY for course DE 304: Research methods in education and the social sciences. Milton Keynes: Open University Press.

KELLY School Science Review, volume 55, pp. 765 - 783.

KELLY, P. J. (1975) The curriculum diffusion research project: Outline Report. University of London: Chelsea College, Centre for Science Education.

KEMPA, R. F. and L'ODIAGA, J. (1984) "Criterion-referenced interpretation of examination grades". Educational Research, Volume 26, No. 1, February 1984, pp. 56 - 64.

KERR, J. (1968) "The problem of curriculum reform" in Kerr J. (Ed.) Changing the Curriculum. London: University of London Press, pp. 13 - 38.

KIEMER, L. (1981) "Personal characteristics of teachers, situational variables and deliberations in the process of planning instruction". Research in Education, No. 26, November 1981, pp. 21 - 30.

LAWTON, D. (1973) Social Change, Educational Theory and Curriculum Planning. London: University of London Press.

LAWTON, D. (1983) Curriculum Studies and Educational Planning. London: Hodder and Stoughton.

LAWTON, D. et. al. (1978) Theory and Practice of Curriculum Studies. London: Routledge and Kegan Paul.

LEWIN, K. (1980) "Curriculum Renewal and Examination Reform: A Case Study from Malaysia". (Institute of Development Studies, Sussex.) Bulletin, Volume 11, No. 2, pp. 34 - 41.

LOVELL, K. and LAWSON, K. S. (1970) Understanding Research in Education. London: London University Press.

MACDONALD, B. and RUDDOCK, J. (1981) "Curriculum Research and Development Projects: Barriers to Success". British Journal of Educational Psychology, 41, No. 2,

MACDONALD-ROSS, M. (1975) "Behavioural Objectives: A Critical Review". In: Golby, M., Greenwald, J. and West, R. (Eds.) Curriculum Design. London: Open University, Croom Helm.

MACLURE, J. S. (1968) Curriculum Innovation in Practice, London: H.M.S.O.

MAGER, R. F. (1962) Preparing objectives for programmed instruction. San Francisco: Fearon.

MERTON, R. K. and KENDALL, P. L. (1946) "The focused interview". American Journal of Sociology, 51, pp. 541 - 57. In: Cohen, L. and Manion, L. (1980) Research Methods in Education. London: Croom Helm.

MURPHY, R. J. L. (1978) "Reliability of marking in eight GCE examinations". British Journal of Educational Psychology, 48, pp. 196 - 200.

NISBET, J. (1980) "Educational Research: The state of the Art". In: W. B. Dockrell and D. Hamilton (Eds.) Rethinking Educational Research. London: Hodder and Stoughton.

NORTHERN IRELAND SCHOOLS EXAMINATION COUNCIL (1978) Regulations and Syllabuses 1980.

NUTTALL, D. L. (1971) The 1968 CSE monitoring experiment. Schools Council Working Paper 34. London: Evans/Methuen.

NUTTALL, D. L. (1982) "Prospects for a common system of examining at 16+". Forum, Volume 24, No. 3, pp. 60 - 62.

NUTTALL, D. L. and WILLMOTT, A. S. (1972) British Examinations. Techniques of Analysis. Slough: N.F.E.R.

NUTTALL, D. L., BACKHOUSE, J. K. and WILLMOTT, A. S. (1974) Comparability of Standards Between Subjects. Schools Council Examinations Bulletin 29. London: Evans/Methuen.

ORR, L. and NUTTALL, D. L. (1983) Determining Standards in the Proposed Single System of Examining at 16+. Comparability in Examinations Occasional Paper 2. London: Schools Council.

PARLETT, M. and DEARDEN, G. (1977) Introduction to Illuminative Evaluation: Studies in Higher Education. California: Soundings Press.

PHILLIPS, R. F. (1982) "Did the Exam Work? - Part 2". Education in Science, No. 99, pp. 15 - 19.

POPHAM, W. J. et. al. (1969) Instructional Objectives. Chicago: Rand McNally.

RAVEN, J. (1971) "Objectives in Education". Irish Journal of Education, Volume 1, pp. 15 - 27.

RICHMOND, W. K. (1971) The School Curriculum. London: Methuen and Co. Ltd.

SAFARI (1974) Success and failure and recent innovation: Innovation, evaluation, research and the problem of control: some interim papers. CARE. Norwich: University of East Anglia with Verlag Lothar Botsch.

SCHOOLS COUNCIL EXAMINATIONS BULLETIN 27 (1973) Assessment in Attainment in 6th Form Science. London: Evans/Methuen Educational.

SCHOOLS COUNCIL FORUM ON COMPARABILITY (1979) Standards in Public Examinations: Problems and possibilities. Comparability in Examinations Occasional Paper 1. London: Schools Council.

SECONDARY SCHOOL EXAMINATION COUNCIL (1964) The Certificate of Secondary Education: An Introduction to some techniques of Examining. Examinations Bulletin No. 3. London: H.M.S.O.

SKILBECK, M. (1976) The Child, The School and Society. Open University Educational Studies. A second level course. Curriculum Design and Development, E203. Milton Keynes: Open University Press.

SKURNICK, L. S. and HALL, J. (1969) The 1966 CSE Monitoring Experiment. Schools Council Working Paper 21. London: H.M.S.O.

SKURNICK, L. S. and CONNAUGHTON, I. (1970) The 1967 CSE Monitoring Experiment. Schools Council Working Paper 30. London: Evans/Methuen.

SOCKETT, H. T. (1976) Designing the Curriculum. London: Open Books.

SPURGIN, C. B. (1967) "What earns the marks". Physics Education. Volume 2, pp. 306 - 310.

STENHOUSE, L. (1970/1) "Some limitations of the use of objectives in curriculum research and planning". In: Eggleston, S. J. (Ed.) Paedogigica Europea, 6, pp. 73 - 83.

STENHOUSE, L. (1975) An introduction to curriculum research and development. London: Heinemann.

STONES, E. in collaboration with ANDERSON, D. (1972) Educational Objectives and the teaching of educational psychology. London: Methuen and Co. Ltd.

TABA, H. (1962) Curriculum Development Theory and Practice. New York: Harcourt, Brace and World Inc.

TATTERSALL, K. (1983) Differentiated Examinations: A strategy for Assessment at 16+? Schools Council Examination Bulletin 42. London: Methuen Educational.

TAYLOR, P. H. (1970) How Teachers Plan their courses. Slough: N.F.E.R.

TAYLOR, P. H. and RICHARDS, C. (1979) An Introduction to Curriculum Studies. Slough: N.F.E.R.

TUCKMAN, B. W. (1972) Conducting Educational Research. New York: Harcourt, Brace Jovanovich.

TYLER, R. W. (1949) Basic Principles of Curriculum and Instruction. Chicago and London: University of Chicago Press.

WALTON, J. and WELTON, J. (1976) Rational Curriculum Planning - Four Case Studies. London: Ward Lock Educational.

WARING, M. (1979) Social pressures and curriculum innovation: A Study of the Nuffield Foundation Science Teaching Project. London: Methuen.

WHEELER, D. (1967) Curriculum process. London: University of London Press.

WILLMOTT, A. S. and HALL, G. W. (1975) 'O' level examined - the effect of question choice. Schools Council Research Studies. London: Macmillan Educational.

WILLMOTT, A. S. and NUTTALL, D. L. (1975) The Reliability of Examinations at 16+. Schools Council Research Studies. London: Macmillan Educational.

WISEMAN, S. and PIDGEON, D. (1970) Curriculum Evaluation. Slough: N.F.E.R.

WOOD, R. (1968) "Objectives in the reading of mathematics". Educational Research, 10, pp. 83 - 98.

WOOD, R. (1982) "Educational and Psychological Measurement. Further efforts at Differentiation". Educational Analysis, Volume 4, No. 3, pp. 119 - 134.

WRAGG, E. C. (1978) Conducting and Analysing Interviews. Rediguide 11: Guides in Educational Research. Nottingham University, School of Education.

WRIGLEY, J. (1976) "Pitfalls in Educational Research". Research Intelligence, Volume 2, pp. 2 - 4.

YOUNGMAN, M. B. (1978) Designing and Analysing Questionnaires. Rediguide 12: Guides in Educational Research. Nottingham University, School of Education.

APPENDIX ONE

THE FACT FINDING QUESTIONNAIRE

QUESTIONNAIRE

Please complete the questionnaire by entering the appropriate number in the box in the margin on the right, and by filling in details, where asked for, in the space provided.

School:

EXAMPLE

Q.1 What type of school is it?

(1) Comprehensive
(2) Grammar
(3) Secondary Modern
(4) Other (please give details)

_____

_____

If the school is a comprehensive then you should fill in the box on the right with 1 1

Q.1 What type of school is it?

(1) Comprehensive
(2) Grammar
(3) Secondary Modern
(4) Other (please give details)

_____

_____

Q.2 Approximately how many pupils are there (to the nearest 100)

(1) up to 600
(2) 700 - 1000
(3) 1100 - 1500
(4) over 1500

/Q.3

Q.3 Is the school

(1) Co-educational
(2) Girls only
(3) Boys only

☐

Q.4 What is the age range of the pupils?

(1) 11 - 18
(2) 11 - 16
(3) 12 - 16
(4) Other (please give details)

☐

_____

_____

Q.5 (In this question and in question 6, "Biology" information should not include Human Biology or Biology as part of an integrated or combined science programme.)

Approximately how many candidates will the school be entering for "Biology" examinations in summer 1981? Please enter numbers into boxes directly.

Enter actual number of candidates in the boxes

CSE Mode 1 ☐

CSE Mode 2 ☐

CSE Mode 3 ☐

'O' level (if you do have 'O' level candidates please answer question 6) ☐

Q.6 Which 'O' level board(s) are used by the school for "Biology"? Please give details of the board(s) and the syllabus(es) e.g. AEB 'O' level Biology (syllabus 006).

_____

_____

_____

_____

_____

_____

Please leave this box blank ☐

/Q.7

Q.7 (In this question and question 9 "Biology" information should not include Human Biology or Biology as part of an integrated or combined science programme.)

Is "Biology" taught to examination level as

(1) A five year course
(2) A three year course
(3) A two year course
(4) Other (please give details)

_____

_____

_____

_____

_____

Q.8 Are 'O' level and CSE candidates in "Biology" taught together in any groups?

(1) Yes
(2) No

Q.9 Are pupils allowed to be double entered for CSE and 'O' level (whether or not they pay their own fees)?

(1) Yes
(2) No

Q.10 (In this question "Biology" information should not include Human Biology or Biology as part of an integrated or combined science programme unless specifically asked for.)

Please enter numbers into boxes directly.

How many teachers are there in the school teaching "Biology"?

How many teach "Biology" as their main subject?

How many teach both 'O' level and CSE level "Biology"?

How many teach both "Biology" and Human Biology at either level?

Enter actual number of teachers in the boxes

/Q.11

Q.11 Approximately how many pupils will be entered for Human Biology examinatins in Summer 1981?

CSE Mode 1

CSE Mode 2

CSE Mode 3

'O' level

Q.12 The information given in answer to this questionnaire will be used in part to select a small number of Biology teachers who are willing to co-operate further with the project. This would involve two short visits by the researcher to their schools arranged at convenient times. The purpose of the visits would be to discuss any problems that arise from the teaching of the SREB Biology syllabus, use and relevance of text books, the objectives of the syllabus, the final examination and any associated problems connected with questions on content in that examination. (Information gathered in these interviews will not be used in any way to affect the grades of current or future candidates for the examination.)

If the school agrees to staff co-operating I should be grateful if individuals who would be willing to take part would complete the panel below so that I can contact them.

Name	Do you teach Human Biology 'O' or CSE	Do you teach CSE Mode 1 Biology	Do you teach 'O' level Biology	No. years experience in Biology teaching approx.

Thank you for completing the questionnaire. I would be very grateful if you could let me have completed questionnaires back as soon as possible before 20th February, 1981 (stamped addressed envelope enclosed).

Anne Jones

A. Jones (Mrs.)
Department of Education,
University of Southampton
Hants.
Tel: 559122 ext. 707

AJ/BJ

APPENDIX TWO

QUESTIONNAIRE TO BIOLOGY SUB-PANEL MEMBERS

1. Could you provide some details of your teaching and examining experience as follows:

   (a) No. of years in teaching:

   (b) Posts of responsibility held:

   (c) Age range taught: (i.e. overall experience)

   (d) Ability range taught (i.e. overall experience)

   (e) No. of years serving on examination board committees etc.: (with details and any special responsibilities e.g. working parties, Mode 3, examiner etc.)

(f) Examining experience with other boards:

2. What do you think the function(s) of the sub-panel is/are?

Which of these do you consider to be the most important?

Are these the ones which are emphasised?

The following questions refer to the SREB Biology Mode 1 course

3. What role(s) do you think that the syllabus objectives have, i.e. why were they written into the syllabus?

4. Were you involved in devising the existing Biology objectives 1 - 6?

5. Have you been involved in discussions about the objectives of the Biology Mode 1 syllabus recently? Please give details.

6. Do you think that the present objectives reflect current classroom practice? Please explain in as much detail as possible.

7. Do you think that the objectives are suitable for a Biology course or are there changes that should be made? Please give details.

8. Do you think that the examination generally reflects the objectives as stated in the syllabus? Please explain your answer.

9. Have you had any formal training in the use of objectives?

10. Are there any other comments you would like to make either concerning the use of objectives in syllabus design or the functioning of the sub-panel?

Comments:

APPENDIX THREE

QUESTIONNAIRE TO EXAMINER/MODERATORS

Please could you give some details of your experience:

1. How long have you been teaching Biology?

2. What experience have you had teaching CSE candidates?

3. Have you had experience of examination board activities e.g. marking, writing items, sitting on committees etc? (Please give details of responsibilities and boards.)

Training for examining

1. Could you give some details of any formal or informal training which you have had, prior to becoming a chief examiner for Biology or during your office, which has been related to the task of examining?

2. How have you come by most of the experience you need for this role of examiner/moderator?

3. Are there any specific areas you would like training in?

Use of objectives

1. How do you use the syllabus objectives in setting the paper?

2. Do you feel the objectives as stated are suitable for the syllabus? Please give details of any changes that you feel should be made.

3. Do you feel that the objectives as stated can be assessed at this level?

4. Are there any other roles which the objectives serve other than to provide a blue-print for the assessment?

Setting the paper

1. How closely do you feel your examinations reflect the objectives set for the course? (i.e. how easy was it to construct the examination to the objective specification grid?)

2. Were there particular topics or item types or skills which you found difficult to cover? Why?

General

What were the most difficult aspects of your role as examiner/moderator?

Do you think there are any ways in which you could be supported/ trained for this role? (Please comment as fully as possible.)

What do you feel the role of the sub-panel is with regard to the assessment, the syllabus, the objectives of the Mode 1 Biology exam?

Any other comments you would like to make?

APPENDIX FOUR

FIRST TEACHER INTERVIEW SCHEDULE

Interview Questions

1. Do you think that objectives help you to understand the syllabus more clearly?

2. What are your main objectives when teaching this course?

3. How well do these fit in with the boards objectives?

4. Has your teaching changed over the last few years?

5. Which of the first six objectives is the most difficult to teach to CSE children?

6, Do you think the weighting table is a good representation of assessment for an average CSE child?

7. What skills or behaviours or attitudes do you think its important for the children to gain as they go through the course?

8. When they have completed the course what skills have most candidates actually mastered?

9. How many of these will be of use to them in later life?

10. Each time you teach the syllabus do you teach it in the same way?

    What factors influence your approach?

11. Do you have problems teaching the 'O' level course and CSE course together when you have mixed CSE/O level groups?

    What skills would you expect an 'O' level candidate to show over a CSE candidate?

12. Do you think that the exam has been fair over the years or have there been things which you were surprised that the children were assessed on?

13. Are there any areas that you think are undertested or overtested generally?

14. Do you think this exam will have affected the accuracy of your forecast grades?

15. What do you think about the practical assessment?

    Can you give me brief details of how you go about the assessment here?

16. Were you involved in making the decision to opt for external marking of scripts or to eliminate choice from the paper?

17. If a common exam at 16 was introduced what would you like to see?

18. Give the opportunity to develop your own Mode 3 type exam for children taking Biology what would you do?

19. Are there any ways in which you think the board could give you more help with your teaching?

20. Are there any other points you would like to make?

APPENDIX FIVE

SECOND TEACHER INTERVIEW SCHEDULE

Interview Questions

1. Could you give me some detail of the way in which the Biology groups are compiled e.g. are they set for ability or are there timetable restrictions etc.?

2. How much does the syllabus control your teaching and in what ways?

   How much does the final examination control your teaching and in what ways?

3. What do you think are the aspects of Biology which are most important in the education of children?

4. What do you understand by the term "objective"?

5. Have you ever had any training in the use of objectives in teaching?

6. Have you ever had any training in the use of assessment techniques?

7. Could you give me an example of the kind of teaching methods you generally employ in teaching this course?

8. Information was also collected on the way in which forecast grades were produced.

9. The teachers discussed points about their own candidates' performance on the examination.

APPENDIX SIX

SREB BIOLOGY MODE 1 1981 - 82

THE SYLLABUS

BIOLOGY AND HUMAN BIOLOGY

One syllabus in Biology and one in Human Biology are offered. In both cases the assessments will be designed to test the following objectives.

1. Knowledge of facts and terminology as applied to Biology and/or Human Biology.
2. Ability to summarise or explain the contents of a text.
3. Ability to interpret and draw conclusions from information and evidence given in the form of graphs, diagrams, tables, etc.
4. Ability to apply scientific principles to new situations.
5. Ability to formulate a hypothesis from evidence available.
6. Ability to plan an experiment to test a hypothesis.
7. Ability to use and handle apparatus and materials.
8. Ability to make and record observations accurately.

OBJECTIVES/ASSESSMENT GRID

The following grid relates the objectives to the method of assessment. The purpose of the grid is to give guidance on the emphasis placed on the objectives by the Sub-Panel in the different aspects of the assessment.

Objective		Written Paper	Practical Assessment	% Weighting of Objective
		Biology Human Biology		Biology Human Biology
1		45	-	45
2		10	-	10
3		15	-	15
4		5	-	5
5 and 6		5	-	5
7 and 8		-	20	20
% Weighting of Method of Assessment	Human Biology	80	20	100

APPENDIX SIX

CSE BIOLOGY MODE I SYLLABUS

CONTENT

BIOLOGY, SYLLABUS R, Alternative A

The written examination will be in two parts:

Part A—20% multiple choice questions

Part B—60% a compulsory question 1 which will include the testing of objectives formerly tested in practical examinations, plus a choice of 3 from 7 long questions.

Candidates will be recommended to spend not more than 30 minutes out of the total 2 hours on part A.

Syllabus

The diversity and interdependence of plant and animal life

Where possible the work on this section of the syllabus should be based on ecology. Candidates will be expected to be able to use a simple key and to have some knowledge of the way in which plants and animals are classified. Their studies should enable them to become familiar with the main distinguishing features of cryptogams, spermatophytes and animals (vertebrates and invertebrates). It is intended that as far as possible the work should be on living organisms observed in their natural habitats, e.g. house, garden and small pond. Emphasis should be placed on the inter-relationships between animals, plants and their habitats.

Social insects, e.g. hive bees, wasps, ants.

The life cycle of the house fly and locust.

The life cycle of the mosquito—as an example of a carrier of disease.

The Cell

The unit of living matter. Plant and animal cells compared.

Cell activities. Cell structure—nucleus, nuclear membranes, mitochrondria, ribosomes, plastids, endoplasmic reticular membranes.

Cell walls and vacuoles in plants. Chromosomes. Mitosis. Organisation of cells into tissues. Examples of unicellular organisms.

Bacteria—experimental work on culture.

Respiration

The composition of inspired and expired air. The properties of the gases in the air. Atmospheric pressure.

Breathing mechanisms in man. The absorption of gases through moist surfaces. The oxidation of food substances resulting in the release of energy in plants and animals. ADP and ATP. The formation of lactic acid in muscle. The transference of heat. Anaerobic respiration. Anaerobic bacteria. The circulation of the blood. Composition of the blood. Blood groups. Respirometers. Carbon dioxide indicators. Gaseous exchange in leaves and small organisms.

Nutrition

Energy. The sun as the source of all energy. The units in which force, energy, work and power are measured (newton, joule and watt).

The plant as the primary store of energy. Photosynthesis. Chlorophyll. The function of root, stems and leaves. The distinction between organic and inorganic substances. Carbohydrates, protein, vitamins, mineral salts and water. Diffusion, osmosis, transpiration.

Food tests. Food values. Food requirements of man. Digestive system in mammals with special reference to man. Ruminants. Teeth—the care of the teeth. Adaptation for different diets in animals.

Enzymes (ptyalin, rennin, pepsin, amylase, trypsin, lipase, maltase, sucrase) and bile.

Experiments using visking tubing. Experiments with vitamins. The liver and its functions. The fate of the end products of digestion. (Ingestion, absorption, and assimilation of food in amoeba and mammals).

Storage organs in plants. Examples of symbiosis, parasitism, saprophytism Insectivorous plants. The nitrogen cycle—nitrogen fixing bacteria. The carbon cycle. Food webs and food chains.

Excretion

The elimination of products of metabolism. Osmoregulation.

The mammalian kidney structure and function (elaborate detail of tubules in the kidney NOT required). The reduction of water loss in plants and animals. The function of stomata. The structure of the skin. The lungs as excretory organs. The control of the amount of heat lost by the skin.

Cooling by evaporation.

Transportation

Transportation in plants and animals. The action of vascular bundles. The blood and circulatory system in man.

Movement

The need for movement in relation to the mode of life.

Exoskeletons and endoskeletons. Voluntary and involuntary muscles—recognition from microphotographs or slides. Involuntary movement, e.g. peristalsis.

Amoeboid movements. The ear as an organ of balance. The centre of gravity, its importance in balance. The arm or leg as a lever. The names of muscles other than those in the arm will not be required. Candidates will be expected to know the names of the main bones in the body.

Work and energy—modern definition.

Supporting tissues in plants. Turgor and plasmolysis.

Soil

The structure and properties of different types of soil. Simple soil tests. The tolerance of plants to different degrees of acidity and alkalinity in soils. Adaptation of plants to climate. Adaptation of plants to life in bogs, the seashore and at high altitudes.

The water cycle.

Physical and chemical properties of water in relation to biological systems. The pH value of water—hard and soft water. The behaviour of water when freezing.

Reproduction

Reproduction in plants and animals. Asexual reproduction. Vegetative reproduction. Reproduction by grafting, cuttings and budding. Methods of reproduction in fungi, ferns, mosses. The parts of a flower. Meiosis. The production of gametes. Pollination and fertilisation. The development of the fruit. Seed dispersal. Germination and growth. External and internal fertilisation in animals. Reproduction in man. Ovulation, fertilisation, implantation. Gestation periods. Menstrual cycle. The development of the embryo—parturition. Parental care in animals and man. The function of the family in childhood and old age. Modern trends and discoveries—population control—disease.

The predator as an eliminator of weak stock.

Life cycle of an amphibian and of the house fly.

Genetics

Theories on the origin of life and on evolution—the effect of environment. Natural selection—fossil evidence of evolution.

Plant and animal breeding by selection. A brief outline of the work of Mendel. Monohybrid inheritance. Dominant and recessive characters. Examples of inheritance as shown by eye colour, blood groups or tongue rolling. Incomplete dominance. Mitosis and meiosis. Mutation.

Response to stimuli

Plant responses to water, light and gravity.

Climbing plants. Animal responses to external stimuli. Sensory organs in animals. The nervous system. Structure and function of the eye. Image formation—defects of vision and their correction. Colour blindness. Structure and function of the ear, including balance.

Hormones and the ductless glands.

Klinostat and phototropism experiments. Use of I.A.A. (lanolin suspension).

Hygiene

Personal hygiene—necessity for care in handling food—living organisms including viruses as causes of disease.

APPENDIX SEVEN

EXAMINATION PAPER

Consortium recommended overall grade	Position

SCHOOL CODE

33R

SOUTHERN REGIONAL EXAMINATIONS BOARD

CERTIFICATE OF SECONDARY EDUCATION EXAMINATIONS

BIOLOGY

(Syllabus R)

WRITTEN PAPER

Thursday, 7th May, 1981: afternoon

CANDIDATE'S NAME		CANDIDATE'S NUMBER
Surname	Other names	

TIME ALLOWED: 2 HOURS, 10 MINUTES

PART A

Answer **all** *questions in Part A.*

Do not spend more than half an hour on this part.

Each question carries one mark.

PART B

Answer **all** *questions in Part B.*

The mark allocated to each section of the questions in Part B is indicated in the box in the right-hand margin of each page.

	PART A	PART B							
Question number	1–40	1	2	3	4	5	Theory Total	Theory Grade	Practical Grade
Marks									

[P.T.O.

PART A

Answer **all** *questions on the detachable answer sheet provided.*

1. Fertilisation is best described as the
   - A formation of male sex cells.
   - B movement of male sex cells to a female.
   - C mating of a male and a female.
   - D fusion of a male sex cell and a female sex cell.
   - E formation of female sex cells.

2. Which one of the following exercises would use the greatest amount of energy, if continued for fifteen minutes? A person walking
   - A up a flight of steps.
   - B down a flight of steps.
   - C on a level road.
   - D up a gentle slope.
   - E down a gentle slope.

3. Ruminants are animals which chew their food, which is mainly grass, swallow it and then pass it forward from their stomach back into their mouths to chew it some more. Which of the following is the most likely reason for this?
   - A Ruminants do not find food to eat very often.
   - B Ruminants wander from field to field.
   - C The cellulose in the grass is difficult to digest.
   - D The molar teeth of ruminants are not very sharp.
   - E Ruminants have very small stomachs.

4. Which one of the following food substances may be identified using iodine solution (I_2 KI)?
   - A Glucose.
   - B Protein.
   - C Starch.
   - D Sucrose.
   - E Fat.

SCHOOL CODE

33R

SOUTHERN REGIONAL EXAMINATIONS BOARD

CERTIFICATE OF SECONDARY EDUCATION EXAMINATIONS

BIOLOGY

(Syllabus R)

Answer Sheet for Questions 1–40

CANDIDATE'S NUMBER ..... CANDIDATE'S NAME .....

SCHOOL NAME .....

Instructions DETACH THIS SHEET BEFORE YOU START.

Five possible answers are given in the question booklet for each question. Cross carefully IN PENCIL the letter of the answer which you think is correct for each question, *e.g.*, if you think the correct answer to question 17 is D—cross out D as shown.

17	A	B	C	~~D~~	E

Make sure that you put your answer in the right place for the question you are answering.

Rub out thoroughly any mistakes or answers you change your mind about.

1	A	B	C	D	E	11	A	B	C	D	E	21	A	B	C	D	E	31	A	B	C	D	E
2	A	B	C	D	E	12	A	B	C	D	E	22	A	B	C	D	E	32	A	B	C	D	E
3	A	B	C	D	E	13	A	B	C	D	E	23	A	B	C	D	E	33	A	B	C	D	E
4	A	B	C	D	E	14	A	B	C	D	E	24	A	B	C	D	E	34	A	B	C	D	E
5	A	B	C	D	E	15	A	B	C	D	E	25	A	B	C	D	E	35	A	B	C	D	E
6	A	B	C	D	E	16	A	B	C	D	E	26	A	B	C	D	E	36	A	B	C	D	E
7	A	B	C	D	E	17	A	B	C	D	E	27	A	B	C	D	E	37	A	B	C	D	E
8	A	B	C	D	E	18	A	B	C	D	E	28	A	B	C	D	E	38	A	B	C	D	E
9	A	B	C	D	E	19	A	B	C	D	E	29	A	B	C	D	E	39	A	B	C	D	E
10	A	B	C	D	E	20	A	B	C	D	E	30	A	B	C	D	E	40	A	B	C	D	E

5. In which one of the following does urine accumulate prior to its elimination from the body of a mammal?

   A Bladder.
   B Kidney.
   C Large intestine.
   D Urethra.
   E Ureter.

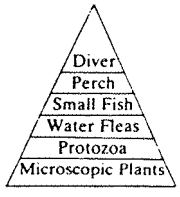
6. The term metamorphosis describes

   A asexual reproduction.
   B development from a larva to an adult.
   C a species of lichen.
   D a type of cell division.
   E an eye defect.

7. To which one of the following classes does an organism with 2 pairs of wings and 3 pairs of legs belong?

   A Arachnid.
   B Crustacean.
   C Myriapod.
   D Insect.
   E Bird.

QUESTIONS 8 TO 10 REFER TO THE FOLLOWING DIAGRAM WHICH REPRESENTS THE PYRAMID OF NUMBERS OF ORGANISMS IN A SHALLOW RIVER.



8. Which one of the following organisms is a producer?

A Perch.
B Small fish.
C Water flea.
D Protozoan.
E Microscopic plant.

9. Which one of the following organisms **cannot** be a carnivore?

A Diver.
B Perch.
C Small fish.
D Water flea.
E Protozoan.

10. There are fewer perch than small fish because

A perch are bigger and take up more space.
B more perch than small fish are eaten by the diver.
C perch need many small fish to eat.
D perch are a less successful species.
E small fish live longer than perch.

11. The red blood cells are primarily responsible for

A clotting.
B transporting food.
C transporting oxygen.
D killing invading bacteria.
E removing CO_2.

12. To which group of plants do seaweeds belong?

A Conifers.
B Fungi.
C Mosses.
D Algae.
E Ferns.

13. Which one of the following parts of the gut does not produce digestive enzymes?

A Stomach.
B Oesophagus.
C Duodenum.
D Small intestine.
E Pancreas.

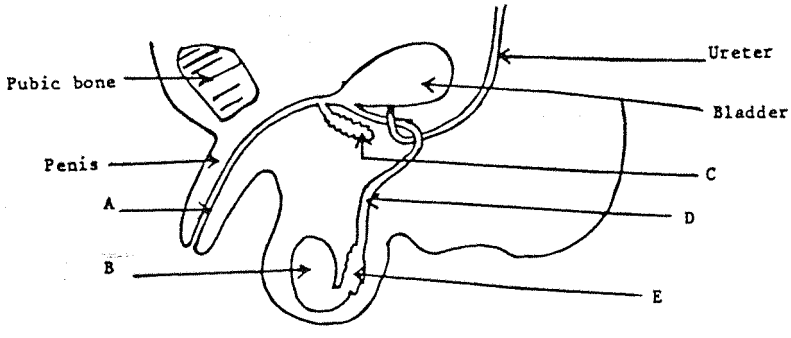
14. Which one of the following metals is present in a haemoglobin molecule?

A Magnesium.
B Calcium.
C Sodium.
D Manganese.
E Iron.

15. A study of the microscopic life, found in a small pond, revealed an organism with gills, jointed limbs and an exoskeleton. This organism is most likely to be

A the larva of an insect.
B a crustacean.
C a millipede.
D an amphibian tadpole.
E a fish fry.

16. Which arrow in the following diagram of the male reproductive system points to the urethra?



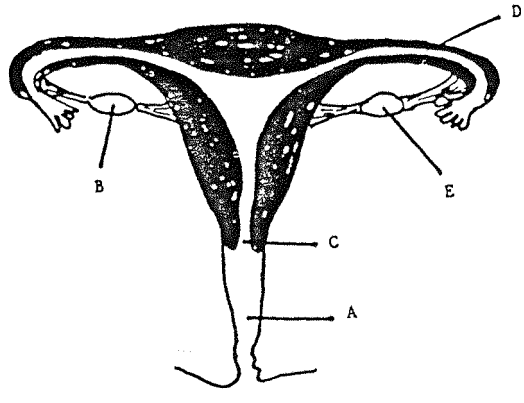
17. Which one of the following reagents would be correctly used to determine the pH of pond water?

A Hydrochloric acid.
B Universal indicator.
C Bicarbonate indicator.
D Benedicts solution.
E Millons reagent.

18. With which one of the following is the form of movement called Peristalsis associated?

A Growing plant.
B Amoeba.
C Alimentary canal.
D Paramecium.
E Human eye.

19.



The diagram represents the female reproductive organs. In which one of the parts labelled A to E does fertilisation normally take place?

20. Water travels up the stem of a leafy shoot through which of the following parts?

A Pith.
B Phloem.
C Xylem.
D Cortex.
E Cambium.

21. Cytoplasm is the name given to the

A whole of the cell.
B cell contents surrounding the nucleus.
C contents of the nucleus.
D membrane surrounding the cell.
E membrane surrounding the nucleus.

22. Why do fungi need to produce such a large number of spores to maintain the species?

A Spores live a short time.
B Very few spores have a chance of fertilisation.
C Very few spores find a suitable environment for growth.
D Mutation rates of fungi are low.
E Most of the spores are infertile.

23. Which one of the following is **not** found in animal cells?

A Nucleus.
B Ribosome.
C Cellulose cell wall.
D Mitochondrion.
E Endoplasmic Reticulum.

24. Some bacteria can obtain energy from the conversion of ethanol (ethyl alcohol) and carbon dioxide into ethanoic (acetic) acid and methane. This is the only source of energy for these bacteria, since they do not have access to oxygen from the air. Such bacteria are

A parasites.
B aerobes.
C bacilli.
D anaerobes.
E cocci.

25. Which one of the following foodstuffs contains the chemical element nitrogen?

A Glucose.
B Sucrose.
C Cellulose.
D Olive oil.
E Egg albumen.

26. The valve between the 2 chambers on the right side of the heart is called the

A cardiac sphincter.
B semilunar or watch-pocket valve.
C tricuspid valve.
D pyloric sphincter.
E bicuspid or mitral valve.

27. Which one of the following structures would **not** be necessary in the male of a species which has external fertilisation?

A Testis.
B Seminal vesicle.
C Penis.
D Urethra.
E Vas deferens.

28. Growth movements (tropisms) in plants are controlled by

A nerves.
B auxins.
C light.
D gravity.
E turgor pressure.

29. Which one of the following parts of the mammalian ear contains the organ which converts vibrations into nerve impulses?

A Sacculus.
B Auditory nerve.
C Cochlea.
D Tympanum (eardrum).
E Eustachian tube.

30. All the cells in an organism contain the same number of chromosomes except the egg and sperm cells which contain

A half the number each.
B twice the number each.
C three times the number.
D one fourth the number.
E one third the number.

31. The movement of respiratory gases within the tracheal system of an insect is dependent on

A secretion.
B diffusion.
C peristalsis.
D infusion.
E osmosis.

32. Which one of the following is an example of a symbiotic relationship?

A Tapeworm in pigs.
B Mushroom on horse manure.
C Sea anemone on hermit crab shell.
D Greenfly on roses.
E Dutch elm disease on elm trees.

33. Meat kept in a refrigerator is less likely to go bad than that kept in a warm kitchen cupboard. Select the best reason for this.

A Chemical changes occur in warm food.
B Decay bacteria on the food grow faster in warm conditions.
C Bacteria cannot get into the refrigerator but they can get into the cupboard.
D The cold conditions in the refrigerator kill any bacteria.
E Bacteria cannot get air necessary for staying alive in the refrigerator.

34. Plants lose most water by transpiration from the

A lower stem.
B upper surface of the leaf.
C root hairs.
D lower surface of the leaf.
E leaf petiole.

35. Which one of the following is an example of an endocrine gland?

A Pituitary.
B Sweat.
C Lymph.
D Mammary.
E Salivary.

36. Subsoil is usually infertile because it lacks

A mineral salts.
B rock particles.
C humus.
D water.
E earthworms.

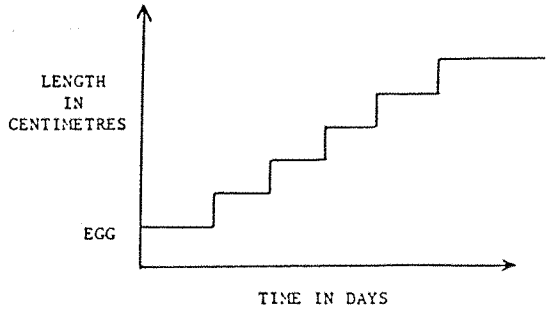
37. Because of the close similarity between the chemistry of the blood of the horseshoe crab and the blood of the spider, it can be assumed that

A both descended from a common ancestor.
B both will also show a close structural similarity.
C parallel changes of blood types have occurred.
D all crabs and spiders have similar blood types.
E horseshoe crabs and spiders eat the same food.

38. The point at which an impulse passes from one nerve cell to another is

A an axon.
B a synapse.
C a nucleus.
D a dendrite.
E a dendron.

39.



To which one of the following organisms could the above growth curve apply?

A Locust.
B Gerbil.
C Mouse.
D Herring.
E Sparrow.

40. Which one of the following would be needed in order to see a virus clearly?

A A hand lens.
B Binocular microscope.
C Low power objective light microscope.
D High power objective light microscope.
E Electron microscope.

PART B

Answer **all** *questions.* *Marks*

1. (*a*) FATS and OILS, CARBOHYDRATES, PHOTOSYNTHESIS, CHLOROPHYLL, MINERAL SALTS, CARBON DIOXIDE, OXYGEN, PROTEINS.

Fill in the blanks in the following passage using some of the above words. 5

During the process of photosynthesis in green plants a substance called .....absorbs energy from the sun when ..... are formed from ....and water. A plant can make....., composed of carbon, hydrogen, oxygen and nitrogen with ..... obtained from the soil.

(*b*) (i) Complete the following summary of the digestion of starch. 3

Enzyme	Reaction	Site of Reaction
.....	starch → maltose	mouth
Amylase	..... → maltose	duodenum
Maltase	..... → monosaccharides	ileum

(ii) Why is the conversion of starch into monosaccharides such as glucose necessary? 2

.....

.....

.....

continued on next page

continued from previous page

(*c*)

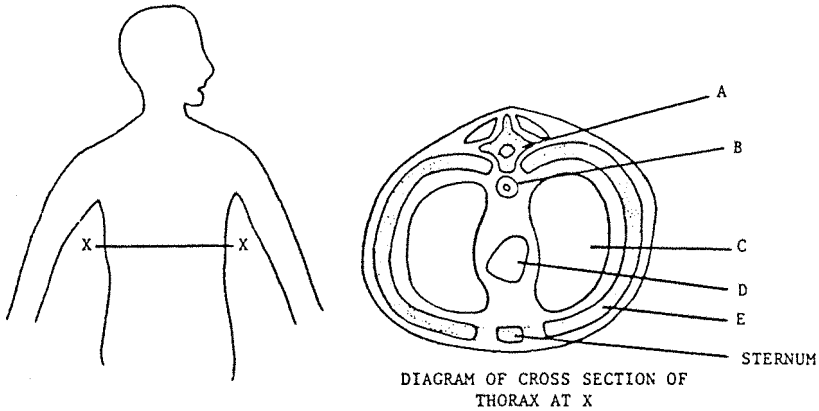


DIAGRAM OF CROSS SECTION OF THORAX AT X

Marks

Name the structures in the above cross section of the thorax. **10**

A = ...

B = ...

C = ...

D = ...

E = ...

(*d*) Organism, Tissue, Organ System, Cell, Organ, Organelle.

Next to each of the structures below, write **one** of the above terms which is appropriate to that structure. **5**

Kidney .....

Striped muscle .....

Earthworm .....

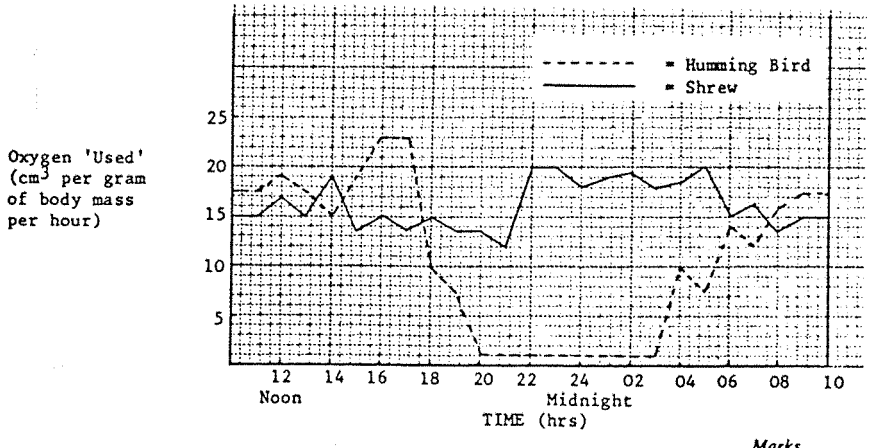
Lymphocyte .....

Ribosome .....

continued on next page

continued from previous page

(e) The graph below shows the amount of oxygen 'used' by two animals over a period of 24 hours. The oxygen 'used' is found by finding the difference between the amount breathed in and the amount breathed out.



Marks

(i) How much oxygen was 'used' by the shrew and humming bird at 16.00 hrs? **2**

Shrew.....cm³ per gram of body mass per hour.

humming bird .....cm³ per gram of body mass per hour.

(ii) If the humming bird has a mass of 100g how much oxygen would it 'use' between 16.00 and 17.00 hrs? **2**

.....cm³.

(iii) What is the oxygen 'used' for by the humming bird? **2**

.....

.....

.....

(iv) Suggest a reason for the difference in oxygen 'used' by these two animals at 02.00 hrs. **2**

.....

.....

.....

continued on next page

continued from previous page *Marks*

(*f*) Two kinds of ladybird exist. One variety is red the other black. Colour is inherited by a single pair of genes. The red gene is dominant (symbol R). The black gene is recessive (r).

The table below shows three genotypes

Type	[Genotype] Genes (in zygote)	Name	Phenotype (Colour)
1		Homozygous or True breeding	Red
2.	[Rr]	Heterozygous or Hybrid	
3.			Black

(i) Complete the table by filling in the four blank sections. 4

(ii) If type 1 was mated with type 3 what colour offspring could be expected? 1

.....

(iii) What types of gamete are possible from type 2 ladybird? 2

.....

(iv) What types of gamete are possible from type 3 ladybird? 2

.....

(v) What are the chances of red offspring in a cross between type 2 and type 3? 2

.....

continued on next page

continued from previous page

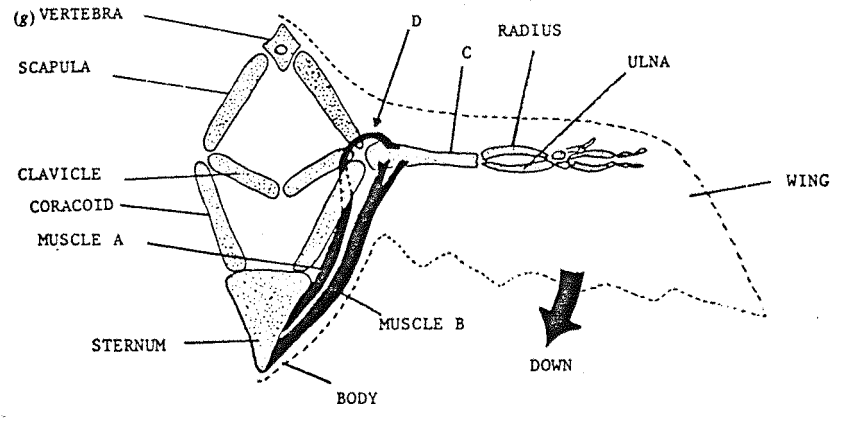


DIAGRAM OF SOME OF THE BONES AND MUSCLES OF THE BODY AND WING OF A BIRD

(i) Which muscle pulls the wing down in the direction of the arrows when it contracts? **2**

.....

(ii) The wing of a bird is an example of a pentadactyl limb. What therefore would be the name of the bone labelled C? **2**

.....

(iii) The joint at D is a 'ball and socket' type of synovial joint. Describe the movement of the wing that this will allow when the bird is flying. **2**

.....

.....

.....

.....

(iv) Which named bone in the diagram is not found in the human body? **2**

.....

(v) When the bird beats the wing down in the direction of the arrow is the pressure greater on the upper or lower surface of the wing? **1**

.....

End of Question 1 **TOTAL** **53**

2.

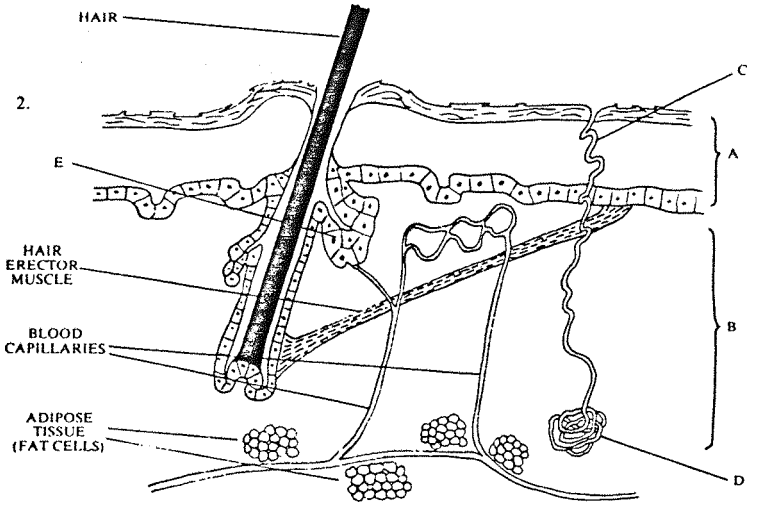


DIAGRAM OF VERTICAL SECTION THROUGH SKIN OF MAMMAL.

Marks

(*a*) Name parts A–E in the above diagram. **10**

A .....

B .....

C .....

D .....

E .....

(*b*) Describe how an increase in the heat *loss* from the skin in warm weather can be caused by: **12**

(i) Sweating

(ii) Hair and hair erector muscle

(iii) Dilating (increasing the diameter) of blood capillaries

.....

.....

.....

.....

.....

.....

.....

continued on next page

continued from previous page

Marks

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(c) In some animals the adipose tissue gets thicker in winter. What is the purpose of this? 4

.....

.....

.....

.....

(d) State *one* way in which the processes of sweating and transpiration from a leaf surface are similar and *one* way in which they are different.

(i) similar 2

.....

.....

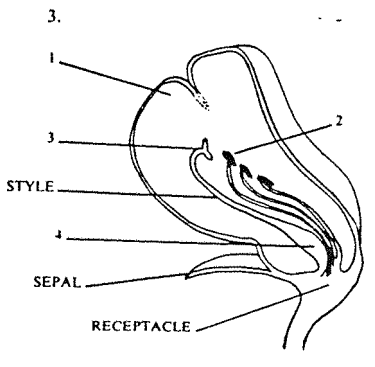
(ii) different 2

.....

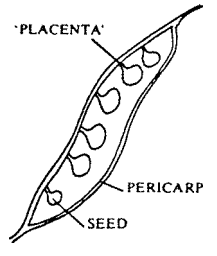
.....

End of Question 2 TOTAL 30

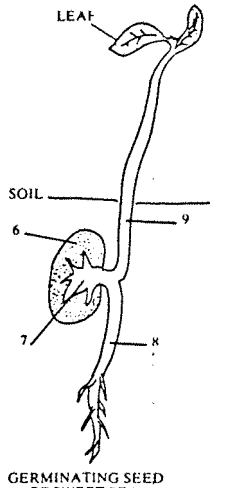
3.



HALF FLOWER OF SWEET PEA.



SECTION OF FRUIT OF SWEET PEA.



GERMINATING SEED OF SWEET PEA.

Marks

(*a*) Name the structures labelled 1–4. | 4 |

1..... 3.....

2..... 4.....

(*b*) Explain how each of parts 1–4 helps with the production of the fruit shown. | 8 |

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

continued on next page

continued from previous page

Marks

.....

.....

.....

.....

.....

.....

.....

.....

.....

(*c*) The structure labelled 'placenta' on the diagram of the fruit has a similar function to the placenta in mammals. What do you think the function of the 'placenta' is in the development of the seed? **4**

.....

.....

.....

(*d*) When the fruit begins to dry out the pericarp shrinks and splits open. How is this important to the reproduction of the sweet pea plant? **2**

.....

.....

.....

(*e*) Name the structures labelled 6–9 **4**

6..... 8.....

7..... 9.....

(*f*) What happens to the structure labelled 6 at the start of germination? What causes this to happen? **4**

.....

.....

.....

.....

.....

.....

continued on next page

continued from previous page *Marks*

(*g*) At the start of germination, the dry mass of the germinating seed starts to decrease. What causes this? 2

.....

.....

.....

(*h*) Why does the dry mass start to increase once the first leaves have formed on the seedling? 2

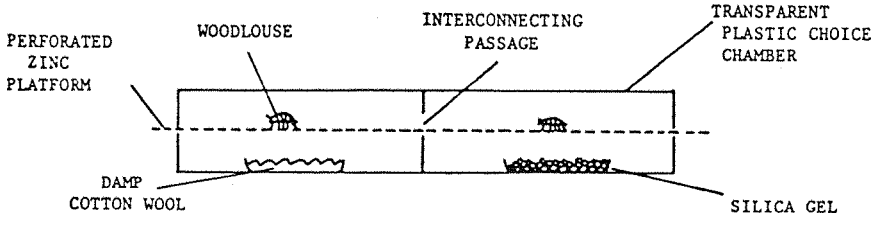
.....

.....

.....

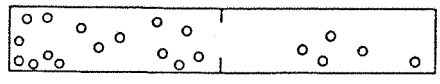
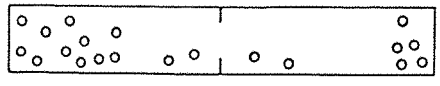
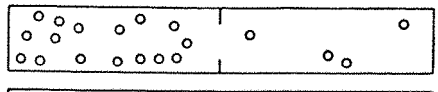
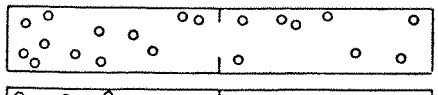
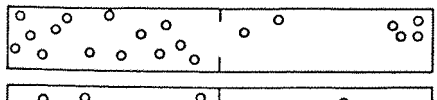
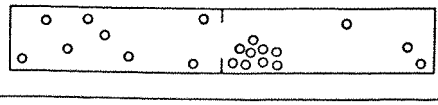
End of Question 3 **TOTAL** 30

4. Twenty woodlice were placed in a choice chamber, illustrated below, ten in the humid half and ten in the dry half.



SECTIONAL VIEW OF A CHOICE CHAMBER
(FROM THE SIDE)

After two minutes the numbers of woodlice in each half of the choice chamber were counted and their positions noted. Then the numbers were restored to ten in each half. After another two minutes a further record of numbers and positions was made. This was repeated four more times. The results are as follows.

TEST	POSITIONS Choice chambers drawn from above (o = one woodlouse) HUMID / DRY	NUMBERS IN HUMID	NUMBERS IN DRY
1		15	5
2		13	7
3		16	4
4		12	8
5		14	6
6		8	12

continued on next page

continued from previous page

Marks

(*a*) What is the function of the silica gel in the choice chamber? **2**

.....

(*b*) Which choice appeared to attract the most woodlice? **1**

.....

(*c*) Work out the average number in each choice. **3**

Average number humid = ...

Average number dry = ...

(*d*) To what do the woodlice appear to have reacted? **2**

.....

(*e*) In what way have they reacted? **3**

.....

.....

(*f*) Suggest a reason why they should behave like this. **3**

.....

.....

.....

(*g*) The result of test 6 seems to show the wrong result. Suggest *one* possible explanation for this result. **2**

.....

.....

.....

.....

(*h*) Why did the experimenter decide to repeat the test five times? **2**

.....

.....

.....

.....

continued on next page

continued from previous page *Marks*

(*i*) Draw and label a diagram of a choice chamber, like the one in this experiment, which could be used to investigate if woodlice are sensitive to *light*. 4

End of Question 4 **TOTAL** 22

5. Read the following passage and then answer the questions below:

Man, because of his industrial and agricultural activities, is the most important living factor affecting the environment. Changes in the plant and animal species of grassland are caused by the grazing of animals. Fields used for crops make ideal conditions for the growth of weeds and animal pests.

Fire on the land is caused by man as a regular farming practice or sometimes by carelessness. Either way its effect on living things can be very serious. Sometimes the soil itself actually catches fire. Stubble burning is when farmers burn off the dead remains of wheat plants in fields after the crop has been harvested. Forest fires can destroy hundreds of years of tree growth and kill many plants and animals.

Pollution is the production and release of substances which change the environment making it less favourable to the animals and plants that live there.

Some polluting substances are biodegradable. This means that they can be broken down by living organisms and so their effect is short-lived. Household sewage is biodegradable and the treatment of sewage by Water Authorities is designed to make sure that the organic material in the sewage is broken down by bacteria before it is emptied into rivers. Small amounts of sewage emptied directly into the sea or rivers does little harm to the animals and plants in these environments. Larger amounts of sewage emptied directly into a river result in a great increase in the number of bacteria. The bacteria use up the oxygen in the water so that other organisms cannot live.

Non-degradable substances such as poisons from metals, radioactive waste, fertilizers and pesticides can build up in the environment and eventually affect the organisms in it. Farmers sometimes use more than the recommended concentration of fertilizer and pesticide. The excess drains into streams or collects in the soil. From there the substances may find their way into animals and collect inside their tissues. At each link in a food chain each consumer in turn takes in the dangerous material. In the winter of 1959–1960 many foxes died. At first it was thought to be due to disease. Later it was found to be due to the foxes having eaten birds which had in turn eaten seeds which had been coated with a pesticide. Although many of the seed eating birds died of poisoning, their numbers actually increased during this period.

Carbon monoxide and sulphur dioxide are two gases which cause pollution of the atmosphere. Lichen seem to be very sensitive to sulphur dioxide and can be used as indicators of pollution.

It can be seen, therefore, that as a result of industry and agriculture, pollution of soil, water and atmosphere occurs.

Marks

(*a*) State *three* agricultural activities, mentioned in the passage, which disturb the habitats of plants and animals. | 3 |

(i).....

(ii).....

(iii).....

(*b*) Name *three* substances, mentioned in the passage, which cause pollution. | 3 |

(i).....

(ii).....

(iii).....

continued on next page

continued from previous page

Marks

(*c*) What damage to the soil might the burning of stubble (line 7) cause? **2**

.....

.....

(*d*) Why does pollution by biodegradable substances (line 12) not last for long? **2**

.....

.....

(*e*) Why does sewage cause a lack of oxygen in a river if it is emptied into the river untreated? **3**

.....

.....

.....

.....

(*f*) Write out the food chain used in the example between line 24 and 29. **3**

.....

(*g*) Why did so many foxes die in the winter of 1959–1960? **3**

.....

.....

.....

(*h*) Why do you think the number of seed eating birds (line 29) increased as a result of pollution? **3**

.....

.....

.....

(*i*) Lichen are said to be "indicators of pollution". How do you think they might *indicate* pollution? **3**

.....

.....

.....

.....

End of Question 5 **TOTAL** **25**

APPENDIX EIGHT

LIST OF OBJECTIVES

From Minutes of Biology Subject Panel Group 17th September 1974

KNOWLEDGE

1. Biological terminology
2. Specific biological facts
3. Names of parts and their functions
4. Classification of Plants and Animals and the criteria employed

COMPREHENSION

5. Ability to summarise or explain the content of a biological text.
6. Ability to interpret information given in the form of graphs, diagrams, tables, etc.

APPLICATION

7. Ability to use and handle apparatus and materials
8. Ability to make and record observations accurately
9. Ability to apply scientific principles to new situations

ANALYSIS

10. Ability to identify cause and effect relationships

EVALUATION

11. Ability to formulate a hypothesis from evidence available

12. Ability to plan an experiment to test a hypothesis

13. Ability to draw valid conclusions from evidence provided

APPENDIX NINE

ANALYSIS OF BIOLOGY EXAMINATION QUESTIONS TO IDENTIFY WHICH SKILLS ARE BEING ASSESSED

Introduction, problems and points to watch out for

Introduction

The aim of this analysis is to identify exactly which skills or behaviours the candidate has to employ in order to gain marks in the examination, in other words what does the candidate have to do to gain the mark.

For the purpose of this analysis the skills we are trying to identify fall into six major categories and it is under these headings that you are asked to classify the questions.

A. Knowledge

B. Comprehension

C. Application

D. Analysis

E. Synthesis

F. Evaluation

Each category is defined on the attached sheet and an indication is also given of areas of biological knowledge and ability which are loosely associated with each category.

On another attached sheet you will find a list of "action words". These are words which describe an action which would fit into one of the six major categories and will be useful to help you categorise the questions. E.g. If the skill the child has to employ is to label, or list, or name then the question would fall into the knowledge category.

I would point out here that some action words are repeated in different categories e.g. "re-write" appears as comprehension and synthesis and an evaluation would need to be made using the other information (guidelines, marking scheme, syllabus) to determine the context in which the action is undertaken before you could choose the most appropriate of the two categories.

Some of the problems involved in the analysis

1. Each child has a different background of Biology. For example what is recall for one candidate may be interpretation for another. E.g. A diagram of a cross section of a buttercup is given to the candidate and he is asked to name the parts labelled A - E (the reproductive organs) this is recall (knowledge) for a child familiar with the buttercup but could be interpretation (comprehension) for a child who is only familiar with a generalised diagram of a flower and has never seen a buttercup.

   Obviously to get this kind of information for an accurate analysis would require a detailed discussion with each individual candidate and is beyond the scope of this study. For this analysis we must generalise.

So using the guidelines and syllabus I would like you to use your experience to consider the average CSE candidate who has followed the course content closely. So if the candidates are asked questions on saliva and starch solution experiements with regard to enzyme activity you should bear in mind that most children should have encountered this situation in their teaching (guidelines booklet P. 3 No. 12) and analyse the question accordingly.

2. You may decide that the action words provided are not appropriate and prefer to use one of your own choice. This is perfectly acceptable as long as you identify the action word with one of the six major categories.

3. The questions are divided up for this analysis in the same way as they are on the paper, i.e. one part of a question is taken as the subsection to which the mark is allocated.

e.g.	Name four parts of the ear	(2 marks)
or	Briefly describe the action of the heart	(10 marks)
or	Name this process	(1 mark)

All three of these subsections of questions would be considered as separate parts for analysis. Each subsection or part needs to be categorised. (There are tables provided for this.)

For some question parts you may decide that there is more than one still required to gain the marks and these should be specified clearly.

e.g. Draw a cross sectional diagram of the eye and label the
(a) retina (b) cornea (c) lens (d) optic nerve
(6 marks)

Looking carefully at the marking scheme there are 4 marks for naming (knowledge) and 2 marks for the accuracy of the diagram. You may consider the skill of neatness or accuracy does not fall easily into any of the six major categories and a note should be made in Column D of the table to this effect. (Of course you may not agree with this analysis of the question!)

Some points to watch out for

1. The wording of the question can be misleading. Some questions incorporate words which appear in the action word list but do not correspond to the associated category.

   e.g. Select the best statement to complete the following:-

   The semi circular canals are associated with

   (a) taste
   (b) touch
   (c) balance
   (d) sight
   (e) smell

The word "select" is an action word associated with synthesis whereas this question seems to be more recall (knowledge).

So try to identify what the candidate actually has to do to gain the mark on the question and do not be confused by the verb used in the question. In some other cases the verb in the question is the same as the action word and is associated with the same category e.g. Name four parts of the respiratory tract in man. Here Name corresponds to knowledge and that is also the action word which describes the skill for which the marks are awarded.

2. The marking scheme can give valuable information about which skills are actually awarded marks (See (3) above). It is always useful to check with the marking scheme to see exactly how the marks are awarded. They are not always awarded as one might expect from the question i.e. other skills are being tested than those which might at first seem obvious.

3. The guidelines booklet gives the content of the course in some detail and may be useful to distinguish whether or not some questions are likely to have been covered during the course.

4. Action words are not confined to one category i.e. the same word can appear in two different categories e.g. explain in comprehension and evaluation. Use the additional information explaining the categories and the guidelines etc to determine which one is the most appropriate in the context of the question and skill required.

5. The marking schemes are often changed at consortium meetings however for this work please use them as they are even if they appear incorrect or unfair at times.

How to Begin!

Remember

1. There are no correct categories for each question part, you decide which is the most appropriate. If you have a doubt note in column D on the table provided.

2. The action words are only guides and there could be many more associated with each category. You may use alternative words of your own if you feel they are more appropriate as long as you indicate which category you associate them with.

3. (a) Try to identify in your own mind which skills is being assessed.

   (b) Select the most appropriate action word to describe the skills from the list or failing that use your own alternative.

   (c) Enter the category associated with the action word.

   (d) If you have any comment to make on the question generally or on the categorisation you have used enter it in the table or on a separate sheet of paper.

You will find attached a selection of test questions for you to try. We will discuss problems which arise at the meeting. There is also a table for you to complete as follows.

1. The question part is written in column A.

2. Select the most appropriate action word and enter it in column B.

3. Enter the associated category in column C.

4. Make any notes you wish in column D or on a separate sheet.

5. Please try not to miss any section or parts. If in doubt make your best decision and a note in D. There are no correct answers!!

6. Please contact me if you feel uncertain or would like clarification of any points before the meeting.

Action Words associated with the major Categories

From GRONLUND, p. 569, Macmillan U.S.A., 1981.

KNOWLEDGE	Define, describe, identify, label, list, match, name, outline, recall, recognise, state.
COMPREHENSION	Convert, distinguish, estimate, explain, extend, generalise, give example, infer, interpret, paraphrase, predict, re-write, translate, transform.
APPLICATION	Calculate, change, compute, demonstrate, discover, manipulate, measure, modify, operate, predict, prepare, produce, show, solve, use.
ANALYSIS	Breakdown, differentiate, distinguish, illustrate, infer, outline, point out, select, separate, sub-divide.
SYNTHESIS	Categorise, combine, compile, compose, create, design, devise, discuss, organise, re-write, precis.
EVALUATE	Appraise, compare, conclude, contrast, criticise, discriminate, explain, judge, justify, interpret, summarise, support.

TABLE 1. Major Categories in the Cognitive Domain of the Taxonomy of Educational Objectives (Bloom, 1956)

From Schools Council Examination Bulletin 35
Question Banking: an approach through Biology (Duckworth & Hoste, 1975)

Descriptions of the Major Categories in the Cognitive Domain	Descriptions of the Major Categories related to Biology
1. KNOWLEDGE. Knowledge is defined as the remembering of previously learned material. This may involve the recall of a wide range of material, from specific facts to complete theories, but all that is required is the bringing to mind of the appropriate information. Knowledge represents the lowest level of learning outcomes in the cognitive domain.	1. Knows particular biological terminology: knows specific biological facts: identifies forms, structures etc. and states their function: draws or labels standard diagrams: know classification or organisms and the criteria employed: knows more important biological generalisations, principles and theories.
2. COMPREHENSION. Comprehension is defined as the ability to grasp the meaning of material. This may be shown by translating material from one form to another (words to numbers), by interpreting material (explaining or summarizing), and by estimating future trends (predicting consequences or effects). These learning outcomes go one step beyond the simple remembering of material, and represent the lowest level of understanding.	2. Grasps context of a biological text and is able to summarise or explain its content. Drawing graphs.
3. APPLICATION. Application refers to the ability to use learned material in new and concrete situations. This may include the application of such things as rules, methods, concepts, principles, laws and theories. Learning outcomes in this area require a higher level of understanding than those under comprehension.	3. Interprets experimental data and draws reasonable conclusions from them. Applies scientific principles to new situations in Biology.
4. ANALYSIS. Analysis refers to the ability to break down material into its component parts so that its organisational structure may be understood. This may include the identification of the parts, analysis of the relationships between parts, and recognition of the organizational principles involved. Learning outcomes here represent a higher intellectual level than comprehension and application because they require an understanding of both the content and the structural form of the material.	4. Analyses biological problems in order to determine method for solution. Identifies cause-effect relationships and isolates relevant facts from irrelevant ones.
5. SYNTHESIS. Synthesis refers to the ability to put parts together to form a new whole. This may involve the production of a unique communication (theme or speech), a plan of operation (research proposal), or a set of abstract relations (scheme for classifying information). Learning outcomes in this area stress creative behaviours, with major emphasis on the formulation of <u>new</u> patterns or structures.	5. Formulates a hypothesis from evidence available. Plans experiments to test a hypothesis. Prepares an effective report of an experiment.
6. EVALUATION. Evaluation is concerned with the ability to judge the value of material (statement, novel, poem, research report) for a given purpose. The judgements are to be based on definite criteria. These may be internal criteria (organization) or external criteria (relevance to the purpose) and the student may determine the criteria or be given them. Learning outcomes in this area are highest in the cognitive hierarchy because they contain elements of all of the other categories, plus conscious value judgements based on clearly defined criteria.	6. Evaluates conclusions in the light of the procedures on which they are based.